

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Computer Science & Engineering
 (Applicable from the academic session 2020-2021)

Curriculum Structure

Semester III (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Engineering Science Course	ESC 301	Analog and Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-CS301	Data Structure & Algorithms	3	0	0	3
3	Professional Core Courses	PCC-CS302	Computer Organisation	3	0	0	3
4	Basic Science course	BSC 301	Mathematics-III (Differential Calculus)	2	0	0	2
5	Humanities & Social Sciences including Management courses	HSMC 301	Economics for Engineers (Humanities-II)	3	0	0	3
Practical							
6	Professional Core Courses	PCC-CS393	IT Workshop (Sci Lab/MATLAB/Python/R)	0	0	4	2
7	Engineering Science Course	ESC 391	Analog and Digital Electronics	0	0	4	2
8	Professional Core Courses	PCC-CS391	Data Structure & Algorithms	0	0	4	2
9	Professional Core Courses	PCC-CS392	Computer Organisation	0	0	4	2
			Total credits				22
Semester IV (Second year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
Theory							
1	Professional Core Courses	PCC-CS401	Discrete Mathematics	3	1	0	4
2	Professional Core Courses	PCC-CS 402	Computer Architecture	3	0	0	3
3	Professional Core Courses	PCC-CS403	Formal Language & Automata Theory	3	0	0	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Computer Science & Engineering
(Applicable from the academic session 2020-2021)

4	Professional Core Courses	PCC-CS404	Design & Analysis of Algorithms	3	0	0	3
5	Basic Science courses	BSC 401	Biology	2	1	0	3
6	Mandatory Courses	MC401	Environmental Sciences	1	-	-	1
Practical							
7	Engineering Science Course	PCC-CS 492	Computer Architecture	0	0	4	2
8	Professional Core Courses	PCC-CS494	Design & Analysis of Algorithms	0	0	4	2
						Total credits	21

Semester V (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Engineering Science Course	ESC501	Software Engineering	3	0	0	3
2	Professional Core Courses	PCC-CS501	Compiler Design	3	0	0	3
3	Professional Core Courses	PCC-CS502	Operating Systems	3	0	0	3
4	Professional Core Courses	PCC-CS503	Object Oriented Programming	3	0	0	3
5	Humanities & Social Sciences including Management courses	HSMC-501	Introduction to Industrial Management (Humanities III)	3	0	0	3
6	Professional Elective	PEC-IT 501A/B/C/D	(Elective-I) Theory of	3	0	0	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Computer Science & Engineering
 (Applicable from the academic session 2020-2021)

	courses		Computation/Artificial Intelligence/ Advanced Computer Architecture/ Computer Graphics				
7	Mandatory Courses	MC- CS501A/B	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-	0
Practical							
8	Professional Core Courses	ESC- 591	Software Engineering		0	4	2
9	Professional Core Courses	PCC- CS592	Operating Systems		0	4	2
10	Professional Core Courses	PCC- CS593	Object Oriented Programming		0	4	2
				Total credits			24

Semester VI (Third year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core Courses	PCC- CS601	Database Management Systems	3	0	0	3
2	Professional Core Courses	PCC- CS602	Computer Networks	3	0	0	3
3	Professional Elective courses	PEC- IT601A/B/C/D	(Elective-II) Advanced Algorithms/ Distributed Database Management System/ Signals & Systems / Image Processing	3	0	0	3
4	Professional Elective courses	PEC- IT602A/B/C/D	(Elective-III) Parallel and Distributed Algorithms/ Data Warehousing & Data Mining/Human Computer Interaction/Pattern Recognition	3	0	0	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Computer Science & Engineering
 (Applicable from the academic session 2020-2021)

5	Open Elective courses	OEC-IT601A/B	(Open Elective-) Numerical Methods/ Human Resource Development and Organizational Behavior	3	0	0	3
6	Project	PROJ-CS601	Research Methodology	3	0	0	3
Practical							
7	Professional Core Courses	PCC-CS691	Database Management Systems	0	0	4	2
8	Professional Core Courses	PCC-CS692	Computer Networks	0	0	4	2
			Total credits				22

Semester VII (Fourth year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-CS701A/B/C/D/E	(Elective-IV) Quantum Computing/ Cloud Computing/ Digital Signal Processing/Multi-agent Intelligent Systems/Machine learning	3	0	0	3
2	Professional Elective courses	PEC-CS702A/B/C/D/E	(Elective-V) Neural Networks and Deep Learning/ Soft Computing/ Ad-Hoc and Sensor Networks/Information Theory and Coding/Cyber Security	3	0	0	3
3	Open Elective courses	OEC-CS701A/B/C	(Open Elective-II) Operations Research/Multimedia Systems/Introduction to Philosophical Thoughts	3	0	0	3
4	Humanities & Social	HSM	Project Management and	2	1	0	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Computer Science & Engineering
(Applicable from the academic session 2020-2021)

	Sciences including Management courses	C 701	Entrepreneurship				
5	Project	PROJ-CS781	Project-II	0	0	12	6
			Total credits				18

Semester VIII (Fourth year)							
[Summer Industry Internship]							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Elective courses	PEC-CS801A/B/C/D/E	(Elective-VI) Signals and Networks/Cryptography & Network Security/Speech and Natural Language Processing/Web and Internet Technology/Internet of Things	3	0	0	3
2	Open Elective courses	OEC-CS801A/B/C/D/E	Open Elective-III Big Data Analysis/Cyber Law and Ethics/ Mobile Computing/Robotics/Soft Skill & Interpersonal Communication	3	0	0	3
3	Open Elective courses	OEC-CS802A/B/C	(Open Elective-IV) E-Commerce and ERP/Micro-electronics and VLSI Design/Economic Policies in India	3	0	0	3
4	Project	PROJ-CS881	Project-III	0	0	12	6
			Total credits				15

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Code: CE (BS) 301

Course Type: Theory

Course Designation: Compulsory

Program Specific Outcome (PSO):

	PSO1	PSO2	PSO3	PSO4
CO1	L	M	L	L
CO2	L	M	L	L
CO3	L	M	L	L
CO4	L	M	L	L
CO5	L	M	L	L
CO6	L	M	L	L

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
BSC CE301.1	Describe how biological observations of 18th Century that lead to major discoveries.	Define, Understand, Explain, Describe, Discuss	Understand (L1)
BSC CE301.2	Find that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.	Apply, calculate, estimate, find, solve, examine	Apply (L2)
BSC CE301.3	Classify the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.	Analyze, Classify, Illustrate, categorize	Analyze (L3)
BSC CE301.4	Examine that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine and biological processes at the reductionistic level.	Select, model, examine, design, show.	Synthesize (L4)
BSC CE301.5	Justify enzymes and distinguish between different mechanisms of enzyme action and Apply thermodynamic principles to biological systems.	Assess, test, justify, compare,	Evaluate (L5)
BSC CE301.6	Identify DNA as a genetic material in the molecular basis of information transfer and microorganisms.	Design, formulate, develop, derive, modify, build, identify	Create (L6)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3							2				1
CO2			2				3					2
CO3		3		1		1						
CO4						2						2
CO5	3				2	2	2					1
CO6	3	1		2	2		2					
Average	2.8	2	2	1.5	2	1.6	2.3	2				1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1 : INTRODUCTION

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. [2L]

Module 2 Classification

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitataaquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Purpose: To convey that classification ~~per se~~ is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. [3L]

Module 3 Genetics

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" [4L]

Module 4 Biomolecules

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine [4L]

Module 5 Enzymes

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Purpose: To convey that without catalysis life would not have existed on earth [4L]

Module 6 Information Transfer

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Purpose: The molecular basis of coding and decoding genetic information is universal [4L]

Module 7 Macromolecular analysis

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Purpose: How to analyses biological processes at the reductionistic level [5L]

Module 8 Metabolism

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO₂ + H₂O (Glycolysis and Krebs cycle) and

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

synthesis of glucose from CO₂ and H₂O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. [4L]

Module 9 Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. [3L]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: MATHEMATICS III

Course Code: CE(BS) 301

Semester of Study: 3rd

Course Type: Theory

Course Designation: Compulsory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(BS) 302.1	Learn the tools of Laplace Transform, Fourier Transform and Z-Transform to analyse engineering problems.	Learn	L1
CE(BS) 302.2	Learn the ideas of functions, relation and algebraic structure and their applications in engineering environment.	Analyse	L4
CE(BS) 302.3	Understand the concept of Logic, partially ordered set and apply the Counting technique in the problems of engineering fields.	Understand	L2
CE(BS) 302.4	Learn Basics of Graph Theory which are useful to solve engineering problems.	Apply	P3

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	-	-	-	-	-	2
CO2	3	3	1	1	-	-	-	-	-	-	-	2
CO3	3	3	2	1	-	-	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	2
Average	3	3	1.2	1	0.5							2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1 Transform Calculus-1

Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials; Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.

Module 2 Transform Calculus-2

Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Module 3 Sets, relations and functions

Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.

Module 4 Propositional Logic

Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, Deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order theory.

Module 5 Partially ordered sets

Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo Boolean lattices.

Module 6 Algebraic Structures

Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations – ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).

Module 7 Introduction to Counting

Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.

Module 8 Introduction to Graphs

Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Engineering Mechanics Course Code: CE(ES)301

Semester of Study: 3rd (Semester III)

Course Type: Theory

Course Designation: Compulsory

.....

Program Outcome (PO):

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)301.1	CO1: Illustrate system of forces and its resultant and free body diagram of forces.	Illustrate	Understand
CE(ES)301.2	CO2: List the types and laws of friction and analyse truss by method of joints and method of sections.	List	Analyse
CE(ES)301.3	CO3: Locate the centroid of simple figures and composite sections.	Locate	Analyse
CE(ES)301.4	CO4: Identify the principles of Virtual Work and Energy method and solve problems	Identify	Analyse
CE(ES)301.5	CO5: Demonstrate particle dynamics and kinematics of rigid bodies.	Demonstrate	Apply
CE(ES)301.6	CO6: Recognise mechanical Vibration and solve problems related to vibration and pendulum.	Solve	Analyse

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	2
CO2	3	3	3	3	-	-	-	-	-	-	-	2
CO3	3	3	3	3	-	-	-	-	1	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	1	-	-	1
CO6	3	3	3	3	-	-	-	-	-	-	-	2
Average	3	3	2.83	2.83	0	0	0	0	0.3	0	0	1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1	Introduction to Engineering Mechanics: Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.
Module 2	Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.
Module 3	Basic Structural Analysis: Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.
Module 4	Centroid and Centre of Gravity: Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.
Module 5	Virtual Work and Energy Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.
Module 6	Review of particle dynamics: Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).
Module 7	Introduction to Kinetics of Rigid Bodies: Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.
Module 8	Mechanical Vibrations: Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Energy Science and Engineering

Course Code: CE(ES)302

Semester of Study: 3rd (Semester III)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)302.1	To discuss the ideas of scientific principles, energy systems and various non-renewable and renewable resources for energy.	Discuss	Understand
CE(ES)302.2	To describe different energy generation systems and their environmental impacts.	Describe	Understand
CE(ES)302.3	To develop the idea about the role of civil engineering in energy sources.	Develop	Create
CE(ES)302.4	To use the concepts about green building LEED ratings, energy audit of facilities and optimization of energy consumption.	Use	Apply
CE(ES)302.5	To relate the global policy initiatives and meet the emerging challenges with sustainable technological solutions in the field of energy and environment.	Relate	Analyse
CE(ES)302.6	To relate the ideas of energy, environment and economic system.	Relate	Analyse

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	3	2	2	3	0	1	1	0	2
CO2	3	3	3	2	3	2	3	0	1	2	1	2
CO3	3	1	1	3	2	3	2	0	2	0	1	3
CO4	3	3	3	2	3	2	3	0	2	3	2	3
CO5	3	2	3	3	3	2	3	3	2	3	3	2
CO6	3	3	3	3	2	2	3	3	2	2	2	2
Average	3	2.5	2.5	2.66	2.5	2.16	2.83	1	1.66	1.83	1.5	2.33

University Syllabus:

Module 1	Introduction to Energy Science: Scientific Principles and historical interpretation to Place energy use in the Context of pressing societal, environmental, and climate issues; Introduction to energy systems and Resources; Introduction to Energy, Sustainability & the Environment. Tutorials: Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption, and Carbon Footprint
Module 2	Energy Sources: Overview of energy systems, sources, transformations, efficiency, and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal, and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydropower projects, superconductor-based energy storages, high-efficiency batteries) Tutorials: Compile a Word Map showing Alternative Energy source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil platform. Compile a map of India showing exiting potential and utilized potential for hydropower. List the pros and cons of Thermal, hydro, nuclear and solar power projects.
Module 3	Energy & Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy Tutorials: Study the functioning of an Electro Static Precipitator in a thermal power plant; study the uses of coarse and fine Fly Ash from thermal power plants. Compile the safety provisions in design and construction of a reactor containment building
Module 4	Civil Engineering Projects Connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney projects, wave energy caissons, coastal installations for tidal power, windmill towers; hydropower stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems Tutorials: Compile a process diagram for a typical underground hydropower project; Collect details of a model solar chimney project; collect details of a wave energy project at Vizhinjam; Collect details of the Kalpasar (Tidal energy) project

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering

(Applicable from the academic session 2023-2024)

Module 5	Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy-related enterprises that represent the breadth of the industry and prioritize these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and Optimization of energy consumption. Tutorials: Draw a typical geometrical orientation of a house in your area to avoid sun's radiation in the bedroom in the evening; Identify typical examples of Indian buildings having various LEED ratings; List various building materials with their embodied energy content. Do an Energy Audit of your departmental Building in the college.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Humanities 1.(Effective Technical Communication)

Course Code: CE (HS 301)

Semester of Study: THIRD

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE HS 301.1.	Understand the dynamics of Verbal and Non Verbal aspects of technical communication	Annalyse	L 4
CE HS301.2.	Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations	Apply	L 1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

CE HS 301.3	. Illustrate and examine the knowledge of ethical aspects of engineering	Understand	L 2
CE HS 301.4.	Demonstrate and explain social and professional etiquettes	Apply	L3
CE HS301.5..	Plan self-development and practice self-assessment to function on multi-disciplinary teams	Evaluate	L 5
CE HS 301.6.	Organize and write business correspondence properly and correctly, using appropriate formats, grammar, vocabulary, and syntax, and demonstrate effective writing and editing skills.	Create	L 6

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										*		
CO2	*									*		
CO3								*				
CO4				*								
CO5												*
CO6			*									
Average												

University Syllabus:

CE(HS)301 Humanities-I

(Effective Technical Communication)

Module 1 Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for on line media.

Module 2 Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing,

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Localization.

Module 3 Self Development and Assessment- Self assessment, Awareness, Perception and attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

Module 4 Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation,

Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Module 5 Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex **problem**

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Introduction to Civil Engineering Course Code: CE(HS)302

Semester of Study: 3rd (Semester III)

Course Type: Theory

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(HS)302.1	Describe the basic of civil engineering.	Describe	Understand
CE(HS)302.2	Summarize the History of Civil engineering, National Planning for Construction and Infrastructure Development, Fundamentals of Architecture & Town Planning, Fundamentals of Building Materials.	Summarize	Comprehension
CE(HS)302.3	Discuss the Basics of Construction Management & Contracts Management, Environmental Engineering & Sustainability, basics of Geotechnical Engineering.	Discuss	Comprehension
CE(HS)302.4	Explain fundamentals of Hydraulics, Hydrology & Water Resources Engineering, Ocean Engineering, Power Plant Structures, surveying techniques, & Geomatics, Traffic & Transportation Engineering, Repairs & Rehabilitation of Structures, Computational Methods, IT, IoT in Civil Engineering.	Explain	Comprehension
CE(HS)302.5	Analyze the cases of large civil engineering projects by industry professionals, covering comprehensive planning to commission.	Analyze	Analysis
CE(HS)302.6	Summarize Basics of Professionalism.	Summarize	Comprehension

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(HS)302.1	3	1	2	1	-	-	-	-	-	-	-	2
CE(HS)302.2	3	1	2	1	-	-	-	-	-	-	-	2
CE(HS)302.3	3	1	2	1	-	-	-	-	-	-	-	2
CE(HS)302.4	3	1	2	1	2	-	-	-	-	-	-	2
CE(HS)302.5	3	1	2	1	-	-	-	-	-	-	-	2
CE(HS)302.6	-	-	-	-	-	-	-	-	-	-	-	2
Average	2.5	0.83	1.67	0.83	0.33	0	0	0	0	0	0	2

University Syllabus:

Module 1	Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career Tutorials Develop a matrix of various disciplines and possible roles for engineers in each
Module 2	History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers Tutorials Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each
Module 3	Overview of National Planning for Construction and Infrastructure Development; Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works Tutorials Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area
Module 4	Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities Tutorials Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each; List down the possible systems required for a typical Smart City
Module 5	Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes Tutorials Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report
Module 6	Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management Tutorials Identify 5 typical construction methods and list their advantages/ positive features

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Module 7	Environmental Engineering & Sustainability: Water treatment systems; Effluent treatmentsystems; Solid waste management; Sustainability in Construction Tutorials Sustainability principles, Sustainable builtenvironment, water treatment systems, and goodpracticesof wastewater management. examples of Solid andhazardous waste management, Air pollution andcontrol
Module 8	Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; varioustypes of foundations; basics of rock mechanics & tunnelling Tutorials List top five tunnel projects in India and their features;collect and study geotechnical investigation report ofany one Metro Rail (underground) project; Visit aconstruction site and make a site visit report
Module 9	Hydraulics, Hydrology &Water Resources Engineering: Fundamentals of fluid flow, basics ofwater supply systems; Underground Structures; Underground Structures Multi-purpose reservoirprojects Tutorials Identify three river interlinking projects and theirfeatures; visit a Hydraulics Lab and make areport
Module 10	Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports&Harbours and other marine structures Tutorials Identify 5 typical ports in India and list the structuresavailable in them; Visit a related/similarfacility, ifpossible in nearby place and make a report
Module 11	Power Plant Structures: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects Tutorials Collect the typical layout for a large thermal powerplant and a large hydro power plant and identify all thestructures and systems falling in them.
Module 12	Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies; Tutorials Identify 5 unique features for typical buildings,bridges, tall structures and large span structures; VisitStructures Testing Lab/facility and make a report
Module 13	Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR; Tutorials Collect visual representations prepared by a TotalStation and LIDAR and compare; Study typicalGoogle street map and Google Earth Map and studyhow each can facilitate the other
Module 14	Traffic &Transportation Engineering: Investments in transport infrastructure development inIndia for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety underheterogeneous traffic; Sustainable and resilient pavement materials, design, construction andmanagement; Case studies and examples. Tutorials Investments in transport infrastructure; Developmentsand challenges; Intelligent Transport Systems; SmartCities, Urban Transport; Road Safety; Sustainable andresilient highway design principles; Plan a sustainabletransport system for a city; Identify keyfeatures/components in the planning and design of a green field highway/airport/port/railway and the cost –economics.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Module 15	Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non- Destructivetesting systems; Use of carbon fibre wrapping and carbon composites in repairs. Tutorials Collect the history of a major rehabilitation project and list the interesting features
Module 16	Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,...GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM, ...) Tutorials Visit an AutoCad lab and prepare a report; Identify ten interesting software systems used in Civil Engg and their key features
Module 17	Industrial lectures: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning; Tutorials For each case study list the interesting features
Module 18	Basics of Professionalism: Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skills enhancement; Facilities Management; Quality & HSE Systems in Construction
Tutorials	List 5 cases of violation of professional ethics and list preventive measures; Identify 5 interesting projects and their positive features; Write 400 word reports on one ancient monument and a modern marvel of civil engineering

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Basic Electronics

Course Code: CE (ES)391

Semester of Study: 3rd Semester

Course Type: Laboratory

Course Designation: Compulsory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcomes:

Course Outcome	Details/Statement	Action Verb	Knowledge Level
CE(ES)391.1	Analyze behaviour of passive electrical components such as resistors, capacitors and inductors and understand carrier transport phenomenon in semiconductors	Analyze	K6
CE(ES)391.2	Illustrate the principle of operation of measuring instruments such as volt meters, ammeters power supplies, CRO etc used to measure electrical parameters according to the range selected..	Determine	K5
CE(ES)391.3	Illustrate the characteristics and working principles of semiconductor diodes and determine their parameters.	Determine	K5
CE(ES)391.4	Bias the transistor such as BJT, JFET and MOSFET in the desired operating region using any of the available biasing techniques.	Apply	K3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(ES)391.5	Analyze the characteristics of Integrated circuits and its use in several applications in electronics circuits particularly the IC Op - Amp and 555 timer, IC voltage regulators etc.	Analyze	K4
CE(ES)391.6	Design combinational and sequential circuits for a given functions using logic gates.	Design	K2

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	1	1	1	1	1	2	1	1
CO2	1	3	3	3	1	1	1	1	1	1	1	1
CO3	1	2	3	3	1	1	1	1	1	1	1	1
CO4	1	3	3	3	1	1	1	1	1	1	1	1
CO5	1	3	3	3	1	1	1	1	1	1	1	1
CO6	1	3	3	3	2	2	1	1	1	1	2	2
Average	1	2.83	3	3	1.2	1.16	1	1	1	1.16	1.16	1.16

University Syllabus:

Module 1

Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;

Module 2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);

Module 3

Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B) Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;

Module 4

Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators;

Module 5

Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;

Module 6

Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D-Flip-Flop ICs; Serial-In-Serial-Out and Serial-In-Parallel-Out Shift operations using 4-bit/8-bit Shift Register ICs; Functionality of Up-Down / Decade Counter ICs

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Computer Aided Civil Engineering Drawing

Course Code:CE(ES)392

Semester of Study: 3rd (Semester III)

Course Type: Practical

Course Designation: Compulsory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)392.1	Discuss the basic concepts of drawing.	Discuss	Understand
CE(ES)392.2	Differentiate the various signs and symbols used in AUTOCAD.	Differentiate	Analyse
CE(ES)392.3	Sketch the site plan, floor plan, elevation and section drawing of small residential buildings.	Sketch	Apply
CE(ES)392.4	Illustrate isometric, perspective view of building and fundamentals of Building Information Modelling.	Illustrate	Apply
CE(ES)392.5	Describe the types of masonry bonds.	Describe	Understand
CE(ES)392.6	Construct an Industrial building and roof truss.	Construct	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	3	-	-	-	-	-	-	2
CO3	3	3	3	1	1	-	-	-	2	1	-	2
CO4	3	3	1	2	1	-	-	-	2	1	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	2
CO6	3	3	3	3	1	-	-	-	2	1	-	2
Average	3	2.5	1.5	1	1	0	0	0	1	0.5	0	2

University Syllabus:

Module 1	INTRODUCTION Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards
Module 2	SYMBOLS AND SIGN CONVENTIONS Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards
Module 3	MASONRY BONDS English Bond and Flemish Bond – Corner wall and Cross walls -One brick wall and one and half brick wall
Module 4	BUILDING DRAWING Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity
Module 5	PICTORIAL VIEW Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM)
Drawings	
1	Buildings with load bearing walls including details of doors and windows
2	Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500-700 words
3	RCC framed structures
4	Reinforcement drawings for typical slabs, beams, columns and spread footings
5	Industrial buildings - North light roof structures – Trusses
6	Perspective view of one and two storey buildings

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Life Science Laboratory ; Code: CE(ES)393

Semester of Study: 3rd (Semester III)

Course Type: Practical

Course Designation: Compulsory

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)393.1	Describe about Ecosystems- Components, types, flow of matter and energy in an ecosystem Biotic & food chain, food web, ecological pyramids;	Describe	Understand
CE(ES)393.2	Explain about Plant Physiology: like Transpiration; Mineral nutrition	Explain	Understand
CE(ES)393.3	Recognize the Structures of DNA and RNA; Concept of Gene, Gene regulation	Recognize	Understand
CE(ES)393.4	Identify the Basic concepts: of Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications	Identify	Understand
CE(ES)393.5	Calculate Value Index of a	Calculate	Analyse

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	species in a plant community and its importance		
CE(ES)393.6	Comparison of stomata index in different plants	Comparison	Evaluate

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	2	2	2	2	-	-	1	-	1
CO2	3	-	-	1	2	-	-	-	-	1	-	1
CO3	3	1	1	1	3	-	-	-	-	1	-	3
CO4	3	1	1	1	3	-	-	-	-	1	-	3
CO5	3	-	1	1	2	-	-	-	-	1	-	3
CO6	3	-	1	1	2	-	-	-	-	1	-	3
Average	2.83	0.33	0.67	1.17	2.33	0.33	0.33	0	0	1	0	2.33

University Syllabus:

Module 1A	Plant Physiology Transpiration; Mineral nutrition
Module 1B	Ecology Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure-Biotic and a-biotic factors, food chain, food web, ecological pyramids;
Module 2A	Population Dynamics Population ecology- Population characteristics, ecotypes; Population genetics- Concept of genepool and genetic diversity in populations, polymorphism and heterogeneity;
Module 2B	Environmental Management Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant);
Module 3A	Molecular Genetics Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept
Module 3B	Biotechnology Basic concepts: Tot potency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications
Module 4	Biostatistics Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)
Module 5	Laboratory & Fieldwork Sessions

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering

(Applicable from the academic session 2023-2024)

	Comparison of stomata index in different plants; Study of mineral crystals in plants; Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem; Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation by Gel Electrophoresis; Data analysis using Bio-statistical tools;

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Introduction to Fluid Mechanics

Course Code: CE(ES)401

Semester of Study: 4th (Semester IV)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)401.1	Define basic terms, values and laws in the areas of fluids properties.	Define	Remember
CE(ES)401.2	Use the basic equations of fluid statics to solve problems on submerged planes and manometers.	Use	Apply
CE(ES)401.3	Identify the concept and application of fluid kinematics and fluid dynamics	Identify	Understand
CE(ES)401.4	Relate dimensional analysis principle for problems in fluid mechanics	Relate	Analyse
CE(ES)401.5	Use fundamental theories of fluid flow for the analysis of flow through the pipeline system.	Use	Apply
CE(ES)401.6	Design components of hydraulic machines, turbines, and pumps; and study their characteristics	Design	Create

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(ES)401.1	2	1	-	-	-	-	-	-	-	-	-	-
CE(ES)401.2	3	3	3	1	-	-	-	-	-	1	-	1
CE(ES)401.3	2	3	3	2	-	-	-	-	-	-	-	1
CE(ES)401.4	3	3	3	3	-	1	-	-	-	-	-	2
CE(ES)401.5	2	3	3	3	-	1	-	-	-	1	-	1
CE(ES)401.6	3	3	3	3	-	1	2	-	-	1	-	2
Average	2.5	2.7	3	2.4	0	1	2	0	0	1	0	1.4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module 1	Properties of fluids: Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.
Module 2	Fluid statics: Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.
Module 3	Fluid Kinematics: The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends.
Module 4	Fluid Dynamics: Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line.
Module 5	Dimensional Analysis: Buckingham Pi Theorem, determination of Pi terms, correlation of experimental data, examples.
Module 6	Flow through Pipes: Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.
Module 7	Pipeline Systems: Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks.
Module 8	Hydraulic Machines: Basics of hydraulic machines, specific speed of pumps and turbines.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Introduction to Solid Mechanics

Course Code: CE(ES)402

Semester of Study: 4th (Semester IV)

Course Type: Theory

.....

Program Outcomes (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)402.1	To identify different degrees of freedoms for support conditions, equilibrium conditions and elastic properties of axially loaded bars through stress-strain and force-displacement curves.	Identify	Comprehension
CE(ES)402.2	To calculate the bending moment diagram, shear force diagram, bending and shear stresses and deflection of beams for uniformly distributed, concentrated, linearly varying and external concentrated moment.	Calculate	Analysis
CE(ES)402.3	To identify strain energy due to bending moment, axial force, shear force and the concepts of principal stresses, principal planes, and Mohr's circle.	Identify	Comprehension
CE(ES)402.4	To calculate the member forces in plane trusses; hoop and meridional stresses in thin cylinders and spherical shells.	Calculate	Analysis
CE(ES)402.5	To identify torsional moment and twist on a circular shaft and calculate the shear stress.	Identify	Comprehension
CE(ES)402.6	To calculate the buckling load of columns using Euler's theory for different support constraints.	Calculate	Analysis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	0	0	0	0	0	0	0	0	1
CO2	3	2	1	0	0	0	0	0	0	0	0	1
CO3	3	2	1	0	0	0	0	0	0	0	0	1
CO4	3	2	1	0	0	0	0	0	0	0	0	1
CO5	3	2	1	0	0	0	0	0	0	0	0	1
CO6	3	2	1	0	0	0	0	0	0	0	0	1
Average	3	2	1	0	0	0	0	0	0	0	0	1

University Syllabus:

Module 1	Review of Basic Concepts of Stress and Strain: Normal stress, Shear stress, Bearing stress, Normal strain, Shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety, Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams.
Module 2	Symmetric Beam Bending: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre.
Module 3	Deflection of statically determinate beams: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution.
Module 4	Analysis of determinate plane trusses: Concepts of redundancy, Analysis by method of joints, method of sections.
Module 5	Two Dimensional Stress Problems: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle.
Module 6	Introduction to thin cylindrical & spherical shells: Hoop stress and meridional - stress and volumetric changes.
Module 7	Torsion: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical springs.
Module 8	Columns: Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Civil Engineering- Societal & Global Impact CE(HS)401

Semester of Study: 4th (Semester IV)

Course Type: Theory

.....

Program Outcome (PO):

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

On completion of the course, the students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(HS)401 .1	Discuss the change in trends of civil engineering from the past to present and future in Indian as well as global scenario.	Discuss	Understand
CE(HS)401 .2	The impact, which Civil Engineering projects have on the Society and identifying the ancient and modern marvels of civil engineering to plan for a better world.	Identify	Understand
CE(HS)401 .3	Recognise the different infrastructural requirements of civil engineering related to megacities, smart cities, energy generation and communication.	Recognise	Understand
CE(HS)401 .4	Classification of environmental engineering including waste managements, flood control, pollution control to build a sustainable society.	Classification	Understand
CE(HS)401 .5	Identify the built environment and factors influencing the quality of life ensuring sustainability.	Identify	Understand
CE(HS)401 .6	Understand the EIA procedures and apply advanced engineering techniques to contribute to GDP and generate employment.	Apply	Apply

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	2	2	-	-	-	-	1
CO2	3	3	3	2	-	2	2	-	-	-	-	1
CO3	3	1	-	-	1	-	-	-	-	-	-	-
CO4	3	2	2	2	-	2	3	2	1	-	2	2
CO5	2	2	3	2	-	3	3	1	-	1	2	2
CO6	3	3	3	3	1	3	3	2	2	2	2	3
Average	2.83	2.17	1.83	1.5	0.33	2	2.16	0.83	0.5	0.50	1.00	1.50

University Syllabus:

Module 1	Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis
Module 2	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering
Module 3	Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;
Module 4	Environment-Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.
Module 5	Built environment-Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability
Module 6	Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Soil Mechanics - I

Course Code: CE(PC)401

Semester of Study: 4th (Semester IV)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)401.1	Classify soil as per grain size distribution curve and understand the index properties of soil.	Classify	Understand
CE(PC)401.2	Implement the concept of total stress, effective stress and pore water pressure for solving geotechnical problems.	Implement	Apply
CE(PC)401.3	Assess the permeability of different types of soil and solve flow problems.	Assess	Evaluation
CE(PC)401.4	Estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure.	Estimate	Evaluation
CE(PC)401.5	Explain vertical stress on a horizontal plane within a soil mass subjected to different	Explain	Comprehension

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area.		
CE(PC)401.6	Use the concept of shear strength to analyse different geotechnical problems and determine the shear strength parameters from lab and field tests.	Use	Application

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	1	1	-	-	-	-	1
CO2	3	3	3	3	-	-	-	-	-	-	-	1
CO3	3	3	3	2	-	1	-	-	-	-	-	-
CO4	3	3	3	3	-	2	1	-	-	-	-	2
CO5	3	3	3	3	-	2	1	-	-	-	-	-
CO6	3	3	3	3	-	2	-	-	-	-	-	2
Average	3	3	3	2.83	0	1.5	0.5	0	0	0	0	1

University Syllabus:

Module 1	Soil Formation Introduction, Origin of Soil, Formation and Types of soil, Formative classification, Typical Indian Soil, Some Special Types of Soils, Structure and Composition, Clay Mineralogy. Soil as a Three Phase System Basic Definitions, Weight - Volume Relationship, Measurement of Physical Properties of Soil: Insitu Density, Moisture Content, Specific Gravity, Relative density, Functional Relationships. Index Properties of Soil Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil– Atterberg Limits, Different Indices, Discussion on Limits and Indices. Classification of Soil Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, as per IS Code Recommendation, Field Identification of Soil, Classification by Casagrande's Plasticity Chart.
Module 2	Soil Hydraulics Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition.
Module 3	Permeability Introduction, Darcy's Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors Affecting Permeability. Determination of Coefficient of Permeability – Constant Head and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability – Unconfined and Confined Aquifers.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Module 4	Seepage Analysis Introduction, Seepage, Seepage Pressure, Two-Dimensional Flow, Laplace's Equations, Continuity equation, Flow Nets, Flow through Earthen Dam, Estimation of Seepage, Construction, Properties and Use of Flow Nets, Piping and Heaving, Uplift due to Seepage, Design of Fillers.
Module 5	Stress distribution in soils Introduction, Geostatic Stress, Boussinesq's Equation, Determination of Stress due to Point Load, Vertical Stress Distribution on a Horizontal Plane, Isobar and Pressure Bulb, Vertical Stress Distribution on a Vertical Plane, Vertical Stress under Uniformly Loaded Circular Area, Vertical Stress Beneath a Corner of a Rectangular Area, Equivalent Point Load Method, 2:1 Method, Newmark's Influence Chart, Vertical Stress Beneath Line and Strip Loads. Westergaard Analysis, Comparison of Boussinesq and Westergaard Theories, Contact Pressure.
Module 6	Shearing strength of soils Shear Strength of Soil Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr – Coulomb Theory, Relationship between Principal Stresses and Cohesion. Determination of Shear Parameters of Soil Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters- Direct Shear Test, Triaxial Test, Classification of Shear Tests Based on Drainage Conditions, Unconfined Compression Test, Vane Shear Test as per Relevant IS Codes. Stress- Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton's Pore Pressure Parameters. Sensitivity and Thixotropy of clay. Concept of Stress path.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Environmental Engineering-I

Course Code: CE(PC)402

Semester of Study: 4th (Semester IV)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)402.1	Define the basic concepts and terminologies of water supply engineering and solid waste management.	Define	Remember
CE(PC)402.2	Describe different surface and groundwater sources; and composition and characteristics of municipal solid waste.	Describe	Understand
CE(PC)402.3	Implement the methods of quantifying water requirement and MSW generation.	Implement	Apply
CE(PC)402.4	Solve different mathematical problems regarding different components of water supply systems, distribution networks and MSW management systems.	Solve	Apply
CE(PC)402.5	Compare between different water samples based on their physical, chemical and biological characteristics.	Compare	Analyse
CE(PC)402.6	Design different unit processes and operations involved in wastewater treatment.	Design	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	2	-	-	-	-	1
CO2	3	2	-	1	-	-	3	-	-	-	-	1
CO3	3	3	-	-	-	2	1	-	-	-	-	3
CO4	3	3	-	2	-	1	1	-	-	-	-	-
CO5	3	3	-	3	-	2	3	-	-	-	-	-
CO6	3	-	3	1	-	2	3	-	-	-	-	1
Average	3	2.33	0.83	1.5	0	1.33	2.17	0	0	0	0	1

University Syllabus:

Module 1	Water Requirement Estimation : Water Demand: Different types of water demand; Per capita demand; Variations in demand; Factors affecting water demand; Future Demand Forecasting: Design period; Population forecasting methods
Module 2	Sources of Water : Surface Water Sources; Ground Water Sources
Module 3	Water Quality : Water Quality Characteristics: Physical, Chemical, and Biological parameters Drinking Water Standards: BIS; WHO; USEPA Water Quality Indices: Basic concept and examples
Module 4	Water Treatment : Typical flow chart for surface and groundwater treatments Unit Operation and Processes: Aeration, Plain Sedimentation, Sedimentation with Coagulation and Flocculation, Water Softening, Filtration, Disinfection
Module 5	Water Conveyance and Distribution : Hydraulic design of pressure pipes; Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.
Module 6	Characteristics of Municipal Solid Waste (MSW) : Composition and characteristics of MSW
Module 7	Handling of MSW : Generation, collection and transportation of MSW
Module 8	Engineered Systems for MSW Management : Methods of reuse/ recycle, energy recovery, treatment and disposal of MSW

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Surveying & Geomatics

Course Code: CE(PC)403

Semester of Study: 4th (Semester IV)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)403.1	To explain and state the scope of surveying and geomatics in civil engineering	Explain	Understand
CE(PC)403.2	To demonstrate the basic principles of surveying and geomatics engineering	Demonstrate	Apply
CE(PC)403.3	To solve the problems using different methods of surveying and geomatics to measure the features of interest	Solve	Apply
CE(PC)403.4	To examine the traditional and advanced methods of surveying	examine	Analyze
CE(PC)403.5	To relate the different techniques of surveying and geomatics in solving real world problems.	Relate	Analyze

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

CE(PC)403.6	To develop and construct solutions for real-world problems related to surveying and geomatics.	Develop	Create

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	0	0	3	2	2	3
CO2	3	2	3	2	3	3	1	0	2	2	3	3
CO3	3	3	2	3	3	3	0	0	3	2	3	2
CO4	3	3	3	3	3	3	0	0	1	1	2	2
CO5	3	3	2	2	3	1	0	0	3	2	3	2
CO6	3	3	3	2	3	2	0	0	2	2	3	2
Average	3	2.83	2.5	2.33	3	2.16	0.16	0	2.33	1.83	2.66	2.33

University Syllabus:

Module 1	Principles of Surveying Introduction, Principles and classification of surveying; Concept of scales; Survey stations and lines – ranging and bearing; Chain surveying – Concept, Instruments, numerical problems on errors due to incorrect chain; Plane table surveying – Advantages, disadvantages, parts, methods; Elements of simple and compound curves.
Module 2	Levelling: Levelling – Principles, Precautions and Difficulties; Differential levelling, Concepts and numerical problems; Contouring.
Module 3	Triangulation and Trilateration: Theodolite survey – Instruments, measurements of horizontal and vertical angles; Triangulation – Network, signals, numerical examples; Baseline measurement – site selection, measuring equipment, numerical problems on baseline corrections; Trigonometric levelling – Axis signal correction.
Module 4	Advanced Surveying: Principle of Electronic Distance Measurement (EDM); Types of EDM instruments; Distomats; Total Station – Parts, advantages, applications, field procedure and errors; Global Positioning System (GPS) – Concept, applications, segments, location determination, errors; Principle of Differential GPS; Terrestrial laser scanner.
Module 5	Photogrammetric Surveying: Concept; Classification of photogrammetric surveying – terrestrial, aerial and satellite; scale of a vertical photograph; relief displacement and object height determination; Stereoscopic vision – depth perception, parallax angle, stereoscopes; Object height determination using parallax; Parallax bar; Flight planning – Concept and numerical problems; Photo mosaic; Orthophotography; Stereoscopic plotting instruments.
Module 6	Remote Sensing: Energy sources and radiation principles; Concept of Electromagnetic Spectrum; Energy interactions in the atmosphere and earth surface features; Data acquisition and interpretation; Platforms and sensors – Geostationary and sun-synchronous orbits, push broom and whiskbroom scanning system, characteristics of IRS, Landsat and Sentinel sensors; Visual image Interpretation.
Module 7	Digital Image Processing: Concept; Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment and post-classification smoothing.
Module 8	Applications of Geomatics in Civil Engineering: 3D mapping; Earthquake and landslides; Runoff modeling; Groundwater targeting; Flood risk assessment; Urban planning; Highway and transportation.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: CONCRETE TECHNOLOGY Code: CE(PC)404

Semester of Study: 4th (Semester IV)

Course Type: Theory

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)404.1	Explain the composition, manufacturing process, chemical compounds and types of cement, along with influence of aggregate and water in concrete making.	Explain	Understand
CE(PC)404.2	Examine the properties of materials required for concrete making and the properties of concrete at fresh and hardened state as per IS code and its strength characteristics.	Examine	Analysis
CE(PC)404.3	Select the admixture as per requirement for concreting, its role and properties.	Select	Understand
CE(PC)404.4	Design the concrete mix as per latest IS code methods	Design	Synthesis
CE(PC)404.5	Apply the basic knowledge of non-destructive testing in field operations.	Apply	Application
CE(PC)404.6	Analyze various special types of concrete and their applications.	Analyze	Analysis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PC)404.1	3	3	2	3	2	2	1	1	-	-	-	3
CE(PC)404.2	3	3	2	3	2	2	1	1	-	-	-	3
CE(PC)404.3	3	3	2	3	2	2	1	1	-	-	-	2
CE(PC)404.4	3	3	2	3	2	2	1	-	-	-	-	2
CE(PC)404.5	3	3	2	3	2	2	1	-	-	-	-	2
CE(PC)404.6	3	3	2	3	2	2	1	-	-	-	-	2
Average	3	3	2	3	2	2	1	0.5	0	0	0	2.33

University Syllabus:

Module 1	Cement: Manufacturing of cement, Oxides composition of cement and the calculation of compounds, Heat of hydration, Types of cement-OPC, RPC. Low heat cement, PPC, PSC, Sulphate resisting cement, High Alumina cement, Expansive cement, White cement; Test on cement- fineness, consistency, initial setting time & final setting time, soundness test, strength test, specific gravity of cement, storage of cement.
Module 2	Aggregates: Classification, Grading, alkali-aggregate reaction, deleterious substances in aggregates, physical properties, testing of aggregates- fineness modulus, bulking, specific gravity, sieve analysis, flakiness & elongation index. Quality of Water for mixing and curing - use of sea water for mixing concrete.
Module 3	Properties of fresh concrete: Workability, factors affecting workability, segregation and bleeding, tests on workability- slump test, compacting factor test, vee-bee test, flow table test.
Module 4	Properties of Hardened concrete: Tensile & compressive strength, flexural strength, stress-strain characteristics, modulus of elasticity, poisson's ratio, Creep, shrinkage, permeability of concrete, micro cracking of concrete.
Module 5	Strength of concrete: curing methods, water-cement ratio. gel-space ratio, maturity of concrete.
Module 6	Admixtures: types, uses, superplasticizers, plasticizers, Bonding admixtures.
Module 7	Mix Design – Objective, factors influencing mix proportion - Mix design by I.S. 10262-2019. (with & without admixture)
Module 8	Non-destructive test: Rebound hammer and Ultra-sonic pulse velocity testing methods. Quality control - Sampling and testing, Acceptance criteria.
Module 9	Special Concrete – Ferrocement - Fibre reinforced concrete - Polymer concrete - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Fluid Mechanics Laboratory

Course Code: CE(ES)491

Semester of Study: 4th (Semester IV)

Course Type: Practical

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)491.1	To prepare the Coefficient of discharge, calibration of the notch and orifice meter.	prepare	Application
CE(ES)491.2	Evaluate the performance of pump and turbine.	Evaluate	Evaluation
CE(ES)491.3	Calculate the various hydraulic coefficients.	Calculate	Analysis
CE(ES)491.4	Examine the minor losses through pipes.	Examine	Analysis
CE(ES)491.5	Inspect the water surface profile due to formation of hydraulic jump.	Inspect	Analysis
CE(ES)491.6	Inspect the water surface profile for flow over Broad crested weir.	Inspect	Analysis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	1	-	-	2	1	-	1
CO2	3	2	-	-	-	1	-	-	2	1	-	1
CO3	3	2	-	-	-	1	-	-	2	1	-	1
CO4	3	2	-	-	-	1	-	-	2	1	-	1
CO5	3	2	-	-	-	1	-	-	2	1	-	1
CO6	3	2	-	-	-	1	-	-	2	1	-	1
Average	3	2	0	0	0	1	0	0	2	1	0	1

University Syllabus:

Experiment 1	Calibration of Notches.
Experiment 2	Calibration of Orifice meter.
Experiment 3	Determination of Hydraulic Coefficient of an Orifice.
Experiment 4	Performance Test on Centrifugal Pump.
Experiment 5	Performance Test on Reciprocating Pump.
Experiment 6	Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction.
Experiment 7	Performance Test on Pelton Wheel Turbine.
Experiment 8	Measurement of water surface profile for flow over Broad crested weir.
Experiment 9	Measurement of water surface profile for a hydraulic jump.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Solid Mechanics Laboratory Course Code: CE(ES)492

Semester of Study: 4th (Semester IV)

Course Type: Practical

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)492.1	Demonstrate the method and findings of tension and compression tests on ductile, brittle materials and explain the method of bending tests on mild steel beam and concrete beam.	Demonstrate and Explain	Apply
CE(ES)492.2	Demonstrate the method and findings of Torsion test on mild steel circular bar, concrete beam.	Demonstrate	Apply
CE(ES)492.3	Interpret the concept of hardness and explain the procedure and findings of Brinnel and Rockwell tests.	Interpret and Explain	Apply
CE(ES)492.4	Demonstrate the concept, procedure and calculation of spring constant and execute its use in Civil Engineering.	Demonstrate and Execute	Apply
CE(ES)492.5	Demonstrate the method and findings of Izod and Charpy impact tests.	Demonstrate	Apply
CE(ES)492.6	Explain the concepts of fatigue test.	Explain	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(ES)492.1	3	3	1	2	1	-	-	-	2	1	-	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(ES)492.2	3	3	1	2	1	-	-	-	2	1	-	1
CE(ES)492.3	3	3	1	2	1	-	-	-	2	1	-	1
CE(ES)492.4	3	3	1	2	1	-	-	-	2	1	-	1
CE(ES)492.5	3	3	1	2	1	-	-	-	2	1	-	1
CE(ES)492.6	3	1	0	1	1	-	-	-	1	1	-	1
Average	3	2.7	0.8	1.8	1	0	0	0	1.8	1	0	1

University Syllabus:

Experiment 1	Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)
Experiment 2	Compression Test on Structural Materials: Timber, bricks and concrete cubes
Experiment 3	Bending Test on Mild Steel
Experiment 4	Torsion Test on Mild Steel Circular Bar
Experiment 5	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinell and Rockwell Tests
Experiment 6	Test on closely coiled helical spring
Experiment 7	Impact Test: Izod and Charpy
Experiment 8	Demonstration of Fatigue Test

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Engineering Geology Laboratory

Course Code: CE(ES)493

Semester of Study: 4th (Semester IV)

Course Type: Laboratory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(ES)493.1	Define and state the role of engineering geology in civil engineering.	Define	Remember
CE(ES)493.2	Identify the origin of rocks and geologic structures.	Identify	Understand
CE(ES)493.3	Use different tools to identify rocks and minerals in hand specimens and under the microscope.	Use	Apply
CE(ES)493.4	Relate the geological structures by drawing the cross sections from the geological maps.	Relate	Analyse
CE(ES)493.5	Interpret the results obtained from different geological experiments.	Interpret	Apply
CE(ES)493.6	Investigate the natural hazards/disasters that are caused by geological reasons.	Discuss	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	3	1	-	-
CO3	3	2	-	-	1	1	-	-	3	1	-	1
CO4	3	2	1	-	1	1	-	-	3	1	2	1
CO5	3	2	-	-	-	1	-	-	3	1	-	1
CO6	3	2	-	-	-	-	-	-	-	-	-	-
Average	2.83	2	.16	0	.33	0.5	0	0	2	.66	.33	0.5

University Syllabus:

Experiment 1	Identification of minerals in hand specimen.
Experiment 2	Identification of igneous rocks in hand specimen.
Experiment 3	Identification of sedimentary rocks in hand specimen.
Experiment 4	Identification of metamorphic rocks in hand specimen.
Experiment 5	Study of crystals with the help of crystal models.
Experiment 6	Study of geologic structures with the help of models.
Experiment 7	Interpretation of geological maps: horizontal, vertical, uniclinal, folded and faulted structures.
Experiment 8	Microscopic study of rocks and minerals.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Surveying & Geomatics Laboratory; Code: CE(PC) 493

Semester of Study: 4th (Semester IV)

Course Type: Sessional

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC) 493.1	Interpret the interdependency and advancement of different surveying methods	Interpret	Evaluation
CE(PC) 493.2	Explain the working principles of different surveying and geomatics instruments and experiments	Explain	Understand
CE(PC) 493.3	Execute the different methods of surveying and geomatics to measure the features of interest	Execute	Apply
CE(PC) 493.4	Examine the results obtained from the surveying and geomatics experiments	Examine	Analysis
CE(PC) 493.5	Asses the different techniques of surveying and geomatics in measuring and assessing the features of interest	Asses	Evaluation
CE(PC) 493.6	Design and construct solutions for real world problems related to surveying and geomatics.	Design	Synthesis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	3	-	2	-	3	1	1	1
CO2	3	3	3	3	1	-	1	-	1	2	1	2
CO3	3	3	1	2	3	-	3	-	2	1	1	-
CO4	3	3	2	1	2	-	2	-	1	-	1	1
CO5	3	3	3	2	1	-	3	-	1	1	2	1
CO6	3	3	2	2	3	-	2	-	2	-	1	2
Average	3	3	2.17	1.83	2.17	0	2.17	0	1.67	0.83	1.16	1.16

University Syllabus:

Prerequisite	Surveying & Geomatics [CE(PC)403]
Experiment 1	Traverse survey by Prismatic Compass: Procedure; Computation and checks on closed traverse; Preparation of field book; Plotting the traverse; Sources of errors.
Experiment 2	Theodolite Survey: Closed traverse by transit theodolite, Preparation of field book
Experiment 3	Differential Levelling using Dumpy level: Collimation and Rise and Fall methods, Field book preparation
Experiment 4	Total Station Survey: Traversing and Levelling
Experiment 5	Visual Image Interpretation
Experiment 6	Satellite Image Pre-processing
Experiment 7	Digital Image Classification and Accuracy Assessment
Experiment 8	Stereoscopic fusion of aerial photographs using mirror stereoscope

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Concrete Technology Laboratory Course Code: CE(PC)494
Semester of Study: 4th (Semester - IV)
Course Type: Practical

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)494.1	Demonstrate the method and findings of tension and compression tests on concrete.	Demonstrate	APPLY
CE(PC)494.2	Describe the concepts of different test on hardened concrete and different properties of cement.	Describe	UNDERSTAND
CE(PC)494.3	Calculate the specific gravity of concrete ingredients.	Calculate	ANALYSIS
CE(PC)494.4	Calculate the mix proportion of high grade of concrete.	Calculate	ANALYSIS
CE(PC)494.5	Measure the workability of concrete mix.	Measure	EVALUATION
CE(PC)494.6	Investigate the quality of concrete.	Investigate	CREATE

Course Articulation Matrix (CAM):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	0	1	1	1	0	0	1	1	0	1
CO2	2	1	0	1	1	1	0	0	1	1	0	1
CO3	2	3	1	1	2	1	0	0	2	1	0	1
CO4	2	3	2	1	2	1	0	0	2	1	0	1
CO5	3	3	1	1	2	2	0	1	2	2	0	1
CO6	3	3	2	3	3	3	1	1	3	2	1	1
Average	2.5	2.33	1	1.83	1.83	1.5	0.2	0.33	1.83	1.33	0.2	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Test on Fine aggregates	Bulking, Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.
Test on Coarse aggregates	Specific gravity, Bulk Density, Percentage voids, Fineness Modulus. Grading curve.
Test on Cement	Normal consistency, fineness, Initial setting and final setting time of cement. Specific gravity, soundness and Compressive strength of Cement.
Test on Fresh Concrete	Concrete mix design, Various workability tests – slump, compacting factor, Vee-bee test.
Test on Hardened Concrete	Split-tensile strength test, Flexure test, NDT Tests (Rebound hammer and Ultrasonic pulse velocity), Poission ratio.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Design of RC Structures

Course Code: CE(PC)501

Semester of Study: 5th (Semester V)

Course Type: Theory

.....

Program Outcomes (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)501.1	To identify material properties and design methodologies for reinforced concrete structures.	Identify	Comprehension
CE(PC)501.2	Assess different type of loads and prepare layout for reinforced concrete structures.	Assess	Evaluation
CE(PC)501.3	To apply the applicable industrial design codes relevant to the design of reinforced concrete members.	Apply	Application
CE(PC)501.4	To analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase	Analyze	Analysis
CE(PC)501.5	Assessment of serviceability criteria for reinforced concrete beam and slab	Assess	Evaluation
CE(PC)501.6	Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format	Design	Synthesis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	0	0	1	1	0	0	1	0	1
CO2	3	2	3	0	0	1	1	0	0	1	0	1
CO3	3	2	3	0	0	1	1	0	0	1	0	1
CO4	3	2	3	0	0	1	1	0	0	1	0	1
CO5	3	2	3	0	0	1	1	0	0	1	0	1
CO6	3	2	3	0	0	1	1	0	0	1	0	1
Average	3	2	3	0	0	1	1	0	0	1	0	1

University Syllabus:

Module 1	Introduction: Principles of design of reinforced concrete members- working stress and Limit State method of design
Module 2	Working stress method of design: Basic concepts and IS code provisions (IS:456 2000) for design against bending moment and shear forces - Balanced, under-reinforced and over-reinforced beam/slab sections; design of singly and doubly reinforced sections.
Module 3	Limit state method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of design aids for reinforced concrete (SP: 16).
Module 4	Beam Design by LSM: Analysis, design and detailing of singly reinforced rectangular, T, L, and doubly reinforced beam sections by limit state method.
Module 5	Slab Design by LSM: Design and detailing of one-way and two-way slab panels as per IS code provisions
Module 6	Continuous slab and beam design by LSM: Design and detailing of continuous beams and slabs as per IS code provisions
Module 7	Design of Staircases by LSM: Types; Design and detailing of reinforced concrete dog legged staircase
Module 8	Design of Columns by LSM: Design and detailing of reinforced concrete short columns of rectangular and circular cross sections under axial load. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending)– using SP16.
Module 9	Design of Foundation by LSM: Design and detailing of reinforced concrete isolated square and rectangular isolated and combined footing for columns as per IS code provisions by limit state method Design and detailing of Pile foundation as per IS code provisions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Engineering Hydrology

Course Code: CE(PC)502

Semester of Study: 5th (Semester V)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)502.1	Explain the source, occurrence, movement and distribution of water which is a prime resource for development of a nation.	Explain	Understand
CE(PC)502.2	Interpret to Estimate and process the precipitation data.	Interpret	Apply
CE(PC)502.3	Analyze the functioning of reservoirs and estimation of storage capacities.	Analyze	Analyse
CE(PC)502.4	Calculate to estimate the passage of floods through rivers and reservoirs.	Calculate	Analyse
CE(PC)502.5	Design the flood volumes and flood hazards for various structures	Design	Create
CE(PC)502.6	Estimate the measurement of flow in rivers.	Estimate	Evaluation

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	0	1	2	2	0	0	0	0	0
CO2	3	1	1	0	1	0	1	0	0	0	0	2
CO3	3	3	2	1	0	0	2	0	0	0	0	1
CO4	3	3	3	3	0	0	1	0	0	0	0	0
CO5	3	3	3	2	0	1	2	0	0	0	0	3
CO6	3	3	2	3	0	0	1	0	0	0	0	2
Average	3	2.1	1.83	1.5	0.7	1	1.5	0	0	0	0	1.3

University Syllabus:

Module 1	Hydrology: Hydrologic Cycle, Global Water Budget, India's Water Budget.
Module 2	Catchment: Definition & Descriptions, Various Types of Catchments, Factors Characterizing a Catchment, Delineation of Catchment Boundary.
Module 3	Measurement of Precipitation: Precipitation, Description and Functioning of Various Types of Rain gauges, Rain gauge Network- Codal Provisions, Optimum Number of Raingauge Stations.
Module 4	Processing of Rainfall Data: Normal Rainfall, Estimation of Missing Rainfall Data, Test for Consistency of Record; Mass Curve of Rainfall, Hyetograph, Point Rainfall; Mean Precipitation over an Area– Arithmetic Mean, Thiessen Polygon and Isohyetal Method.
Module 5	Losses from Precipitation: Evaporation – Evaporation Process, Factors affecting Evaporation, Measurement of Evaporation– Description and Functioning of Pan Evaporimeter, Pan Co-efficient Evapo-transpiration: AET, PET, Measurement of ET, Estimation of ET–Blaney Criddle Formulae; Infiltration– Process, Factors Affecting Infiltration, Infiltration Rate and Infiltration Capacity, Measurement of Infiltration, Infiltration Equations, Infiltration Indices.
Module 6	Streamflow Measurement: Importance, Direct and Indirect Methods, Measurement of Stage– Various Gauges and Recorders, Measurement of Velocity–Current Meters, their Functioning and Calibration; Velocity Distribution, Floats; Streamflow Computation– Area-Velocity Method, Moving Boat Method, Dilution Technique, Electromagnetic Method, Ultrasonic Method; Indirect Methods– Flow Measuring Structures, Slope Area Method; Stage Discharge Relation, Permanent Control, Stage for Zero Discharge, Shifting Control– Backwater Effect, Unsteady Flow Effect, Extension of the Rating Curve.
Module 7	Runoff: Description of the Process, Components of Runoff, Factors Affecting Runoff, Characteristics of Streams, Rainfall Runoff Relationships. Hydrographs: Types, Base Flow Separation, Effective Rainfall.
Module 8	Unit Hydrograph– Definition, Assumptions, Applications– Derivation of Unit Hydrograph, Distribution Graph, Unit Hydrograph of Different Durations–Method of Superposition and S-Curve.
Module 9	Floods: Concept of flood as a natural hazard; Estimation of flood discharge in a river – rational method, empirical formulae, unit hydrograph method; flood frequency studies – return period.
Module 10	Flood Routing: Concept of flood routing in channels and through a reservoir, basic routing equations; reservoir routing – Modified Pul's method; channel routing – Muskingum method.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Structural Analysis – I

Course Code: CE(PC)503

Semester of Study: 5th (Semester V)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)503.1	Distinguish between stable and unstable and statically determinate and indeterminate structures.	Distinguish	Analyse
CE(PC)503.2	Solve equations of equilibrium to structures and compute the reactions.	Solve	Apply
CE(PC)503.3	Interpret the internal forces in cable and arch type structures.	Interpret	Apply
CE(PC)503.4	Develop and draw the influence lines for reactions, shears and bending moments in beams due to moving loads.	Develop	Create
CE(PC)503.5	Use approximate methods to solve statically indeterminate structures	Solve	Apply
CE(PC)503.6	Sketch the deflections of truss structures and beams.	Sketch	Apply

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	1	1	0	0	0	0	2
CO2	3	3	3	-	-	1	1	0	0	0	0	2
CO3	3	3	3	-	-	1	1	0	0	0	0	2
CO4	3	3	3	-	-	1	1	0	0	0	0	2
CO5	3	3	3	-	-	1	1	0	0	0	0	2
CO6	3	3	3	-	-	1	1	0	0	0	0	2
Average	3	3	3	0	0	1	1	0	0	0	0	2

University Syllabus:

Module 1	Basics of Structural Analysis: Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures. Theorem of minimum potential energy, law of conservation energy, principle of virtual work, the first and second theorems of Castiglano, Betti's law, Clark Maxwell's theorem of reciprocal deflection.
Module 2	Analysis of Determinate Structures: Portal Frames, Three hinged arches, Cables.
Module 3	Deflection of Determinate Structures: Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.
Module 4	Influence Line Diagram: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.
Module 5	Analysis of Statically Indeterminate Beams: Theorem of three moments, Energy methods, Force method (Method of consistent deformation) [For analysis of propped cantilever, fixed beams and continuous beams (maximum two degree of indeterminacy) for simple loading case], Analysis of two hinged arch.
Module 6	Influence Line Diagram for Indeterminate Structures: Muller – Breslau principle.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Soil Mechanics-II

Course Code: CE(PC)504

Semester of Study: 5th (Semester V)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)504.1	Assess the compaction and consolidation characteristics of soil for solving geotechnical problems.	Assess	Evaluation
CE(PC)504.2	Calculate earth pressure on rigid retaining walls on the basis of classical earth pressure theories	Calculate	Analysis
CE(PC)504.3	Interpret the concept of different methods in design, construction of the pavement.	Interpret	Apply
CE(PC)504.4	Solve the bearing capacity of shallow foundation by applying established theory.	solve	Application
CE(PC)504.5	Estimate settlement in soils by different methods.	Estimate	Evaluation
CE(PC)504.6	Design safety of dams and embankments on the basis of	Design	Synthesis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	various methods of slope stability analysis.		

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	1	1	-	-	-	-	-
CO2	3	3	3	3	-	2	1	-	-	-	-	-
CO3	3	3	3	2	-	2	-	-	-	-	-	-
CO4	3	3	3	2	-	2	-	-	-	-	-	-
CO5	3	3	3	3	-	3	1	-	-	-	-	1
CO6	33	3	3	2	-	2	-	-	-	-	-	1
Average	3	3	3	2.33	0	2	0.5	0	0	0	0	0.33

University Syllabus:

Module 1	Consolidation of Soil Terzaghi's theory of one-dimensional consolidation, Compressibility characteristics of soils, Compression index, Coefficient of compressibility and volume change, Coefficient of consolidation, Degree and rate of consolidation, Time factor, Settlement computation, Consolidometer and laboratory one dimensional consolidation test as per latest IS Code, Determination of consolidation parameters.
Module 2	Compaction of Soil Principles of compaction, Standard and modified proctor compaction test, Field compaction methods, Field compaction control, Factors affecting compaction, Effect of compaction on soil properties.
Module 3	Earth Pressure Theories Plastic equilibrium of soil, Earth pressure at rest, Active and passive earth pressures, Rankine's and Coulomb's earth pressure theories, Different types of backfill, Wedge method of analysis. Analytical and graphical methods for determination of earth pressure against various earth retaining structures. Stability of retaining walls: Cantilever retaining wall.
Module 4	Bearing capacity of shallow foundations Bearing capacity, Definition, Factors affecting bearing capacity, Modes of failures, Methods of determining bearing capacity of soils. Terzaghi's bearing capacity theory, Effect of depth of embedment, Eccentricity of load, Foundation shape on bearing capacity, Effect of 11 water table and eccentric loads. Isolated footings with combined action of loads and moments, Bearing capacity as per IS: 6403.
Module 5	Settlement Allowable bearing pressure and settlement analysis (as per IS: 8009), Immediate and consolidation settlements, Rigidity and depth factor corrections, Settlement values as per IS: 1904 recommendations.
Module 6	Stability of slopes Types of failure, Analysis of finite and infinite slopes, Swedish and friction circle method, Ordinary method of slices, Factor of safety, Taylor's stability number, Bishop's simplified method of stability analysis.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Environmental Engineering-II

Course Code: CE(PC)505

Semester of Study: 5th (Semester V)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)505.1	Recognize the basic concepts and terminologies of waste water engineering and hazardous waste management.	Recognize	Comprehension
CE(PC)505.2	Describe different home plumbing systems for water supply and wastewater disposal	Describe	Comprehension
CE(PC)505.3	Implement the methods of quantifying sanitary sewage and storm sewage.	Implement	Apply
CE(PC)505.4	Solve different mathematical problems regarding different components of sewerage system.	Solve	Application
CE(PC)505.5	Compare between different wastewater samples based on their physical, chemical and biological characteristics	Compare	Analyse
CE(PC)505.6	Design different unit processes and operations involved in wastewater treatment	Design	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	1	2	-	-	-	-	1
CO2	3	3	3	-	-	1	3	-	-	-	-	-
CO3	3	3	2	-	-	1	3	-	-	-	-	3
CO4	3	3	3	2	-	1	2	-	-	-	-	1
CO5	3	2	-	1	-	1	3	-	-	-	-	-
CO6	3	2	3	-	1	1	3	-	-	-	-	1
Average	3	2.67	2.17	0.83	0.17	1	2.67	0	0	0	0	1

University Syllabus:

Module 1	Sewage and Drainage: Sewage or Sanitary Sewage, Drainage or Storm Sewage, Sullage, Black Water, Grey Water Sewerage Systems: Separate system, Combined System, Partially Separate System; applicability, advantages and disadvantages
Module 2	Sewage and Drainage Quantity : Quantity estimation for sanitary sewage; Quantity estimation for storm sewage.
Module 3	Conveyance of Sewage : Sewers: Shapes; Design parameters; Operation and maintenance of sewers; Sewer appurtenances Hydraulic Design of Sewers: Partial flow diagrams and Nomograms
Module 4	Wastewater Characteristics : Physical, chemical and biological characteristics of municipal and domestic sewage; Effluent discharge standards
Module 5	Wastewater Treatment : Primary, secondary and tertiary treatment of wastewater; aerobic and anaerobic treatment options Primary and Secondary Treatment of Domestic Wastewater: Typical Flow Chart of STP; Screen and Bar Racks; Grit Chamber; Primary and Secondary Tank; Activated Sludge Process; Trickling Filter
Module 6	Sludge Handling and Disposal : Sludge Thickening; Sludge Digestion; Sludge Drying Bed.
Module 7	Building Plumbing : Introduction to various types of home plumbing systems for water supply and waste water disposal; high rise building plumbing; Pressure reducing valves; Break pressure tanks; Storage tanks; Building drainage for high rise buildings; various kinds of fixtures and fittings used
Module 8	Hazardous waste : Types and nature of hazardous waste as per the HW Schedules of regulating authorities

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Transportation Engineering

Course Code: CE(PC)506

Semester of Study: 5th (Semester V)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)506.1	Summarize the knowledge of planning, design and the fundamental properties of highway materials in highway engineering.	Summarize	Comprehension
CE(PC)506.2	Apply the knowledge of geometric design and draw appropriate conclusion.	Apply	Apply
CE(PC)506.3	Interpret the concept of different methods in design, construction of the pavement.	Interpret	Apply
CE(PC)506.4	Interpret traffic parameters by applying the knowledge in traffic planning and intersection design.	Interpret	Apply
CE(PC)506.5	Define the various pavement materials, types of pavement and their typical cross-sections; Design parameters	Define and Design	Synthesis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	and design the Flexible Pavement rigid Pavement: with Design of rigid Pavement thickness.		
CE(PC)506.6	Illustrate the scope of adoption of sustainable construction techniques by using recyclable hazardous materials.	Illustrate	Application

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	1	1	-	-	-	-	1
CO2	3	2	2	-	-	1	1	-	-	-	-	1
CO3	3	2	2	-	-	1	1	-	-	-	-	1
CO4	3	2	2	-	-	1	1	-	-	-	-	1
Average	3	2	2	0	0	1	1	0	0	0	0	1

University Syllabus:

Module 1	Scope of Highway Engineering; Jayakar Committee Report: Recommendations – CRF, IRC, CRR; Scope of Motor Vehicle Act; Recommendations of Nagpur Road conference; Road Classification as per third 20 years road development plan (1981-2001); Basic types of Road Patterns and its scope of application
Module 2	Factors controlling alignment; engineering surveys for highway alignment and location.
Module 3	Cross-sectional elements of highway; Design Parameters (as per IRC) – Vehicle Dimensions, Carriageway width, Design speed, Frictional coefficients (Lateral and Longitudinal) etc; Design Principles of Horizontal Alignment: Camber, Sight Distance (PIEV theory, SSD, OSD, ISD); Horizontal Curves – [Radius, Superelevation, Extra widening, Set back distance, Transition curve]; Design Principles of Vertical Alignment: Gradients; Grade Compensation; Vertical Curves – Summit Curve, Valley curve.
Module 4	Traffic studies: Fundamental parameters of Traffic Flow (speed, flow, density, capacity) and their basic relations; Basics of Spot Speed Studies- Speed and Delay study- O & D study; Intersections and Channelization: At Grade and Grade Separated intersections; Conflict points; Salient features of Rotary; Traffic Signs; Signal Design – Basic concepts of IRC design method, 2 phase signal design by Webster method.
Module 5	Pavement materials: Bitumen, Aggregate, Subgrade soil; Types of Pavement: Flexible and Rigid pavements and their typical cross-sections; Design parameters: Wheel Load, ESWL, Tyre Pressure, CBR, Resilient Modulus & Poisson's Ratio of various layers, Subgrade Modulus etc. Design of Flexible Pavement using IRC 37:2018 Design of Rigid Pavement: Wheel Stresses, Frictional Stresses and Warping Stresses; Expansion, Contraction and Construction Joints; Design of rigid Pavement thickness, Dowel Bar and Tie Bar. Distresses in Pavements
Module 6	Sustainability: Scope of adoption of sustainable construction techniques by using recyclable hazardous materials- fly ash, plastics, recyclable construction materials.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: RC Design Sessional

Course Code: CE(PC)591

Semester of Study: 5th (Semester V)

Course Type: Practical

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)591.1	Identify material properties and design methodologies for reinforced concrete structures.	Identify	Understand
CE(PC)591.2	Examine different type of loads and organise layout for reinforced concrete structures.	Examine and Organise	Analyse
CE(PC)591.3	Identify and use the applicable industrial design codes relevant to the design of reinforced concrete members.	Identify and Use	Apply
CE(PC)591.4	Design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase.	Design	Create
CE(PC)591.5	Examine serviceability criteria for reinforced concrete beam and slab.	Examine	Analyse
CE(PC)591.6	Develop structural drawings and detailing in appropriate professional format.	Develop	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PC)591.1	2	1	-	1	-	1	-	-	-	-	-	-
CE(PC)591.2	2	2	1	2	-	-	-	-	-	1	-	-
CE(PC)591.3	3	3	3	2	-	1	-	1	-	-	-	3
CE(PC)591.4	3	3	3	2	-	1	-	1	-	1	-	1
CE(PC)591.5	3	3	3	1	-	1	-	1	-	-	-	1
CE(PC)591.6	3	3	2	-	1	1	-	-	-	2	-	2
Average	2.7	2.5	2	1.3	0.2	0.8	0	0.5	0	0.7	0	1.2

University Syllabus:

Design of a small RCC framed building using Limit State method of design including preparation of necessary working drawing and report in accordance with CE(PC)501.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Soil Mechanics Laboratory Course Code: CE(PC)594

Semester of Study: 5th (Semester V)

Course Type: Practical

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)594.1	Classify the types of soil and determine its natural moisture content alongwith specific gravity.	Classify	Comprehension
CE(PC)594.2	Estimate in-situ density of soil by core cutter and sand replacement method.	Estimate	Evaluation
CE(PC)594.3	Develope grain size distribution curve and Atterberg limits for soil.	Develope	Create
CE(PC)594.4	Demonstrate laboratory tests to determine permeability and compaction characteristics of soil.	Demonstrate	Application
CE(PC)594.5	Calculate the shear strength parameters of soil by using UCS, Vane Shear, Direct Shear & Triaxial Test.	Calculate	Analysis
CE(PC)594.6	Calculate the California Bearing Ratio (CBR) of soil.	Calculate	Analysis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PC)594 .1	3	3	1	2	2	-	1	-	3	2	-	1
CE(PC)594 .2	3	3	1	3	-	-	1	-	3	2	-	1
CE(PC)594 .3	3	3	1	3	2	-	1	-	3	2	-	1
CE(PC)594 .4	3	3	1	3	-	-	1	-	3	2	-	1
CE(PC)594 .5	3	3	1	3	2	-	1	-	3	2	-	1
CE(PC)594 .6	3	3	2	3	2	-	1	-	3	2	-	1
Average	3.00	3.00	1.17	2.83	1.33	-	1.00	-	3.00	2.00	-	1.00

University Syllabus:

Experiment 1	Field identification of different types of soil as per Indian Standards [collection of field samples and identifications without laboratory testing].
Experiment 2	Determination of natural moisture content.
Experiment 3	Determination of specific gravity of cohesionless and cohesive soils.
Experiment 4	Determination of in-situ density by core cutter method and sand replacement method.
Experiment 5	Determination of grain size distribution by sieve and hydrometer analysis.
Experiment 6	Determination of Atterberg limits (liquid limit, plastic limit and shrinkage limit).
Experiment 7	Determination of co-efficient of permeability by constant and variable head permeability tests.
Experiment 8	Determination of compaction characteristics of soil by standard proctor compaction test.
Experiment 9	Determination of unconfined compressive strength of soil by unconfined compression test.
Experiment 10	Determination of shear strength parameters of soil by direct shear test.
Experiment 11	Determination of undrained shear strength of soil by vane shear test.
Experiment 12	Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.
Experiment 13	Determination of California Bearing Ratio (CBR) of soil.
Experiment 14	Determination of relative density of soil.
Experiment 15	Standard Penetration Test.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Environmental Engineering Laboratory

Course Code: CE(PC)595

Semester of Study: 5th (Semester V)

Course Type: Practical

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)595. 1	Test the various physical characteristics for a given sample of water and waste water.	Test	Analyse
CE(PC)595. 2	Recognize the various chemical characteristics for a given sample of water and waste water.	Recognize	Understand
CE(PC)595. 3	Examine the bacteriological characteristics for a given sample of water and waste water.	Examine	Analysis
CE(PC)595.4	Assess the suitability of a few treatment options for a given sample of water and waste water.	Assess	Evaluation
CE(PC)595. 5	Compare the determined quality parameters with standards to decide on the suitability of use for the tested water and disposal of tasted wastewater.	Compare	Analyse
CE(PC)595. 6	Use the most appropriate technique to purify and control water contamination.	Use	Application

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	3	-	2	3	-	2	2	-	1
CO2	3	2	-	2	-	2	3	-	2	2	-	1
CO3	3	3	-	2	-	2	3	-	2	2	-	1
CO4	3	3	-	2	-	2	2	-	2	2	-	1
CO5	3	2	-	2	-	1	2	-	2	2	-	1
CO6	3	2	3	1	-	2	3	-	2	2	-	1
Average	3	2.5	0.5	2	0	1.83	2.67	0	2	2	0	1

University Syllabus:

Experiment 1	Determination of turbidity for a given sample of water
Experiment 2	Determination of Electrical Conductivity for a given sample of water
Experiment 3	Determination of Total Solids, Suspended Solids, Dissolved Solids and Volatile Solids in a given sample of water
Experiment 4	Determination of pH for a given sample of water
Experiment 5	Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water
Experiment 6	Determination of acidity for a given sample of water
Experiment 7	Determination of hardness for a given sample of water
Experiment 8	Determination of concentration of Iron in a given sample of water
Experiment 9	Determination of concentration of Chlorides in a given sample of water
Experiment 10	Determination of the Optimum Alum Dose for a given sample of water through Jar Test
Experiment 11	Determination of the Chlorine Demand and Break-Point Chlorination for a given sample of water
Experiment 12	Determination of amount of Dissolved Oxygen (DO) in a given sample of water
Experiment 13	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
Experiment 14	Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
Experiment 15	Determination of Colliform Bacteria: presumptive test, Confirmative test and Determination of MPN

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Transportation Engineering Laboratory

Course Code: CE(PC)596

Semester of Study: 5th (Semester V)

Course Type: Laboratory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)596.1	Classify and examine of aggregates through different tests.	Classify and Examine	Analysis
CE(PC)596.2	Examine the Specific Gravity test, Penetration test, and Static or Kinematic viscosity test on Bitumen.	Examine	Analysis
CE(PC)596.3	Examine Softening point test, Flash and Fire Point test and Ductility test on Bitumen.	Examine	Analysis
CE(PC)596.4	Calculate the CBR value of sub-grade (Soaked and Unsoaked).	Calculate	Analysis
CE(PC)596.5	To design the bituminous mix with Marshall stability test.	Design	Synthesis

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(PC)596.6	Demonstrate on striping value, Loss on heating, Benkelman beam and Bump integrator test.	Demonstrate	Application

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	-	-	-	1	-	-	3	1	-	1
CO2	3	1	-	-	-	1	-	-	3	1	-	1
CO3	3	1	-	-	-	1	-	-	3	1	-	1
CO4	3	2	-	-	-	1	-	-	3	2	-	1
CO5	3	2	-	-	-	1	-	-	3	2	-	1
CO6	3	1	-	-	-	1	-	-	1	1	-	1
Average	3	1.33	0	0	0	1	0	0	2.66	1.33	0	1

University Syllabus:

CE(PC)596	Transportation Engineering Laboratory	2P	1 Credits
Introduction	Introduction on pavement construction materials		
Experiment	Shape test of aggregate.		
Experiment	Crushing strength test of aggregate.		
Experiment	Impact test of aggregate.		
Experiment	Los Angeles Abrasion test of aggregate.		
Experiment	Specific gravity and Water Absorption test of aggregate.		
Experiment	Specific Gravity test.		
Experiment	Penetration Test.		
Experiment	Static or Kinematic viscosity.		
Experiment	Softening point test.		
Experiment	Flash and Fire point test.		
Experiment	Ductility Test.		
Experiment	CBR value of sub-grade (Soaked and unsoaked).		
Experiment	Marshall Stability test.		
Demonstration	Demonstration on Stripping value and Loss on heating tests of bitumen, Benkelman beam and bump integrator test.		

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Computer Applications in Civil Engineering

Course Code: CE(PC)597

Semester of Study: 5th (Semester - V)

Course Type: Practical

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)597.1	Use the computer as a problem-solving tool.	Use	APPLY
CE(PC)597.2	Identify and formulate Civil Engineering problems solvable by computers.	Identify	UNDERSTAND
CE(PC)597.3	Solve Civil Engineering problems by illustrating linear algebra and matrix operations and their applications.	Solve	APPLY
CE(PC)597.4	Solve sets of linear equations and determine roots and nonlinear equations.	Solve	APPLY
CE(PC)597.5	Construct, interpret and solve simple optimization problems.	Construct	CREATE
CE(PC)597.6	Develop programs for Civil Engineering analysis and design problems and with the help of various software, analysis and design are done for industries.	Develop	CREATE

Course Articulation Matrix (CAM):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	0	2	2	2	1	2	1	0	2
CO2	3	3	2	0	2	2	2	1	2	2	0	2
CO3	3	3	3	1	3	2	2	1	2	3	0	2
CO4	3	3	3	1	3	2	2	1	2	3	0	2
CO5	3	3	2	1	2	2	2	1	2	3	0	2
CO6	3	3	3	3	3	2	2	1	3	3	3	2
Average	3	2.83	2.5	1	2.5	3	2	1	2.17	2.5	0.5	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1	Introduction: Concept of problem-solving using computer, use of programming language and software for problem solving; Identification of various design and analysis problems in different fields of Civil Engineering to be solved using computers; Procedure, formulae and data related to the analysis and design of such problems.
Module 2	Use of spreadsheets: Learning spreadsheets like MS Excel, matrix analysis, use of Goal Seek and Solver, Optimization Tools; Plotting. Applications to problems involving tabular data, CE estimation, surveying, and design problems.
Module 3	Programming Languages: Learning at least one language: Fortran 2003/2008/2018, C++11/C++14, Python 3, VBA 7.0; Computing platforms like Matlab/Scilab/MathCAD; Solving analysis and design problems in areas like surveying, hydraulics, structural analysis, RCC design, soil mechanics and foundation, transportation, water resources, etc.
Module 4	Use of Software: Familiarity with widely used Civil Engineering software like STAAD Pro, HEC- RAS, HEC-HMS, SWMM, Mx Roads, etc.; Solving at least two such analysis/design problems.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: SOFT SKILLS AND INTERPERSONAL COMMUNICATION 1.

Course Code: CE (OE) 601 A

Semester of Study: SIXTH

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: : Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE OE 601A.1	Analyse the dynamics of business communication and communicate accordingly.	Analyse/Apply	L4/ 3
CE OE 601A.2	Write business letters and reports	Apply	L 3
CE OE 601A.3	Learn to articulate opinions and views with clarity	Remember	L 1
CE OE 601A.4	. Appreciate the use of language to create beautiful expressions	Creat	L 6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE OE 601A.5	Analyse and appreciate literature.	Understand and evaluate	L 2 /5
CE OE 601A.6	Communicate in an official and formal environment.	understand	L 2

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										*		
CO2										*		
CO3												*
CO4									*			
CO5						*						
CO6										*		
Average												

University Syllabus:

Module 1 : Communication Skill Definition, nature & attributes of Communication

Process of Communication Models or Theories of Communication Types of

Communication Levels or Channels of Communication Barriers to

Communication

Module 2 : Business Communication- Scope & Importance Writing Formal Business

Letters Writing Reports Organizational Communication: Agenda & minutes

of a meeting, notice, memo, circular Project Proposal Technical Report

Writing Organizing e-mail messages E-mail etiquette Tips for e-mail

effectiveness

Module 3 : Language through Literature Modes of literary & non-literary expression

Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and

Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by

Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of the

Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Construction Engineering & Management Code: CE(PC)601

Semester of Study: 6th (Semester VI)

Course Type: Theory

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)601.1	Prepare well planned building which balances all aspects of building such as space conditioning, ventilation, privacy etc. maintain building bye-laws regulations with respect to building side spaces and fire protections.	Prepare	Application
CE(PC)601.2	Inspect the project planning and control activities in the construction projects by using the techniques of PERT and CPM.	Inspect	Analysis
CE(PC)601.3	Apply the concept of wall panels , slabs, columns during erection of prefabricated buildings evaluate and choose appropriate shoring and scaffolding techniques for construction projects, understand the construction sequence of silos, chimneys and sky scrapers.	Apply	Application
CE(PC)601.4	Choose construction equipments for earthwork, material handling and miscellaneous purposes.	Choose	Application
CE(PC)601.5	Interpret the elements and types of contracts, Contract formation, Potential contractual problems,	Interpret	Evaluation

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	Comparison of actions and laws, Powers and duties of arbitrator and types of laws, justify the legal requirements to solve contractual problems for managing construction contracts, achieve awareness on arbitrations, powers and duty of an arbitrator.		
CE(PC)601.6	List the idea of hierarchy, work responsibility of the administrator.	List	Knowledge

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PC)601.1	3	3	3	-	-	-	-	-	-	-	-	1
CE(PC)601.2	3	3	3	-	1	-	-	-	-	-	2	1
CE(PC)601.3	3	3	3	-	1	-	-	-	-	-	-	1
CE(PC)601.4	3	3	3	-	3	-	-	-	-	-	-	1
CE(PC)601.5	2	-	2	-	1	-	-	-	-	-	1	1
CE(PC)601.6	1	-	-	-	-	1	-	1	-	-	3	1
Average	2.5	2	2.3	0	1	0.17	0	0.17	0	0	1	1

University Syllabus:

Module 1	Planning: General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy.
Module 2	Regulation and Bye laws Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks , ventilation, Requirements for stairs, lifts in public assembly building, offices
Module 3	Fire Protection Fire fighting arrangements in public assembly buildings, planning , offices, auditorium
Module 4	Planning & Scheduling of constructions Projects Planning by CPM Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration. Planning by PERT Expected mean time, probability of completion of project, Estimation of critical path, problems
Module 5	Construction Methods basics Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.
Module 6	Construction plants & Equipment

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering

(Applicable from the academic session 2023-2024)

	Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. Plants & Equipment for concrete construction Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.
Module 7	Contracts Management basics Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.
Module 8	Management Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contract
Module 9	Departmental Procedures Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Engineering Economics, Estimation & Costing

Course Code: CE(PC)602

Semester of Study: 6th (Semester VI)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)602.1	Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses.	Learn	Remember
CE(PC)602.2	Be able to differentiate present worth, future worth and annual worth analyses on one of more economic alternatives.	Differentiate	Analyse
CE(PC)602.3	Be able to sketch benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.	Sketch	Apply
CE(PC)602.4	Be able to explain the technical specifications for various works to be performed for a project and how they impact the cost of a structure.	Explain	Understand
CE(PC)602.5	Be able to weigh the worth of a structure by evaluating quantities of constituents,	Weigh	Evaluate

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	derive their cost rates and build up the overall cost of the structure.		
CE(PC)602.6	Be able to explain how competitive bidding works and how to submit a competitive bid proposal.	Explain	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	1	1	1	1	1	3	2
CO2	2	2	1	-	-	1	1	-	-	-	3	2
CO3	2	2	1	-	-	1	1	-	-	-	3	2
CO4	3	3	3	-	-	1	1	-	-	-	2	2
CO5	3	3	3	-	-	1	1	-	-	-	1	2
CO6	3	3	3	-	-	1	1	2	2	2	3	2
Average	2.5	2.5	2	0	0	1	1	0.5	0.5	0.5	2.5	2

University Syllabus:

Module 1	Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.
Module 2	Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control – Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.
Module 3	Estimation / Measurements for various items: Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.
Module 4	Specifications: Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.
Module 5	Rate analysis: Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.
Module 6	Tender: Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management.
Module 7	Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table.
Module 8	Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Water Resources Engineering

Course Code: CE(PC)603

Semester of Study: 6th (Semester VI)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)603.1	Explain the fundamentals of flow in open channels.	Explain	Understand
CE(PC)506.2	Describe the concepts of irrigation	Describe	Understand
CE(PC)506.3	Estimate the quantity of water required by different crops in different seasons, and accordingly the irrigation water requirement.	Estimate	Evaluate
CE(PC)506.4	Design canals and other irrigation structures required for irrigation and other water-management projects.	Design	Create
CE(PC)506.5	Design drains required for land drainage, soil conservation, flood control.	Design	Create
CE(PC)603.6	Define about groundwater resources, aquifers and wells.	Define	Remember

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	0	0	0	0	0	0	0	2
CO2	3	0	1	0	0	3	1	0	0	0	0	0
CO3	3	3	3	3	1	1	1	0	0	0	0	3
CO4	3	3	3	3	0	1	0	0	0	0	0	1
CO5	3	2	2	0	0	1	1	0	0	0	0	0
CO6	3	1	0	0	0	1	1	0	0	0	0	0
Average	3	2	1.8	1.2	0.3	1.2	0.7	0	0	0	0	2

University Syllabus:

Module 1	Open Channel Flow: Channel Characteristics and parameters, Energy-depth relationship, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually varied flow, Water surface profiles.
Module 2	Irrigation: Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.
Module 3	Soil-water plant relationship: Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation requirement, Gross Irrigation Requirement, Intensity of Irrigation, Consumptive use of water, Estimation of Evapotranspiration, Blaney-Criddle method, Modified Penman's method, Irrigation Efficiencies, Frequency of irrigation.
Module 4	Canal irrigation: Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections- filling, cutting, partial cutting and partial filling.
Module 5	Land Drainage: Water logging issues in irrigation, provisions of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.
Module 6	Groundwater: Occurrence of groundwater- Aquifers, Various types of aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Design of Steel Structures

Course Code: CE(PC)604

Semester of Study: 6th (Semester VI)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)604.1	Identify the material properties of structural steel.	Identify	Understand
CE(PC)604.2	Design different bolted and welded connections for axial and eccentric loads.	Design	Create
CE(PC)604.3	Design the tension, compression & column bases member under axial and combined loading.	Design	Create
CE(PC)604.4	Differentiate between laterally supported and unsupported flexure members and Design the flexure members using Indian codes of practice.	Differentiate and Design	Create
CE(PC)604.5	Examine shear force and bending moment on plate girders, and finally design it following Indian standard design guidelines.	Examine and Design	Create
CE(PC)604.6	Identify different components of gantry girders, examine lateral and vertical	Identify, Examine and	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

	loads acting on the gantry girders and design them.	Design	

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PC)604.1	2	1	-	-	-	1	1	-	-	-	-	-
CE(PC)604.2	3	3	2	1	-	1	-	1	-	1	-	1
CE(PC)604.3	3	3	2	1	-	1	-	1	-	1	-	1
CE(PC)604.4	3	3	2	1	-	1	-	1	-	1	-	1
CE(PC)604.5	3	3	2	1	-	1	-	1	-	1	-	1
CE(PC)604.6	3	3	2	1	-	1	-	1	-	1	-	-
Average	2.8	2.7	1.7	0.8	0	1	0.2	0.8	0	0.8	0	0.7

University Syllabus:

Module 1	Materials and Specification: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. Design of Steel structures using tubular, rectangular and square section
Module 2	Structural connections: Riveted, welded and bolted including High strength friction grip bolted joints. — types of riveted & bolted joints, assumptions, failure of joints, efficiency of joints, design of bolted, riveted & welded joints for axial load. Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.
Module 3	Design of Tension members: Design of tension members, I.S. code provisions. Permissible stresses, Design rules, Examples.
Module 4	Design of Compression members: Effective lengths about major & minor principal axes, I.S. code provisions. Permissible stresses, Design rules, Design of one component, two components and built up compression members under axial load. Examples. Built up columns under eccentric loading: Design of lacing and batten plates, Different types of Column Bases- Slab Base , Gusseted Base, Connection details
Module 5	Design of Beams: Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams. simple Beam end connections, beam -Column connections. I.S. code provisions
Module 6	Design of Plate girders: Design of webs & flanges, Concepts of curtailment of flanges — Riveted & welded web stiffeners, web flange splices - Riveted, welded & bolted.
Module 7	Design of Gantry Girder: Design gantry girder considering lateral buckling — I.S. code provisions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Foundation Engineering

Course Code: CE(PE)601B

Semester of Study: 6th (Semester VI)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)601B.1	Classify the shallow and deep foundation Determine the load carrying capacity of pile foundation.	Classify	Comprehension
CE(PE)601B.2	Calculate the efficiency and settlement of pile group.	Calculate	Analysis
CE(PE)601B.3	Express different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis.	Express & interpret	Application
CE(PE)601B.4	Categorize bearing capacity of shallow foundation from field test data.	Categorize	Analysis
CE(PE)601B.5	Analyze and design sheet pile structure on the basis of earth pressure theories.	Analyze	Analysis
CE(PE)601B.6	Identify and apply various types of ground improvement methods for solving complex geotechnical problems.	Identify & Apply	Application

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module 1	Classification, selection- shallow and deep foundations.
Module 2	Pile foundation: Types of piles, material, Suitability and uses, Method of installation of piles - classification of piles based on material, Installation Techniques – Selection and uses, Determination of types and lengths of piles, Load transfer mechanism, Determination of load carrying capacities of piles by static and dynamic formulae as per IS codes, Pile spacing and group action, Group efficiency, Negative skin friction, Pile load test, Settlement of pile group, Lateral load capacity of pile by IS: 2911 and Reese & Matlock methods, Uplift capacity of pile - introduction.
Module 3	Site Investigation & Soil Exploration Planning of sub-surface exploration, Methods of boring, sampling, Different types of samples, Spacing, Depth and number of exploratory borings, Bore log, Preparation of sub-soil investigation report. In-situ tests Standard penetration test, Static cone penetration test, Dynamic cone penetration test, Field vane shear test, Plate load test. Indirect methods of soil exploration Geophysical method: seismic refraction and electrical resistivity methods.
Module 4	Shallow Foundations Bearing Capacity from SPT, SCPT and Plate load Test data. of loads and moments, Bearing capacity as per IS: 6403.
Module 5	Type of sheet piling, Design of sheet pile, Cantilever sheet piling, Anchored sheet piling, Free earth and fixed earth support methods, Analysis with anchored bulk heads.
Module 6	Introduction to Ground Improvement Techniques Introduction, Economic considerations, Consolidation by preloading and sand drains, Stone columns, Compaction by vibro-floatation, Grouting techniques and principles, Applications of geo-synthetics, Ground anchors and soil nailing.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Structural Analysis – II CE(PE)602B

Semester of Study: 6th (Semester VI)

Course Type: Theory

.....

Program Outcome (PO):

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

PO 2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE (PE)602B.1	Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures.	Apply	Apply
CE (PE)602B.2	Develop and analyze the concept of suspension bridge and stiffness girders	Analyse	Analyse
CE (PE)602B.3	Apply and analyze the concepts of curved beam analysis in hooks, rings and bow girders. Develop the concept bending in unsymmetrical beams.	Develop	Analyse
CE (PE)602B.4	Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis.	Apply	Apply
CE (PE)602B.5	Develop and analyze the portal frames using Portal and Cantilever method.	Analyse	Analyse
CE (PE)602B.6	Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.	Analyse	Analyse

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	1
CO2	3	3	3	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	1
CO4	3	3	3	3	-	-	-	-	-	-	-	2
CO5	3	3	3	3	-	-	-	-	-	-	-	-
CO6	3	3	3	3	-	-	-	-	-	-	-	1
Average	3	3	3	3	0	0	0	0	0	0	0	0.83

University Syllabus:

Module 1	Analysis of statically Indeterminate Structures: Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope deflection method: method and application in continuous beams and frames. Suspension Bridge and stiffening girders.
Module 2	Curved Beam analysis: Hooks, rings and Bow girders. Unsymmetrical bending.
Module 3	Plastic analysis of structures: beams and portal frames.
Module 4	Approximate method of analysis of structures: Portal and Cantilever methods. 4L Module 5
Module 5	Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Water resources Engineering Laboratory

Course Code: CE(PC)693

Semester of Study: 6th (Semester VI)

Course Type: Laboratory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)693.1	Prepare a diagram of the catchment area for any water body manually or using DEM.	Prepare	Synthesis
CE(PC)693.2	Calculate the average rainfall over a catchment.	Calculate	Analysis
CE(PC) 693.3	Measure the rainfall data using different types of rain-gauges.	Measure	Evaluation
CE(PC) 693.4	Measure the rate of infiltration of water through the soil.	Measure	Evaluation
CE(PC) 693.5	Measure the evaporation using evaporimeter.	Measure	Evaluation
CE(PC) 693.6	Measure the sunshine hours in a particular day.	Measure	Evaluation

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	0	3	0	1	0	1	2	1	0
CO2	3	3	2	1	0	2	2	0	2	2	1	1
CO3	3	2	0	1	3	0	2	0	3	2	1	1
CO4	3	2	0	0	3	0	2	0	3	2	1	1
CO5	3	2	0	0	3	0	2	0	3	2	1	1
CO6	3	1	0	1	3	1	2	0	3	2	1	0
Average	3	1.83	0.5	0.5	1.5	0.5	1.83	0	2.5	2	1	0.67

University Syllabus:

CE(PC)693	Water Resources Engineering Laboratory
Experiment 1	Catchment area delineation (Manually and using DEM).
Experiment 2	Calculation of average rainfall over a catchment area with arithmetic mean method, Thiessen polygon method and Isohyetal Method.
Experiment 3	Use of different type of Rain-Gauges.
Experiment 4	Measurement of infiltration rate using double ring infiltrometer.
Experiment 5	Measurement of evaporation using evaporimeter.
Experiment 6	Measurement of bright sunshine hours using sunshine recorder.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Steel Structure Design Sessional Code:CE(PC)694

Semester of Study: 6th (Semester VI)

Course Type: Sessional

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)694.1	Identify the material properties of structural steel. Moreover, the students will identify different bolted and welded connections, analyse and design them for axial and eccentric loads.	Identify	Understand
CE(PC)694.2	Design different steel sections subjected to axial compression and tension following Indian codes of practices.	Design	Synthesis
CE(PC)694.3	Identify the differences between laterally supported and unsupported flexure members. Designing of the flexure members using Indian codes of practice.	Identify	Understand
CE(PC)694.4	Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension.	Analyse	Analysis
CE(PC)694.5	Calculate shear force and bending moment on rolled and built up girders, dimension the section and finally design it following Indian standard design guidelines.	Calculate	Analysis
CE(PC)694.6	Identify different components of gantry system, calculate lateral and vertical loads acting on the system, dimension the components and design them. Design different components of an industrial building.	Identify	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	-	2	2	-	2	2	-	1
CO2	2	2	1	2	-	1	1	-	3	1	-	3
CO3	2	3	2	1	-	3	1	-	1	1	-	1
CO4	2	3	3	2	-	2	2	-	2	3	-	2
CO5	2	2	1	1	-	1	2	-	2	1	-	3
CO6	3	2	1	2	-	3	1	-	1	3	-	3
Average	2.17	2.33	1.5	1.67	0	2	1.84	0	1.84	1.83	0	2.17

University Syllabus:

Prerequisite	Design of Steel Structures (CE(PC)604)
	Design of a factory shed including preparation of necessary working drawings and report in accordance with CE(PC)604

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Quantity Survey Estimation & Valuation

Course Code: CE(PC)695

Semester of Study: 6th

Course Type: Sessional

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PC)695. 1	Explain about Quantity Surveying, different types of estimates, items of work and their units.	Explain	Understand
CE(PC)695. 2	Analyze the schedule of rates	Analyze	Analysis
CE(PC)695. 3	Prepare the specification of materials & works.	Prepare	Application
CE(PC)695. 4	Prepare bar bending schedule for RCC structure	Prepare	Application
CE(PC)695. 5	Interpret the fundamental concept of valuation	Interpret	Evaluation
CE(PC)695. 6	Estimate the detailed quantity of material consumption and abstracts for constructions for single storied building, road, Underground reservoir, Surface drain, Septic tank	Estimate	Evaluation

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	2	1	-	-	1	2	-
CO2	3	2	-	-	1	2	-	2	-	1	2	1
CO3	3	1	2	-	-	2	-	1	-	1	2	1
CO4	3	3	2	1	2	2	-	1	2	1	2	1
CO5	3	1	-	-	3	2	2	3	2	2	3	1
CO6	3	-	2	-	2	2	1	3	3	2	3	3
Average	3	1.17	1	0.17	1.34	2	0.67	1.67	1.17	1.34	2.34	1.17

University Syllabus:

1. Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment.
2. Quantity estimate of a single storied building
3. Bar bending schedule.
4. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities.
5. Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank.
6. Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing,
7. Specification of materials: Brick, cement, fine and coarse aggregates
8. Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering, pointing, white washing, colour washing, distempering, lime punning, painting and varnishing
9. Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Metro System and Engineering

Course Code: CE(OE)701A

Semester of Study: 7th (Semester VII)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(OE)701A.1	Describe the overview of metro system.	Describe	Understand
CE(OE)701A.2	Design the construction methods related to civil engineering structures of metro system.	Design	Create
CE(OE)701A.3	Design the survey, planning and managements related to civil engineering structures of metro system.	Design	Create
CE(OE)701A.4	Explain about required electronics and communication system for Metro system.	Explain	Understand
CE(OE)701A.5	Identify different parts of the mechanical structure for metro system and engineering.	Identify	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(OE)701A.6	Apply knowledge on the Electrical system required for metro system and engineering.	Apply	Apply

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	0	0	1	0	1	1	0	0	0	0	0
CO2	3	3	3	3	0	1	1	0	0	0	0	0
CO3	3	2	2	1	0	1	1	0	0	0	1	0
CO4	3	2	2	1	0	1	1	0	0	0	0	0
CO5	3	2	2	1	0	1	1	0	0	0	0	0
CO6	3	2	2	1	0	1	1	0	0	0	0	0
Average	3	1.9	2	1.3	0	1	1	0	0	0	0.3	0

University Syllabus:

Module 1	Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financial.
Module 2	CIVIL ENGINEERING: Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management. Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management.
Module 3	ELECTRONICS AND COMMUNICATION ENGINEERING: Signalling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.
Module 4	MECHANICAL & TV + AC Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators
Module 5	ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Hydraulic Structures

Course Code: CE(PE)701C

Semester of Study: 7th (Semester VII)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)701C.1	Identify the characteristics of various types of dams and their selection procedure.	Identify	Understand
CE(PE)701C.2	Operate the reconnaissance survey and, geophysical investigations necessary for selection of suitable dam site.	Operate	Apply
CE(PE)701C.3	Examine forces acting on gravity dams and develop stability analysis.	Examine and Develop	Create
CE(PE)701C.4	Examine the seepage loss through embankment dams and construct necessary remedial measures.	Examine and construct	Create
CE(PE)701C.5	Describe various diversion head works and their components, including creep in foundation.	Describe	Understand
CE(PE)701C.6	Examine the discharge through the overflow section and design the appropriate energy dissipation structures.	Examine and design	Create

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PE)701C.1	3	2	-	-	-	1	1	-	-	-	-	-
CE(PE)701C.2	3	2	-	-	-	1	1	-	-	-	-	-
CE(PE)701C.3	3	3	2	1	-	2	-	1	-	1	-	1
CE(PE)701C.4	3	3	2	1	-	2	-	1	-	1	-	1
CE(PE)701C.5	3	3	1	-	-	2	-	-	-	-	-	-
CE(PE)701C.6	3	3	2	1	-	2	-	1	-	-	-	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Average	3	2.7	1.2	0.5	0	1.7	0.3	0.5	0	0.3	0	0.5

University Syllabus:

Module 1	Storage Structures: Dams, Types of Dams — Embankment dams, gravity dams, various components and their functions
Module 2	Selection of Dam Site: Site investigations, initial study, reconnaissance survey, geophysical investigations, preliminary selection, evaluation of selected site -various types of foundation testing, field testing and borrow pit investigations, detailed investigations; assessment of foundation characteristics and suitability; selection of type of dam.
Module 3	Gravity Dam: Definition, Features of some important gravity dams, Forces acting on a gravity dam, estimation of forces due to: self-weight, water pressure on upstream and downstream face, Uplift pressure, wave pressure, silt pressure, wind pressure, earthquake forces, hydrodynamic forces; Stability analysis - load combinations, codal provisions, modes of failures - overturning, sliding, tension and compression failures, factors of safeties, principal stresses; Elementary profile of a gravity dam - forces acting, minimum base width - no tension, no sliding basis, principal stresses. Embankment Dams: Definitions, Features of some important embankment dams- Types of embankment dams and their sectional features; Design criteria; Freeboard - necessity, estimation procedure; Seepage analysis - Laplace's flow equations, drainage blanket and rock toe, phreatic line, graphical procedure of drawing phreatic line, estimation of seepage loss; Stability analysis of embankment dams — slip circle method; Seepage Control - cut-offs, slurry trench, sheet piling, grouting, slope protection. Diversion headworks: Necessity and uses, different types, layout and different components; weirs on permeable foundation, Creep theories, Khosla's method; Different types of modules, Canal escapes, Silt control devices.
Module 4	Spillways and Energy Dissipation Structures: Necessity, types, selection, spillway gates; High overflow ogee spillway - profile, discharge computation, flow equations, factors affecting coefficient of discharge, codal provisions. stilling basins (USSR and BIS) types.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Prestressed Concrete

Course Code: CE(PE)702A

Semester of Study: 7th (Semester VII)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)702A.1	Learn the introduction of prestressed concrete member and its deflection properties.	Learn	Understand
CE(PE)702A.2	Develop the design criteria of prestressed concrete section for flexure and shear properties.	Develop	Create
CE(PE)702A.3	Design the anchorage zone stress for post-tensioned members.	Design	Create
CE(PE)702A.4	Use the methods for Analysis of Statically Indeterminate Structures.	Use	Apply
CE(PE)702A.5	Explain the composite construction of Prestress and In-situ concrete.	Explain	Understand
CE(PE)702A.6	Design the Prestressed concrete poles and sleepers and introduction of partial prestressing.	Design	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	1	1	0	0	1	0	2
CO2	3	3	3	-	-	1	1	0	0	1	0	2
CO3	3	3	3	-	-	1	1	0	0	1	0	2
CO4	3	3	3	-	-	0	0	0	0	1	0	2
CO5	3	3	3	-	-	0	0	0	0	1	0	2
CO6	3	3	3	-	-	0	0	0	0	1	0	2
Average	3	3	3	0	0	0.5	0.5	0	0	1	0	2

University Syllabus:

Module 1	Introduction of Prestressed concrete: Materials, prestressing system, analysis of prestress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of prestressed concrete members: Importance, factors, short term and long term deflection.
Module 2	Shear and Torsional Resistance: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending. Limit State Design Criteria: Inadequacy of Elastic and Ultimate Load Method, Criteria for Limit States, Strength and Serviceability. Design of Prestressed Concrete Section: for Flexure & methods by Lin and Magnel.
Module 3	Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement.
Module 4	Statically Indeterminate Structures: Advantages of Continuous Member, Effect of Prestressing, Methods of Achieving Continuity and Method of Analysis of Secondary Moments.
Module 5	Composite Construction of Prestressed and In-situ Concrete: Types, Analysis of Stresses.
Module 6	Prestressed Concrete Poles and Sleepers: Design of Sections for Compression and Bending. Introduction to Partial Prestressing.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Air and Noise Pollution and Control

Course Code: CE(PE)703A

Semester of Study: 7th (Semester VII)

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)703.1	To explain the basic concepts and terminologies regarding air pollution and noise pollution	Explain	Understand
CE(PE)703.2	To demonstrate the physics of air pollution and noise pollution	Demonstrate	Apply
CE(PE)703.3	To use the methods to solve the air pollution and noise pollution measurements	Solve	Apply
CE(PE)703.4	To examine different concepts of air and noise pollution for solving mathematical problems	Examine	Analyse
CE(PE)703.5	To investigate air and noise quality with allowable standards and limits	Investigate	Create

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

CE(PE)703.6	To select and design proper techniques for air pollution, noise pollution, and control	Select	Evaluate

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	0	2	3	1	0	0	0	2
CO2	3	2	1	2	2	2	3	1	0	1	0	2
CO3	3	3	3	3	3	2	3	2	1	1	1	2
CO4	3	3	3	3	3	3	3	2	2	3	1	2
CO5	3	3	3	3	3	2	3	0	2	2	1	2
CO6	3	3	3	3	3	3	3	2	2	3	2	2
Average	3	2.83	2.5	2.66	2.33	2.33	1	1.33	1.16	1.66	0.83	2

University Syllabus:

Module 1	Air Pollutants: Sources; Classification; Effects on Human, Vegetation, Material Effects of Air pollution on Atmosphere: Photochemical Smog, Ozone Layer Depletion, Acid Rain, Greenhouse Effect and Global Warming
Module 2	Air Pollution Meteorology: Lapse Rate; Atmospheric Stability; Inversion; Plume Pattern
Module 3	Dispersion of Air Pollutants: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height
Module 4	Air Quality: Methods of Measurement: Gaseous pollutants, Particulate pollutants, Air Quality Standards and Indices: Ambient Air Quality Standard, NAAQS, Emission Standard, Air Quality Indices.
Module 5	Air Pollution Control: Control of Gaseous Pollutants: Adsorption, Absorption, Condensation Control of Particulate Pollutants: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators Control of Pollution from Automobiles
Module 6	Physics of Noise: Basics of Acoustics; Sound Pressure, Power and Intensity and their Interrelations
Module 7	Measurement of Noise: Noise Level; Interrelation between Noise, Pressure, Power and Intensity Levels; Noise Meter; Noise Networks; Frequency Band Analysis; Decibel Addition Measurement of Community Noise: L_N , L_{eq} , L_{dn} , L_{NP}
Module 8	Source and Effect of Noise: Psychoacoustics and noise criteria; effects of noise on health; annoyance rating schemes
Module 9	Noise Pollution Control: Noise Standards and Limits; Methods of Noise Pollution Control

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Advanced Structural Analysis

Course Code: CE(PE)704B

Semester of Study: 7th (Semester VII)

Course Type: Theory

Program Outcomes (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)704B.1	To use matrix methods of structural analysis for plane trusses, beams, continuous frames.	Use	Application
CE(PE)704B.2	To solve simple problems by the finite difference method.	Solve	Application
CE(PE)704B.3	To identify various relaxation techniques used in structural analysis.	Identify	Comprehension
CE(PE)704B.4	To demonstrate three dimensional stress and strain analysis, stress invariants, equilibrium and compatibility equations.	Demonstrate	Application
CE(PE)704B.5	To identify plane stress, plane strain problems.	Identify	Comprehension
CE(PE)704B.6	To solve simple plate and shell problems.	Solve	Application

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	0	0	0	0	1	0	1
CO2	3	2	1	1	0	0	0	0	0	1	0	1
CO3	3	2	1	1	1	0	0	0	0	1	0	1
CO4	3	2	1	1	0	0	0	0	0	1	0	1
CO5	3	2	1	1	0	0	0	0	0	1	0	1
CO6	3	2	1	1	0	0	0	0	0	1	0	1
Average	3	2	1	1	0.33	0	0	0	0	1	0	1

University Syllabus:

Module 1	Matrix Methods of Structural Analysis: Application of matrix methods to plane truss, beams, continuous frames
Module 2	Finite difference and relaxation technique- application to simple problems.
Module 3	Theory of plate bending: Navier's Solutions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.
Module 4	Theory of Elasticity: Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equilibrium and compatibility equations. Two dimensional problems in Cartesian and polar coordinates. Plane stress, plane strain problems, St. Venant's principle.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Pavement Design

Course Code: CE(PE)705B

Semester of Study: 7th (Semester VII)

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)705.1	Differentiate between different types of pavements, both structurally and functionally.	Differentiate	Analyse
CE(PE)705.2	Execute Axle Load Survey and Estimate Design Traffic.	Execute	Apply
CE(PE)705.3	Classify different stresses, strains and deflections in flexible and rigid pavements.	Classify	Understand
CE(PE)705.4	Design different components of bituminous pavement.	Design	Create
CE(PE)705.5	Identify the specifications and design criteria of low-volume rigid pavement.	Identify	Understand
CE(PE)705.6	Recognize the principles of Pavement Maintenance and identify various pavement distresses	Recognize, Identify	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(PE)705.1	2	2	-	-	-	-	-	-	-	-	-	-
CE(PE)705.2	3	3	3	3	1	-	-	-	-	1	-	2
CE(PE)705.3	3	3	-	-	-	-	-	-	-	-	-	1
CE(PE)705.4	3	3	3	3	-	-	-	-	-	1	-	2
CE(PE)705.5	3	3	3	3	-	-	2	-	-	1	-	1
CE(PE)705.6	3	3	-	-	-	-	-	-	-	-	-	-
Average	2.83	2.83	1.5	1.5	.16	0	0.3	0	0	0.5	0	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1	Pavement Design Flexible Pavement Design: Stresses and Deflections in homogeneous masses.; Burmister's two layer theory; Three layer and multi-layer theories; wheel load stresses, various factors in traffic wheel loads; ESWL of multiple wheels; McLeod method of design; AASTHO method of flexible pavement design. Low Volume Rigid Pavement: Criteria of Load, Scope and Specifications as per different Govt policies in India, Design Criteria.
Module 2	Pavement Construction and Management Flexible Pavement Construction: Earthwork (Method of Alignment-wise marking using chainage), compaction of embankments, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers; Construction procedure of Low Volume Rigid Pavement.
Module 3	Pavement Evaluation - Pavement Distress Functional condition evaluation of pavements- Roughness, Skid Resistance, Serviceability Index; Structural evaluation of pavements –Benkelman beam and Falling Weight Deflectometer; Pavement strengthening; Design of bituminous and concrete overlays as per IRC

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Industrial Internship Code: CE(IN)791

Semester of Study: 7th (Semester VII)

Course Type: Practical/Sessional

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(IN)791.1	Apply fundamental principles of engineering to find solutions based on a systems approach which integrate theory with practice.	Apply	Application
CE(IN)791.2	Demonstrate skills to work in a team and understand to work with people from diverse backgrounds.	Demonstrate	Application
CE(IN)791.3	Develop the skills required in a profession to become updated with the latest technical advancements and adapt to the changes of the industry.	Develop	Synthesis
CE(IN)791.4	Develop communication and interpersonal skills as per the Industry standards.	Develop	Synthesis
CE(IN)791.5	Evaluate leadership skills by accomplishing the tasks assigned by the industry.	Evaluate	Evaluation
CE(IN)791.6	Analyze the challenges and future of potential career in an organization in particular and the sector in general.	Analyze	Analysis

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(IN)791.1	3	3	2	2	3	-	-	-	1	-	3	3
CE(IN)791.2	-	-	1	1	2	2	-	2	3	1	3	3
CE(IN)791.3	2	2	3	2	3	-	-	2	-	-	2	3
CE(IN)791.4	-	-	-	-	1	-	-	-	-	3	2	3
CE(IN)791.5	1	1	1	-	1	-	-	3	2	-	3	3
CE(IN)791.6	-	2	3	1	2	2	1	2	1	-	2	3
Average	1	1.3	1.67	1	2	0.67	0.17	1.5	1.17	0.67	2.5	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project I

Course Code: CE(PROJ)792

Semester of Study: 7th (Semester VII)

Course Type: Sessional

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PROJ)792.1	To recognize the scope of the problem and conduct a Literature review	Identify	Understand
CE(PROJ)792.2	To use existing/new methods to apply the fundamental aspects of civil engineering and their relevance with respect to the societal benefit	Execute	Apply
CE(PROJ)792.3	To set up experimentation/design/development of models to analyze and compare the results	Formulate	Create
CE(PROJ)792.4	To identify the modern techniques to collect the data & solve the real-life problems	Develop	Create
CE(PROJ)792.5	To Identify the solutions and relate them with the literature with proper analysis of the problem	Discuss	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(PROJ)792.6	To develop the ability of working in the groups and to develop skills related to comprehensive report writing.	Report	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	2	2	1	3	0	2	2
CO2	3	3	3	3	2	2	2	0	3	0	3	2
CO3	3	3	3	2	3	2	2	2	3	1	3	2
CO4	3	3	3	2	3	3	3	2	3	2	3	2
CO5	3	3	3	3	3	2	2	2	3	3	3	2
CO6	3	2	3	2	3	2	0	3	3	3	3	3
Average	3	2.66	3	2.5	2.67	2.16	1.83	1.67	3	1.5	2.83	2.16

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Professional Practice, law & Ethics Course Code: CE(HS)801A

Semester of Study: 8th (Semester VIII)

Course Type: Theory

Course Category: Humanities and Social Sciences including Management courses

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(HS)801.1	Recognize the importance of Values and Ethics in their Personal lives and professional careers.	Recognize	Understand
CE(HS)801.2	Discuss the key principles, aspects and purpose of contract management	Discuss	Understand
CE(HS)801.3	Implement the process for tender, bid evaluation, contract documentation, and contract notices	Implement	Apply
CE(HS)801.4	Discuss Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system	Discuss	Understand
CE(HS)801.5	Identify the role of labour in civil engineering and methods of engaging labour	Identify	Understand
CE(HS)801.6	Identify the need for intellectual property, main forms of IP, Copyright, Trademarks, and the process of obtaining Patents.	Identify	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CE(HS)801.1	-	-	-	-	-	2	-	3	-	-	-	1
CE(HS)801.2	-	-	-	-	-	2	-	2	-	-	-	-
CE(HS)801.3	3	2	-	-	-	2	-	3	-	1	2	2
CE(HS)801.4	-	-	-	-	-	2	-	2	-	1	2	-
CE(HS)801.5	-	-	-	-	-	2	-	2	-	1	1	-
CE(HS)801.6	3	-	-	-	-	3	-	3	-	1	-	2
Average	1	0.33	0	0	0	2.16	0	2.5	0	0.66	0.83	0.83

University Syllabus:

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

Module 1	Professional Practice: Respective roles of various stakeholders: Government(constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice);professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction);Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards) Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.
Module 2	General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Nonperformance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public- Private Partnerships; International Commercial Terms
Module 3	Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.
Module 4	Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour subcontract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017
Module 5	Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Deep Foundation

Course Code: CE(OE)801C

Semester of Study: 8th (Semester VIII)

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(OE)801C.1	Explain the concept of bearing capacity for deep foundation.	Explain	Understand
CE(OE)801C.2	Differentiate in what circumstances pile is needed and how to estimate pile and pile group capacity under various soil conditions Characterize	Differentiate	Analysis
CE(OE)801C.3	Estimate the safe bearing capacity including settlement consideration for deep foundations.	Estimate	Evaluation
CE(OE)801C.4	Select a suitable deep foundation system for various site conditions and also analysis of that.	Select	Evaluate

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

CE(OE)801C.5	Identify different types and methods of construction for cassion foundation.	Identify	Understand
CE(OE)801C.6	Explain different types and suitable design method of well foundation to check their stability analysis.	Explain	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	2	1	-	-	-	-	-
CO3	3	3	3	3	-	2	-	-	-	-	-	-
CO4	3	3	3	3	-	1	-	-	-	-	-	-
	3	3	3	2	-	-	1	-	-	-	-	-
	3	3	3	3	-	1	1	-	-	-	-	-
Average	3	3	3	2.83	0	1	0.5	0	0	0	0	0

University Syllabus:

Module 1	Piles: Types - load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule –Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction – under-reamed piles, pile cap.
Module 2	Drilled Pier: Introduction, uses, types, bearing capacity, settlement, construction procedures.
Module 3	Cassion foundations: Types & selections, forces & moments, depth determination.
Module 4	Well foundations: The Types, components, design of well foundations – grip, size, steining, curb, cutting edge, top & bottom plug, well cap; stability analysis of well foundation, construction, shift & tilts

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Environmental Impact Assessment and Life Cycle Analyses
Course Code: CE(OE)802D

Semester of Study: 8th (Semester VIII)

Course Type: Theory

Course Designation: Open Elective-IV

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(OE)802D.1	Recognize perspectives from ecological and social sciences to understand complex socio-ecological issues in developmental projects at multiple spatial scales.	Recognize	Understand
CE(OE)802D.2	Assess the impact of any activity (large or small scale) on the surrounding environment.	Assess	Evaluation
CE(OE)802D.3	Implement the process of environmental impact modelling and prediction as a design tool.	Implement	Apply
CE(OE)802D.4	Formulate mitigation strategies to protect the environment leading to sustainability.	Formulate	Create
CE(OE)802D.5	Measure the environmental performance of energy and production systems.	Measure	Evaluation
CE(OE)802D.6	Identify the intricacies of Life Cycle Analysis and basic knowledge for coherent existence.	Identify	Comprehension

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	1	2	-	-	-	-	1
CO2	3	3	3	-	-	1	3	-	-	-	-	-
CO3	3	3	2	-	-	1	3	-	-	-	-	3
CO4	3	3	3	-	-	1	3	-	-	-	-	1
CO5	3	2	-	-	-	1	3	-	-	-	-	-
CO6	3	2	3	-	-	1	3	-	-	-	-	1
Average	3	2.67	2.17	0	0	1	2.83	0	0	0	0	1

University Syllabus:

Module 1	Introduction Definition, Objective with legal aspect of Environmental Impact Assessment(EIA)
Module 2	Methodology for EIA with Base Line Studies, Screening , Scoping and Public Consultation
Module 3	EIA Analysis Data Collection & Environmental Impact Analysis, preparation of EIA report
Module 4	EIA Mitigation and Audit- Mitigation and Impact Management with various case studies, Environmental Audit
Module 5	Introduction to Life Cycle Analysis (LCA): History, Definition, Standards and structure of LCA Goal and Scope of LCA: System of a product with boundary, unit process and functional unit
Module 6	Life Cycle Interpretation and Inventory: Limitation of LCA, Identification of significant issues, Evaluation, Reporting, Critical Review. Inventory: Data Collection, Data Bases, Allocation, Validation
Module 7	LCA Impact Assessment and Practice: Categories, Classification, Normalization, LCA Management, Life Cycle thinking, Sustainability

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Pavement Materials and Design

Course Code: CE(PE)801D

Semester of Study: 8th (Semester VIII)

Course Type: Theory

Course Designation: Compulsory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PE)801D.1	To identify the engineering properties and characteristics of the different materials that concern the pavement engineer	Identify	Understand
CE(PE)801D.2	To use the modern testing techniques of soil, granular and bituminous materials for pavement analysis and design	Use	Apply
CE(PE)801D.3	To implement the use of different superlative aggregate tests and requirements	Implement	Apply
CE(PE)801D.4	To solve the design mix of rigid pavement	Solve	Apply
CE(PE)801D.5	To discuss the relationship between key materials and their properties along with the behaviour of pavement component systems.	Discuss	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

CE(PE)801D.6	To select the proper pavement techniques, the deflection of pavements, and methods of maintenance of pavements.	Select	Evaluate

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2	2	2	0	2	2	2	2
CO2	3	2	3	3	2	2	1	0	3	3	2	2
CO3	3	2	3	3	2	2	1	0	3	3	2	2
CO4	3	3	3	3	3	2	3	0	2	2	2	3
CO5	3	3	3	3	3	2	3	0	2	2	3	2
CO6	3	3	3	3	3	2	3	0	2	3	3	2
Average	3	2.5	2.83	3	2.5	2	2.16	0	2.33	2.5	2.33	2.16

University Syllabus:

Module 1	Introduction: Basic road construction materials: Types of basic materials, Suitability of different materials depending on their availability and characteristics, Economic, Environmental, and Social issues of material usage, Life cycle analysis, and its use in design
Module 2	Soil: Classification; Index & Engineering properties of soil, Properties of sub-grade; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Introduction to Soil Stabilization: Physical and Chemical Modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. CBR, Plate Load test, resilient modulus, DCPT
Module 3	Aggregate: Characterization: Origin, classification, properties. Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation problems on Rothfutch's and Critical sieve methods and Shape factor in mix design
Module 4	Bitumen Binders: Different types, properties and uses, Tests on bitumen, Rheological and pavement performance-related properties, and Criteria for selection of different binders. Marshall Method of mix design, Additives & Modifiers in Bituminous mixes, problems on mix design
Module 5	Cement: Requirements, design of mix for CC pavement, use of additives, IRC specifications & Tests, joint filler and sealer materials.
Module 6	The modern trend of using Modified, Sustainable and Environment-friendly materials: Geo-Synthetics: Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short term aging and its effect on bitumen performance Plastic waste: Types of polymer, the applicability of polymer-based waste product in different layers of pavement

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Comprehensive Viva Voce

Course Code: CE(CV)881

Semester of Study: 8th (Semester VIII)

Course Type: Sessional

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(CV)891.1	To memorize the basic and advanced knowledge in civil engineering	Memorize	Remember
CE(CV)892.2	To develop an idea about the environment of job market and their preparedness to defend the interview after graduation	Develop	Create
CE(CV)892.3	To implement their knowledge in civil engineering acquired in the last four years.	Implement	Apply
CE(CV)892.4	To relate usefulness to the society and assess the impact of civil engineering on the environment.	Relate	Analyze
CE(CV)892.5	To Recognize the properties, uses, advantages and disadvantages of different	Recognize	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
 (Applicable from the academic session 2023-2024)

	materials/construction - techniques used in civil engineering		
CE(CV)892.6	To identify the usage of the different provisions given in the IS codes & schedules	Identify	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	0	2	0	0	0	0	0	0	3
CO2	3	1	3	1	1	2	1	0	2	0	0	3
CO3	3	2	2	2	0	1	0	0	1	0	0	3
CO4	3	2	2	3	0	2	2	1	0	0	0	3
CO5	3	2	2	2	1	1	2	2	0	0	0	3
CO6	3	2	2	2	0	1	0	0	0	0	0	3
Average	3	1.67	2.16	1.67	0.67	1.17	0.83	0.5	0.5	0	0	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project 2

Course Code: CE(PROJ)882

Semester of Study: 8th (Semester VIII)

Course Type: Sessional

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will have strong fundamental knowledge in core topics of each subject of the University curriculum of Civil Engineering.

PSO2: Graduates will have the ability to describe, analyse, and solve problems using mathematics and systematic problem-solving technique for core subjects of Civil Engineering.

PSO3: Graduates will be able to patronize higher studies and technological practice in Civil Engineering.

PSO4: Graduates will be able to keep pace with the modern construction techniques and management tools of Civil Engineering, either in industry or through entrepreneurship.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CE(PROJ)892.1	To recognize the scope of problem and conduct a Literature review	Identify	Understand
CE(PROJ)892.2	To use existing/new methods to apply the fundamental aspects of civil engineering and their relevance with respect to the societal benefit	Execute	Apply
CE(PROJ)892.3	To set up experimentation / design / development of models to analyze and compare the results	Formulate	Create
CE(PROJ)892.4	To identify the modern techniques to collect the data & solve the real-life problems	Develop	Create
CE(PROJ)892.5	To Identify the solutions and relate them with the literature with proper analysis of the problem	Discuss	Understand

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2023-2024)

CE(PROJ)892.6	To develop the ability of working in the groups and to develop skills related to comprehensive report writing	Report	Understand

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	2	2	2	1	3	0	2	2
CO2	3	3	3	3	2	2	2	0	3	0	3	2
CO3	3	3	3	2	3	2	2	2	3	1	3	2
CO4	3	3	3	2	3	3	3	2	3	2	3	2
CO5	3	3	3	3	3	2	2	2	3	3	3	2
CO6	3	2	3	2	3	2	0	3	3	3	3	3
Average	3	2.67	3	2.5	2.67	2.16	1.83	1.67	3	1.5	2.83	2.16

University Syllabus:

Module 1	Scope of Highway Engineering; Jayakar Committee Report: Recommendations – CRF, IRC, CRR; Scope of Motor Vehicle Act; Recommendations of Nagpur Road conference; Road Classification as per third 20 years road development plan (1981-2001); Basic types of Road Patterns and its scope of application
Module 2	Factors controlling alignment; engineering surveys for highway alignment and location.
Module 3	Cross-sectional elements of highway; Design Parameters (as per IRC) – Vehicle Dimensions, Carriageway width, Design speed, Frictional coefficients (Lateral and Longitudinal) etc; Design Principles of Horizontal Alignment: Camber, Sight Distance (PIEV theory, SSD, OSD, ISD); Horizontal Curves – [Radius, Superelevation, Extra widening, Set back distance, Transition curve]; Design Principles of Vertical Alignment: Gradients; Grade Compensation; Vertical Curves – Summit Curve, Valley curve.
Module 4	Traffic studies: Fundamental parameters of Traffic Flow (speed, flow, density, capacity) and their basic relations; Basics of Spot Speed Studies- Speed and Delay study- O & D study; Intersections and Channelization: At Grade and Grade Separated intersections; Conflict points; Salient features of Rotary; Traffic Signs; Signal Design – Basic concepts of IRC design method, 2 phase signal design by Webster method.
Module 5	Pavement materials: Bitumen, Aggregate, Subgrade soil; Types of Pavement: Flexible and Rigid pavements and their typical cross-sections; Design parameters: Wheel Load, ESWL, Tyre Pressure, CBR, Resilient Modulus & Poisson's Ratio of various layers, Subgrade Modulus etc. Design of Flexible Pavement using IRC 37:2018 Design of Rigid Pavement: Wheel Stresses, Frictional Stresses and Warping Stresses; Expansion, Contraction and Construction Joints; Design of rigid Pavement thickness, Dowel Bar and Tie Bar. Distresses in Pavements
Module 6	Sustainability: Scope of adoption of sustainable construction techniques by using recyclable hazardous materials- fly ash, plastics, recyclable construction materials.



Principal
Regent Education & Research Foundation
Bara Kanthalia, P.O.-Sewli Telinipara
Barrackpore, Kolkata-700121

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

Curriculum Structure

2nd Year: 3rd Semester

A. Theory							
Sl No	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC301	Electronic Devices	3	0	0	3	3
2.	EC302	Digital System Design	3	0	0	3	3
3.	EC303	Signals and Systems	3	0	0	3	3
4.	EC304	Network Theory	3	0	0	3	3
5.	ES-CS301	Data Structure & Algorithm (ES)	3	0	0	3	3
6.	BS-M301	Probability & Statistics(BS)	3	0	0	3	3
Total Theory						18	18
B. Practical							
7.	EC391	Electronic Devices Lab.	0	0	2	2	1
8.	EC392	Digital System Design Lab.	0	0	2	2	1
9.	ES-CS391	Data Structure Lab(ES)	0	0	2	2	1
Total Practical						6	3
Total Credits						24	21
C. Non Credit Course							
	MC381	Environmental Science	0	0	2	2	0

2ndYear: 4th Semester

A. Theory							
Sl No	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC401	Analog Communication	3	0	0	3	3
2.	EC402	Analog Electronic Circuits	3	0	0	3	3
3.	EC403	Microprocessor & Microcontrollers	3	0	0	3	3
4.	ES-CS401	Design and Analysis of Algorithm(ES)	3	0	0	3	3
5.	BS-M401	Numerical Methods(BS)	2	0	0	2	2
6.	BS-B401	Biology for Engineers	2	1	0	3	3
Total Theory						14	17
B. Practical							
7.	EC491	Analog Communication Lab	0	0	2	2	1
8.	EC492	Analog Electronic Circuits Lab.	0	0	2	2	1
9.	EC493	Microprocessor & Microcontrollers Lab	0	0	2	2	1
10.	BS-M(CS)491	Numerical Methods Lab	0	0	2	2	1
11.	HS-HU481	Soft Skill Development Lab	0	0	2	2	1
Total Practical						10	5
Total Credits						24	22

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

3rd Year: 5th Semester

A. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC501	Electromagnetic Waves	3	0	0	3	3
2.	EC502	Computer Architecture	3	0	0	3	3
3.	EC503	Digital Communication & Stochastic Process	3	1	0	4	3.5
4.	EC504	Digital Signal Processing	3	0	0	3	3
5.	PE-EC505	Program Elective I	3	0	0	3	3
6.	OE-EC506 A/B/C/D	Open Elective I	3	0	0	3	3
Total Theory						19	18.5
B. Practical							
7.	EC591	Electromagnetic Wave Lab	0	0	2	2	1
8.	EC592	Digital Communication Lab.	0	0	2	2	1
9.	EC593	Digital Signal Processing Lab.	0	0	2	2	1
Total Practical						6	3
C. Sessional							
10.	MC-HU581	Effective Technical Communication	0	0	3	3	0
Total Credits						28	21.5

3rd Year: 6th Semester

C. Theory							
Sl No.	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	EC601	Control System & Instrumentation	3	0	0	3	3
2.	EC602	Computer Network	3	0	0	3	3
3.	PE-EC603	Program Elective II	3	0	0	3	3
4.	OE-EC604	Open Elective II	3	0	0	3	3
5.	HS-HU601	Economics for Engineers	3	0	0	3	3
Total Theory						15	15
D. Practical							
6.	EC692	Computer Network Lab.	0	0	2	2	1
7.	EC691	Control System and Instrumentation Lab.	0	0	2	2	1
8.	EC681	Mini Project/ Electronic Design Workshop	0	0	4	4	2
Total Practical						8	4
Total Credits						23	19
9	MC681	Universal Human Values	2	0	0	2	0

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

4th Year: 7th Semester

D. Theory							
Sl No	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC701	Program Elective -3	3	0	0	3	3
2.	PE-EC702	Program Elective -4	3	0	0	3	3
3.	PE-EC703	Program Elective -5	3	0	0	3	3
4.	OE-EC704	Open Elective - 3	3	0	0	3	3
5.	HS-HU701	Principles of Management	2	0	0	2	2
Total Theory						14	14
E. Practical							
6	EC781	Industrial Training	During Semester Break(6 th & 7 th)				1
7.	EC782	Project Stage – I	0	0	8	8	4
Total Practical						8	5
Total Credits						22	19

4th Year: 8th Semester

E. Theory							
Sl No	Field	Theory	Contact Hours/week				Credit Points
			L	T	P	Total	
1.	PE-EC801	Program Elective – 6	3	0	0	3	3
2.	PE-EC802	Program Elective - 7	3	0	0	3	3
3.	OE-EC803	Open Elective - 4	3	0	0	3	3
4.	OE-EC804	Open Elective - 5	3	0	0	3	3
Total Theory						12	12
F. Practical							
5.	EC881	Project Stage – II	0	0	15	15	7.5
6.	EC882	Grand Viva					1.5
Total Practical						15	9
Total Contact /Credits						27	21

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

Professional Electives

Sl No.	Course Code	Course Title	Hours/week			Credits	Semester
			L	T	P		
1	PE-EC505A	Nano Electronics	3	0	0	3	V
2	PE-EC505B	Speech and Audio Processing	3	0	0	3	
3	PE-EC505C	Power Electronics	3	0	0	3	
4	PE-EC505D	Scientific Computing	3	0	0	3	
5	PE-EC603A	Introduction to MEMS	3	0	0	3	VI
6	PE-EC603B	Bio-Medical Electronics	3	0	0	3	
7	PE-EC603C	CMOS VLSI Design	3	0	0	3	
8	PE-EC603D	Information Theory & Coding	3	0	0	3	
9	PE-EC701A	Microwave Theory and Techniques	3	0	0	3	VII
10	PE-EC701B	Satellite Communication	3	0	0	3	
11	PE-EC701C	Mobile Communication and Networks	3	0	0	3	
12	PE-EC702A	Adaptive Signal Processing	3	0	0	3	
13	PE-EC702B	Digital Image and Video Processing	3	0	0	3	
14	PE-EC702C	Neural Network and Fuzzy Logic Control	3	0	0	3	
15	PE-EC703A	Embedded System	3	0	0	3	
16	PE-EC703B	Wireless Sensor Networks	3	0	0	3	
17	PE-EC703C	Wavelet Transforms	3	0	0	3	VIII
18	PE-EC801A	Antennas and Propagation	3	0	0	3	
19	PE-EC801B	Fibre Optic Communication	3	0	0	3	
20	PE-EC801C	Error Correcting Codes	3	0	0	3	
21	PE-EC802A	Mixed Signal Design	3	0	0	3	
22	PE-EC802B	Industrial Automation and Control	3	0	0	3	
23	PE-EC802C	VLSI Design Automation	3	0	0	3	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electronics & Communication Engineering
 (Applicable from the academic session 2018-2019)

List of Open Elective

Sl No.	Course Code	Course Title	Hours/week			Credits	Semester
			L	T	P		
1	OE-EC506A	Soft Skill and Interpersonal Communication	3	0	0	3	V
2	OE-EC506B	Cyber Law & Intellectual Property Rights	3	0	0	3	
3	OE-EC506C	Human Resource Management	3	0	0	3	
4	OE-EC604A	Electronic Measurements and Measuring Instruments	3	0	0	3	VI
5	OE-EC604B	Operating System	3	0	0	3	
6	OE-EC604C	Object Oriented Programming	3	0	0	3	
7	OE-EC704A	Web Technology	3	0	0	3	VII
8	OE-EC704B	Optimisation Technique	3	0	0	3	
9	OE-EC704C	Entrepreneurship	3	0	0	3	
10	OE-EC803A	Internet of Things(IoT)	3	0	0	3	VIII
11	OE-EC803B	Big Data Analysis	3	0	0	3	
12	OE-EC803C	Cyber Security	3	0	0	3	
13	OE-EC804A	Artificial Intelligence	3	0	0	3	
14	OE-EC804B	Microwave Integrated Circuits	3	0	0	3	
15	OE-EC804C	Organisational Behaviour	3	0	0	3	



Principal

Regent Education & Research Foundation
 Bara Kanthalia, P.O.-Sewli Telinipara
 Barrackpore, Kolkata-700121

Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)***Syllabus for B. Tech in Electrical Engineering****(Applicable from the academic session 2018-2019)****3rd Semester****Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 301	Electric Circuit Theory	3	1	0	4	4
2	PC-EE 302	Analog Electronics	3	0	0	3	3
3	PC-EE 303	Electromagnetic field theory	3	0	0	3	3
4	ES-ME 301	Engineering Mechanics	3	0	0	3	3
5	BS-M 301	Mathematics-III	3	0	0	3	3
6	BS-EE301	Biology for Engineers	3	0	0	3	3
7	MC-EE 301	Indian Constitution	3	0	0	3	0
TOTAL OF SEMESTER:						22	19

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 391	Electric Circuit Theory Laboratory	0	0	2	2	1
2	PC-EE 392	Analog Electronics laboratory	0	0	2	2	1
3	PC-CS 391	Numerical Methods laboratory	0	0	2	2	1
		Total of Practical / Sessional				06	3
TOTAL OF SEMESTER:						28	22

Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)***Syllabus for B. Tech in Electrical Engineering**

(Applicable from the academic session 2018-2019)

4th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 401	Electric machine-I	3	0	0	3	3
2	PC-EE 402	Digital Electronic	3	0	0	3	3
3	PC-EE 403	Electrical and Electronics Measurement	3	0	0	3	3
4	ES-EE 401	Thermal Power Engineering	3	0	0	3	3
5	HM-EE401	Values and Ethics in profession	3	0	0	3	3
6	MC- EE401	Environmental Science	3	0	0	3	0
		TOTAL OF SEMESTER:				18	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 491	Electric machine-I laboratory	0	0	2	2	1
2	PC-EE 492	Digital electronics laboratory	0	0	2	2	1
3	PC-EE 493	Electrical and electronic measurement laboratory	0	0	2	2	1
4	ES-ME 491	Thermal power engineering laboratory	0		2	2	1
		Total of Practical / Sessional				08	4
TOTAL OF SEMESTER:						26	19

Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)***Syllabus for B. Tech in Electrical Engineering****(Applicable from the academic session 2018-2019)****5th Semester****Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 501	Electric machine-II	3	0	0	3	3
2	PC-EE 502	Power system-I	3	0	0	3	3
3	PC-EE 503	Control system	3	0	0	3	3
4	PC-EE 504	Power electronics	3	0	0	3	3
5	PE-EE 501	A. High voltage Engineering B. Power Plant Engineering C. Renewable & Non conventional energy	3	0	0	3	3
6	OE-EE 501	A. Data structure & algorithm B. Object oriented programming C. Computer organization & architecture	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 591	Electric Machine-II laboratory	0	0	2	2	1
2	PC-EE 592	Power system-I laboratory	0	0	2	2	1
3	PC-EE 593	Control system laboratory	0	0	2	2	1
4	PC-EE 594	Power Electronics laboratory	0	0	2	2	1
		Total of Practical / Sessional				08	4
TOTAL OF SEMESTER:						26	22

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Electrical Engineering

(Applicable from the academic session 2018-2019)

6th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 601	Power System-II	3		0	3	3
2	PC-EE-602	Micro processor & micro controller	3	0	0	3	3
3	PE-EE 601	A. Digital control system B. HVDC transmission C. Electrical Machine Design	3	0	0	3	3
4	PE-EE 602	A. Electrical and Hybrid vehicle B. Power quality & FACTS C. Industrial Electrical systems	3	0	0	3	3
5	OE-EE 601	A. Digital Signal Processing B. Communication Engineering C. VLSI & Microelectronics	3	0	0	3	3
6	HM-EE 601	Economics for Engineers	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 691	Power system-II laboratory	0	0	2	2	1
2	PC-EE692	Micro processor & microcontroller laboratory	0	0	2	2	1
2	PC-EE 681	Electrical & Electronic design laboratory	1	0	4	5	3
		Total of Practical / Sessional				09	05
TOTAL OF SEMESTER:						27	23

Summer Internship of 3-week duration after 6th semester. Students will be assessed based on submission of report on internship and presentation in a seminar in 7th semester

Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)***Syllabus for B. Tech in Electrical Engineering**

(Applicable from the academic session 2018-2019)

7th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 701	Electric Drive	3	0	0	3	3
2	PE-EE 701	A. Control system Design B. Electrical Energy conservation & Auditing C. Power generation economics	3	0	0	3	3
3	OE-EE701	A. Artificial intelligence B. Internet of things C. Computer graphics	3	0	0	3	3
4	OE-EE702	A. Embedded system B. Digital image processing C. Computer network	3		0	3	3
5	HM-EE701	Principle of Management	3	0	0	3	3
		TOTAL OF SEMESTER:				15	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 791	Electric Drive laboratory	0	0	2	2	1
2	PW-EE 781	Project stage-I	0	0	4	4	2
3	PW-EE782	Seminar	0	0	0	0	1
		Total of Practical / Sessional				06	04
TOTAL OF SEMESTER:						21	19

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Electrical Engineering

(Applicable from the academic session 2018-2019)

8th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EE 801	Utilization of Electric Power	3	0	0	3	3
2	PE- EE 801	A. Line –commutated and active PWM rectifiers B. Power system dynamics & control C. Advanced Electric Drives D. Industrial Automation and Control	3	0	0	3	3
3	OE-EE 801	A. Soft computing Techniques B. Biomedical Instrumentation. C. Introduction to Machine learning D. Sensors and Transducers	3	0	0	3	3
		TOTAL OF SEMESTER:				09	09

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PW-EE 881	Project stage-II	0	0	16	16	8
		Total of Practical / Sessional				16	08
TOTAL OF SEMESTER:						25	17



Principal

Regent Education & Research Foundation
Bara Kanthalia, P.O.-Sewli Telinipara
Barrackpore, Kolkata-700121

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
 (Applicable from the academic session 2018-2019)

Curriculum Structure

3rd Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-301	Electric Circuit Theory	3	1	0	4	4
2	PC-EEE-302	Analog Electronics	3	0	0	3	3
3	PC-EEE-303	Electromagnetic field theory	3	0	0	3	3
4	ES-ME-301	Engineering Mechanics	3	0	0	3	3
5	BS-M-301	Mathematics-III	3	0	0	3	3
6	BS-EEE-301	Biology for Engineers	3	0	0	3	3
7	MC-EEE-301	Indian Constitution	3	0	0	3	0
		TOTAL OF SEMESTER:				22	19

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-391	Electric Circuit Theory Laboratory	0	0	2	2	1
2	PC-EEE-392	Analog Electronics laboratory	0	0	2	2	1
3	PC-CS-391	Numerical Methods laboratory	0	0	2	2	1
		Total of Practical / Sessional				06	3
TOTAL OF SEMESTER:						28	22

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
 (Applicable from the academic session 2018-2019)

4th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-401	Electric machine-I	3	0	0	3	3
2	PC-EEE-402	Digital Electronics	3	0	0	3	3
3	PC-EEE-403	Electrical and Electronic Measurement	3	0	0	3	3
4	ES-EEE-401	Thermal Power Engineering	3	0	0	3	3
5	HM-EEE-401	Values and Ethics in profession	3	0	0	3	3
6	MC- EEE-401	Environmental Science	3	0	0	3	0
		TOTAL OF SEMESTER:				18	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-491	Electric Machine-I laboratory	0	0	2	2	1
2	PC-EEE-492	Digital Electronics laboratory	0	0	2	2	1
3	PC-EEE-493	Electrical and Electronic measurement laboratory	0	0	2	2	1
4	ES-ME-491	Thermal Power Engineering laboratory	0		2	2	1
		Total of Practical / Sessional				08	4
TOTAL OF SEMESTER:						26	19

Maulana Abul Kalam Azad University of Technology, West Bengal*(Formerly West Bengal University of Technology)***Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)**

(Applicable from the academic session 2018-2019)

5th Semester**Theory:**

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-501	Electric machine-II	3	0	0	3	3
2	PC-EEE-502	Power System-I	3	0	0	3	3
3	PC-EEE-503	Control system	3	0	0	3	3
4	PC-EEE-504	Power Electronics	3	0	0	3	3
5	PE-EEE-501A/B/C	High Voltage Engineering/Power Plant Engineering/Renewable& Non Conventional Energy	3	0	0	3	3
6	OE-EEE-501A/B/C	Data Structure & Algorithm/Object Oriented Programming/Computer Organization	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-591	Electric Machine-II laboratory	0	0	2	2	1
2	PC-EEE-592	Control system laboratory	0	0	2	2	1
3	PC-EEE-593	Power Electronics laboratory	0	0	2	2	1
		Total of Practical / Sessional				06	3
TOTAL OF SEMESTER:						24	21

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
 (Applicable from the academic session 2018-2019)
6th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-601	Power System-II	3		0	3	3
2	PC-EEE-602	Microprocessor & Micro controller	3	0	0	3	3
3	PE-EEE-601	A. Nano Electronics B. Electrical Machine Design C. VLSI & Microelectronics	3	0	0	3	3
4	PE-EEE-602	A. Electrical & Hybrid vehicle B. Power Quality & FACTS C. Industrial Electrical Systems	3	0	0	3	3
5	OE-EEE-601	A. Artificial Intelligence B. Database Management Systems C. Analytical Instrumentation	3	0	0	3	3
6	HM-EEE-601	Economics for Engineers	3	0	0	3	3
		TOTAL OF SEMESTER:				18	18

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-691	Power system laboratory	0	0	2	2	1
2	PC-EEE-692	Microprocessor & Microcontroller laboratory	0	0	2	2	1
3	PC-EEE-681	Electrical & Electronic design laboratory	1	0	4	5	3
		Total of Practical / Sessional				09	05
TOTAL OF SEMESTER:						27	23

Summer Internship of 3-week duration after 6th semester. Students will be assessed based on submission of report on internship and presentation in a seminar in 7th semester

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)
 (Applicable from the academic session 2018-2019)

7th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-701	Analog and digital communication	3	0	0	3	3
2	PE-EEE-701	A. Electric Drive B. Digital Control system C. HVDC transmission System	3	0	0	3	3
3	OE- EEE-701	A. Embedded system B. Computer network C. Introduction to Machine learning	3	0	0	3	3
4	OE- EEE-702	A. Internet of Things B. Computer Graphics C. Soft computing Techniques	3		0	3	3
5	HM- EEE-701	Principle of Management	3	0	0	3	3
		TOTAL OF SEMESTER:				15	15

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE 791	Analog and digital Communication laboratory	0	0	2	2	1
2	PW-EEE 781	Project stage-I	0	0	4	4	2
3	PW-EEE782	Seminar	0	0	0	0	1
		Total of Practical / Sessional				06	04
		TOTAL OF SEMESTER:				21	19

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Electrical & Electronics Engineering (EEE)

(Applicable from the academic session 2018-2019)

8th Semester

Theory:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
1	PC-EEE-801	Digital signal processing	3	0	0	3	3
2	PE- EEE-801	A. Utilization of Electric Power B. Advanced Electric Drives C. Power system dynamics and control D. Industrial Automation and Control	3	0	0	3	3
3	OE- EEE-801	A. Digital Image Processing B. Biomedical Instrumentation C. Cryptography and Network Security D. Sensors and Transducers	3	0	0	3	3
TOTAL OF SEMESTER:						09	09

Practical / Sessional:

Sl. No.	CODE	Paper	Contact periods Per week			Total Contact Hrs	Credits
			L	T	P		
	PC-EEE-891	Digital signal processing laboratory	0	0	2	2	1
1	PW-EEE-881	Project stage-II	0	0	16	16	8
		Total of Practical / Sessional				18	09
TOTAL OF SEMESTER:						27	18

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Inspiring students and preparing them for successful professional careers by applying the

Knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering software.

PSO2: Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: BIOLOGY
Course Code: BS-BIO(301) Semester of Study:
Course Type: Theory
Course Designation: Compulsory

Program Specific Outcome (PSO):

	PSO1	PSO2	PSO3	PSO4
CO1	L	M	L	L
CO2	L	M	L	L
CO3	L	M	L	L
CO4	L	M	L	L
CO5	L	M	L	L
CO6	L	M	L	L

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
BS ME BIO301.1	Describe how biological observations of 18th Century that lead to major discoveries.	Define, Understand, Explain, Describe, Discuss	Understand (L1)
BS ME BIO301.2	Find that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.	Apply, calculate, estimate, find, solve, examine	Apply (L2)
BS ME BIO301.3	Classify the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.	Analyze, Classify, Illustrate, categorize	Analyze (L3)
BS ME BIO301.4	Examine that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine and Analyse biological processes at the reductionistic level.	Select, model, examine, design, show.	Synthesize (L4)
BS ME BIO301.5	Justify enzymes and distinguish between different mechanisms of enzyme action and Apply thermodynamic principles to biological systems.	Assess, test, justify, compare,	Evaluate (L5)
BS ME BIO301.6	Identify DNA as a genetic material in the molecular basis of information transfer and microorganisms.	Design, formulate, develop, derive, modify, build, identify	Create (L6)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3							2				1
CO2			2				3					2
CO3		3		1		1						
CO4						2						2
CO5	3				2	2	2					1
CO6	3	1		2	2		2					
Average	2.8	2	2	1.5	2	1.6	2.3	2				1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module 1 : INTRODUCTION

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. [2L]

Module 2 Classification

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitatacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

Purpose: To convey that classification **per se** is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. [3L]

Module 3 Genetics

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" [4L]

Module 4 Biomolecules

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine [4L]

Module 5 Enzymes

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Purpose: To convey that without catalysis life would not have existed on earth [4L]

Module 6 Information Transfer

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structurefrom single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Purpose: The molecular basis of coding and decoding genetic information is universal [4L]

Module 7 Macromolecular analysis

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transrters, receptors and structural elements.

Purpose: How to analyses biological processes at the reductionistic level [5L]

Module 8 Metabolism

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO₂ + H₂O (Glycolysis and Krebs cycle) and synthesis of glucose from CO₂ and H₂O (Photosynthesis). Energy yielding and energy consuming

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

reactions. Concept of Energy charge

Purpose: The fundamental principles of energy transactions are the same in physical and biological world. [4L]

Module 9 Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. [3L]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Basic Electronics Engineering Course Code: ES-ECE301

Semester of Study: 3rd Semester

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Inspiring students and preparing them for successful professional careers by applying the

Knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering software.

PSO2: Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Demonstrate the operating principle and output characteristics of pn junction diodes, zener diode, rectifiers and different diode circuits, BJT.
2. Understand the principles of semiconductor devices and their applications.
3. Design an application using Operational amplifier.
4. Understand the working of timing circuits and oscillators.
5. Understand logic gates, flip flop as a building block of digital systems.
6. Learn the basics of Electronic communication system

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Outcome	Details/Statement	Action Verb	Knowledge Level
ES-ECE301.1	Understand the principles of semiconductor devices and their applications	Understand	K2
ES-ECE301.2	Understanding the operating principle and output characteristics of pn junction diodes, zener diode, rectifiers and different diode circuits. BJT.	Understand	K2
ES-ECE301.3	Design an application using Operational amplifier.	Apply	K3
ES-ECE301.4	Understand the working of timing circuits and oscillators.	Understand	K2
ES-ECE301.5	Understand logic gates, flip flop as a building block of digital systems.	Understand	K2
ES-ECE301.6	Learn the basics of Electronic communication system	Understand	K2

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	3	1	1	1	1	1	2	1	1
CO2	1	3	3	3	1	1	1	1	1	1	1	1
CO3	1	2	3	3	1	1	1	1	1	1	1	1
CO4	1	3	3	3	1	1	1	1	1	1	1	1
CO5	1	3	3	3	1	1	1	1	1	1	1	1
CO6	1	3	3	3	2	2	1	1	1	1	2	2
Average	1	2.83	3	3	1.2	1.16	1	1	1	1.16	1.16	1.16

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Objective:

To provide an overview of electronic device components to Mechanical engineering students.

Subject Name: Basic Electronics Engineering
Code: ES-ECE301

Module 1

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth.

Module 11

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator.

Module 111

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator.

Module IV

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K-map, Logic ICs, half and full adder/sub tractor, multiplexers, De-multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Module V

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)
Course Name: Engineering Mechanics **Course Code:** ES-ME301
Semester of Study: 3rd
Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
ES-ME301.1	To calculate Forces and Moments acting on the given statically determinant Structure & support reaction by using of concept of Free Body Diagram (FBD).	CALCULATE	P
ES-ME301.2	To explain Friction, limiting friction, static and dynamic friction, wedge friction	EXPLAIN	U
ES-ME301.3	To analysis of having structure like trusses, beams and frames	ANALYSIS	A
ES-ME301.4	To determine centroid, centre of gravity, moment of inertia for both area and mass of the given lamina and solid- standard and composite.	DETERMINE	P
ES-ME301.5	To illustrate the stability of an equilibrium and equilibrium of rigid body using the concept of virtual work and energy method.	ILLUSTRATE	A
ES-ME301.6	To calculate the velocity, acceleration, dynamics forces acting on practical and rigid bodies under rectilinear and curve linear motion.	CALCULATE	P

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	3	3	2	1	2	1	-	1	2	1	-	2	3	2
CO2	2	3	2	2	1	1	-	1	2	2	-	2	3	2
CO3	2	2	2	1	2	1	-	1	1	2	-	2	3	2
CO4	3	2	2	2	1	1	-	1	1	2	-	2	3	2
CO5	3	2	2	1	1	1	-	1	1	1	-	2	3	2
CO6	2	3	2	2	2	1	-	1	2	1	-	2	3	2
Average	2.5	2.5	2	1.5	1.5	1	0	1	1.5	1.5	0	2	3	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module No.	Description of Topic	Contact Hrs.
1	Module 1: Introduction to Engineering Mechanics covering, Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.	3
2	Module 2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.	4
3	Module 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.	4
4	Module 4: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.	5
5	Module 5: Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.	5
6	Module 6: Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).	5
7	Module 7: Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.	5
8	Module 8: Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.	5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

9	Tutorials from the above modules covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack.	12

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Name: Thermodynamics

Course Code: PCME301

Semester of Study: Third

Course Type: Theory

.....
Program Outcome (PO):

- (1) Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.
- (2) Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- (3) Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety,
- (4) Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- (5) Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- (6) Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- (7) Graduates will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- (8) Graduate will learn the ability to understand the professional and ethical responsibility.
- (9) Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- (10) Graduate will be able to communicate effectively in both verbal and in the written form.
- (11) Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- (12) Graduate will develop confidence for self and have the ability to engage in life long learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Inspiring students and preparing them for successful professional careers by applying the knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering softwares.

PSO2: Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME301.1	Explain the fundamental thermodynamic properties to solve the problems involving thermodynamic properties viz. Internal energy, enthalpy, entropy, temperature, pressure and specific volume etc	Explain	U
PC ME301.2	Interpret the phases of the pure substances from their thermodynamic properties.	Interpret	U
PC ME301.3	Evaluate changes in thermodynamic properties of pure substances.	Evaluate	E
PC ME301.4	Apply the first and second law of thermodynamics to the thermodynamic process, cycles and devices.	Apply	P
PC ME301.5	Analyse thermodynamic systems using entropy and exergy.	Analyse	A
PC ME301.6	Understand the basics of Vapour power cycles and Gas Power cycles.	Understand	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	1	2	1	2	1	-	2
CO2	3	2	2	2	1	1	2	1	2	1	-	2
CO3	3	2	2	2	1	1	2	1	2	1	-	2
CO4	3	2	2	2	1	1	2	1	2	1	-	2
CO5	3	2	3	2	1	1	2	1	2	1	-	2
CO6	3	2	2	2	1	1	2	1	2	1	-	2
Average	3	2	2	2	1	1	2	1	2	1	-	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code : PC-ME301		Category: Professional Core courses
Subject Name : Thermodynamics		Semester : Third
L-T-P : 3-1-0		Credit: 4
Pre-Requisites: No-prerequisite		
Module No.	Description of Topic	Contact Hrs.
1	Fundamentals - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence of displacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	5
2	Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers- Definition of heat; examples of heat/work interaction in systems- First Law for Cyclic & Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property; Various modes of energy, Internal energy and Enthalpy.	5
3	Definition of Pure substance, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures, Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressure heating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134a tables; Saturation tables; Superheated tables; Identification of states & determination of properties, Mollier's chart.	8
4	First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes including throttling; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.	5
5	Second law - Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Absolute temperature scale.	5
6	Clausius inequality; Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in Ts coordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume.Exergy balance equation and Exergy analysis.	8
7	Thermodynamic cycles - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)
Course Name: Manufacturing Processes Course Code: PCME302

Semester of Study: 3rd

Course Type: Theory

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME302.1	Describe the fundamental principles and concepts of various manufacturing processes used in industry.	Describe	U
PC ME302.2	Apply the knowledge of metal casting principles to effectively address shrinkage, casting defects, and residual stresses in manufacturing	Apply	P
PC ME302.3	Explain the fundamentals of hot and cold working and Estimate loads and forces involved in bulk forming and sheet forming processes.	Explain	P
PC ME302.4	Apply the principles of orthogonal machining, chip formation and tool geometry in machining operations for improved tool performance and surface finish.	Apply	P
PC ME302.5	Examine the various force components involved in machining to address tool wear, and tool life	Examine	P
PC ME302.6	Discuss the physics behind welding, brazing, and soldering processes.	Discuss	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1	1	2	1	1	1	2	1	2	3	2
CO2	3	1	1	1	1	2	1	1	1	2	1	2	3	2
CO3	3	1	1	2	1	1	1	1	1	2	1	2	3	2
CO4	3	1	1	2	1	2	1	1	1	2	1	2	3	2
CO5	3	1	1	1	1	1	1	1	1	2	1	2	3	2
CO6	3	1	1	1	1	1	1	1	1	2	1	2	3	2
Average	3	1	1	1.333333333	1	1.5	1	1	1	2	1	2	3	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of topic	Contact Hrs
1	Conventional Manufacturing processes: Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.	10
2	Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.	10
3	Machining: Single and multi-point machining; Orthogonal machining, cutting tool geometry of SPTT, milling cutter and drill, conversion of rake and clearance angles within ASA and ISO systems, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.	14
4	Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)
Course Name: Practice of Manufacturing Processes Course Code: PCME391

Semester of Study: 3rd

Course Type: Laboratory

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME391.1	Practice pattern & mould making	Practice	P
PC ME391.2	Illustrate the fitting operation using hand tools	Illustrate	P
PC ME391.3	Perform basic forging processes	Perform	P
PC ME391.4	Perform sheet metal works	Perform	P
PC ME391.5	Practice GMAW, SMAW & Gas Welding	Practice	P
PC ME391.6	Demonstrate machining of typical products involving lathe, milling/shaping/machines	Demonstrate	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	2	1	1	1	1	1	1	1	2	3	3	2
CO2	1	2	2	1	1	1	1	1	1	1	2	3	3	2
CO3	1	2	2	1	1	1	1	1	1	1	2	3	3	2
CO4	1	2	2	1	3	1	1	1	2	1	2	3	3	2
CO5	1	2	3	2	1	2	1	1	2	1	3	3	3	2
CO6	1	2	2	1	1	1	1	1	1	1	2	3	3	2
Average	1.0	2.0	2.2	1.2	1.3	1.2	1.0	1.0	1.3	0.8	2.2	3.0	3.0	2.0

Course Content:

It should include about 12 practicing modules (1 module= 3Hour class a week) covering:

1. Machine Shop: Taper turning, drilling, boring, shaping and milling operations- 3 modules
2. Pattern Making: 1 or 2 wooden patterns to make- 2 modules
3. Moulding: 1 module
4. Smithy Shop: 1 module
5. Welding Shop: Practicing SMAW, Gas Welding and/or GMAW- 2 modules
6. Fitting Shop: 2 modules
7. Sheet Metal Shop: 1 module

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Materials Engineering Course Code: ESME401

Semester of Study: 4th Semester

Course Type: Theory

.....

Program Outcome (PO):

1. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
2. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
3. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
4. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
5. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems..
6. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
7. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
8. Graduate will learn the ability to understand the professional and ethical responsibility.
9. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
10. Graduate will be able to communicate effectively in both verbal and in the written form.
11. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
12. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
ES ME401.1	Analyze and classify crystal structures and imperfections in solids using unit cells and defect mechanisms.	Analyze	A
ES ME401.2	Evaluate mechanical properties of materials through testing methods and understand their relationships, including stress-strain curves, hardness, and strength.	Evaluate	E
ES ME401.3	Apply static failure theories and fracture mechanics to predict failure modes and analyze fatigue behaviour and non-destructive testing methods.	Apply	P
ES ME401.4	Interpret phase diagrams and microstructures in alloys, including the iron-carbide phase diagram and micro structural aspects of the given steel types.	Interpret	U
ES ME401.5	Apply heat treatment techniques to control microstructure development in steel and understand the effects on properties.	Apply	P
ES ME401.6	Examine the properties and applications of alloyed steels, cast irons, copper alloys, aluminium alloys, nickel-based super alloys, and titanium alloys.	Examine	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ES ME401.1	3	1	1	1	-	2	1	-	1	-	1	2	3	1
ES ME401.2	3	1	1	1	-	2	1	-	1	-	1	2	3	1
ES ME401.3	3	1	1	1	-	2	1	-	1	-	1	2	3	1
ES ME401.4	3	1	1	1	-	2	1	-	1	-	1	2	3	1
ES ME401.5	3	1	1	1	-	2	1	-	1	-	1	2	3	1
ES ME401.6	3	1	1	1	-	2	1	-	1	-	1	2	3	1
Avg.	3	1	1	1	-	2	1	-	1	-	1	2	3	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module No.	Description of Topic	Contact Hrs.
1	Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.	6
2	Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress- strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength.	6
3	Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to nondestructive testing (NDT)	8
4	Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-iron-carbide phase diagram and microstructural aspects of ledeburite, austenite, ferrite and cementite, cast iron.	6
5	Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbonitriding, flame and induction hardening, vacuum and plasma hardening	6
6	Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based superalloys and Titanium alloys	8

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Name: Applied Thermodynamics

Course Code: PCME401

Semester of Study: Fourth

Course Type: Theory

.....
Program Outcome (PO):

- (1) Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.
- (2) Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- (3) Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety,
- (4) Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- (5) Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- (6) Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- (7) Graduates will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- (8) Graduate will learn the ability to understand the professional and ethical responsibility.
- (9) Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- (10) Graduate will be able to communicate effectively in both verbal and in the written form.
- (11) Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- (12) Graduate will develop confidence for self and have the ability to engage in life long learning.

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PS01: Inspiring students and preparing them for successful professional careers by applying the knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering softwares.

PSO2: Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME401.1	ANALYSE reacting systems using mass, energy and entropy balance and to determine chemical equilibrium composition.	ANALYSE	A
PC ME401.2	ILLUSTRATE vapour power cycles, gas power cycles and vapour compression refrigeration cycles.	ILLUSTRATE	A
PC ME401.3	USE psychrometric processes in real world air-conditioning systems.	USE	P
PC ME401.4	EXPLORE the compressible fluid flow through nozzles, diffusers etc.	EXPLORE	P
PC ME401.5	UNDERSTAND the operation of reciprocating compressors and to determine its performances.	UNDERSTAND	U
PC ME401.6	ANALYSE steam turbines thermodynamically.	ANALYSE	A

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code : PC-ME401		Category: Professional Core courses
Subject Name : Applied Thermodynamics		Semester : Fourth
L-T-P : 3-1-0		Credit:4
Pre-Requisites: No-prerequisite		
Module No.	Description of Topic	Contact Hrs.
1	Introduction to solid, liquid and gaseous fuels– Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy.	8
2	Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Super-critical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles- Air standard Braytoncycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.	12
3	Properties of dry and wet air, use of psychometric chart, processes involving heating/cooling and humidification/dehumidification, dew point.	4
4	Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation- compressible flow in diffusers, efficiency of nozzle and diffuser.	8
5	Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.	5
6	Analysis of steam turbines, velocity and pressure compounding of steam turbines	3

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Name: Fluid Mechanics and Fluid Machines

Course Code: PCME 402

Semester of Study: 4th

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME402.1	UNDERSTAND the fluid properties and conservation laws in fluid mechanics	UNDERSTAND	U
PC ME402.2	APPLY the conservation laws in fluid flow system	APPLY	P
PC ME402.3	EVALUATE pressure drop in pipe flow using Hagen-Poiseuli's equation for laminar flow in pipe	EVALUATE	E
PC ME402.4	DEMONSTRATE boundary layer concept	APPLY	P
PC ME402.5	ANALYSE the dimensional analysis in fluid machines and in fluid flow systems	ANALYSE	A
PC ME402.6	Analyse the simple flow situation mathematically and EVALUATE the performance of hydraulic machines (Turbine and pump)	EVALUATE	E

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PCME402.1	3	2	2	1	1	1	1	1	1	1	-	2
PCME402.2	2	3	2	1	1	1	1	1	1	1	-	2
PCME402.3	2	3	2	1	1	2	1	1	2	1	-	2
PCME402.4	3	2	1	1	2	2	1	1	2	1	-	2
PCME402.5	3	2	2	1	1	2	1	1	1	1	-	2
PCME402.5	3	2	2	1	1	2	1	1	1	1	-	2
Average	2.7	2.3	1.8	1	1.2	1.7	1	1	1.3	1	-	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code : PC-ME402	Category: Professional Core courses
Subject Name : Fluid Mechanics & Fluid Machines	Semester : Fourth
L-T-P : 3-1-0	Credit:4
Pre-Requisites: No-prerequisite	

Course Objective:

1. To learn about the application of mass and momentum conservation laws for fluid flows
2. To understand the importance of dimensional analysis
3. To obtain the velocity and pressure variations in various types of simple flows
4. To analyze the flow in water pumps and turbines.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Definition of fluid, Newton's law of viscosity, Units and dimensions Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications.	9
2	Exact flow solutions in channels and ducts, Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram.	9
3	Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis.	6
4	Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle.	8
5	Classification of water turbines, heads and efficiencies, velocity triangles Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines.	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Strength of Materials

Course Code: PC-ME 403

Semester of Study: 4th

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

After completion of the course, the students will be able to

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC-ME 403.1	EXPLAIN the concept of normal and shear stresses and strains and the relation amongst three elastic constants (E, K, G).	EXPLAIN	Understand/ U
PC-ME 403.2	Discuss the bending theory to CALCULATE shear force and bending moment.	CALCULATE	Apply/ P
PC-ME 403.3	DETERMINE the slope and deflection of cantilever, simply supported beams under the given loading conditions (UDL, point load, varying loads).	DETERMINE	Apply/ P
PC-ME 403.4	CALCULATE the critical load by using the buckling theory of columns.	CALCULATE	Apply/ P
PC-ME 403.5	SOLVE the parameters (maximum shear stress, diameter, working stress, factor of safety) of the given problem related to torsion of circular shaft, helical springs.	SOLVE	Apply/ P
PC-ME 403.6	CALCULATE the hoop and longitudinal stresses in thin/ thick walled cylindrical/ spherical pressure vessels.	CALCULATE	Apply/ P

Course Articulation Matrix:

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	2	2	1	1	1	1	1	-	1
CO2	2	3	2	2	2	1	1	1	1	1	-	1
CO3	2	3	2	2	2	1	1	1	1	1	-	1
CO4	2	3	2	2	2	1	1	1	1	1	-	1
CO5	2	3	2	2	2	1	1	1	1	1	-	1
CO6	2	3	2	2	2	1	1	1	1	1	-	1
Average	2	3	2	2	2	1	1	1	1	1	-	1

Subject Code : PC-ME403	Category: Professional Core courses
Subject Name : Strength of Materials	Semester : Fourth
L-T-P : 3-1-0	Credit:4
Pre-Requisites: No-prerequisite	

Course Objective:

1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
2. To calculate the elastic deformation occurring in various simple geometries for different types of loading

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle.	8
2	Beams and types transverse loading on beams- shear force and bend moment diagrams- Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads.	8
3	Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems. Buckling of columns, Euler's theory, critical loads for different types of constraints.	10
4	Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.	8
5	Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure	8

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Learning Resources:

1. D.S. Bedi, Strength of Materials, Sixth Edition, Khanna Publishing House, 2019
2. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
3. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
4. R.K. Bansal, Strength of Materials, Laxmi Publications

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Name: Metrology & Instrumentation

Course Code: PC-ME404

Semester of Study: 4th

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

j. Graduate will be able to communicate effectively in both verbal and in the written form.

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME404.1	Understand the working of linear and angular measuring instruments and Determine the error and least count	Determine	P
PC ME404.2	Calculate the limits, fits and tolerances of the Hole and Shaft system	Calculate	P
PC ME404.3	Apply measurement techniques to determine the screw thread and surface roughness parameters	Apply	P
PC ME404.4	Acquire an overview of performance characteristics of sensors and transducers for motion and dimension measurement	Acquire	U
PC ME404.5	Demonstrate the working principle and applications of devices for measurement of force, torque, strain and stress	Demonstrate	P
PC ME404.6	Interpret the use of vibration and temperature measuring instruments	Interpret	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	1	2	1	2	3	2
CO2	3	2	1	1	1	1	1	1	1	2	1	2	3	2
CO3	3	3	1	1	1	1	1	1	1	2	1	2	3	2
CO4	3	1	1	1	1	1	1	1	1	2	1	2	2	2
CO5	3	1	1	1	1	1	1	1	1	2	1	2	2	2
CO6	3	1	1	1	1	1	1	1	1	2	1	2	2	2
Average	3.0	1.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0	2.5	2.0

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of Topic	Contact Hrs.
1	Concept of measurement:-Introduction to Metrology; Need for high precision measurements; Terminologies in Measurement- Precision, accuracy, sensitivity, calibration, resolution. Errors in Measurement, types of errors, Abbe's Principle. Basic standards of length- Line standard, End standards, Wavelength standard; Various Shop floor standards. Linear Measurement – Slip gauges, wringing, grades; Surface plate; Dial indicators; Height gauges and Vernier calliper; screw gauge. Comparators mechanical, electrical, optical and pneumatic. Angular Measurement – Bevel protractor; Sine Bar, principle and use of sine bar, sine centre; Angle gauges. Spirit level; Angle Dekkor; Clinometers.	8
2	Limits and Limit gauges – Making to suit, selective assembly, systems of limits and fits; Types of fits; Hole basis system and Shaft basis system. Tolerance, allowance and deviation (as per BIS). Limit Gauges – GO and NO GO gauges; types of limit gauges. Gauge design - Taylor's principle of gauging; Gauge tolerance, disposition of gauge tolerance, wear allowance. Optical Measuring Instruments: - Benefits of light waves as standards; Monochromatic light; Principle of Interference. Interference band, optical flat, surface measurement. Interferometers – NPL, Pitter-NPL, auto collimator.	8
3	Screw thread measurement – Screw thread terminology; Measurement of major diameter; root diameter; pitch; effective diameter with two wire method and three wire method. Measurement of flank angle and form by profile projector and microscope. Measurement of surface texture – roughness and waviness; Analysis of surface traces, peak to valley height, R.M.S. value, Centre Line Average and Ra value, Rt, Rz etc. Methods of measuring surface roughness – Stylus probe, Tomlinson surface meter, Talysurf; surface roughness measurement – assessment length, roughness width cut-off, sampling length and evaluation length.	8
4	Introduction to Digital Measurement– significance of Digital measurement; methods; Classification. Stages in generalized measuring system– Sensor Transducer stage, Signal-Conditioning stage, Readout-Recording stage; Types of input quantities; Active and Passive transducers. Performance characteristic of measuring devices. Drift, Resolution, Threshold, Hysteresis, Static calibration. Dynamic characteristics- different order systems and their response-, Measuring lag, Fidelity, Dynamic error; Transducers– Working, Classification of transducers. Motion and Dimension measurement – LVDT – Principle, applications, advantages and limitations.	8
5	Strain and Stress Measurement- Electrical resistance strain gauge Principle, operation. Measurement of Force and Torque– Strain-Gauge Load Cells, Hydraulic and Pneumatic load cells– force measurement using piezoelectric quartz crystal. Torque Measurement– Dynamometers– Mechanical, Hydraulic and Electrical. Vibration measurement– Vibrometers and Accelerometers. Temperature Measurement– Use of Thermal Expansion– Liquid-in-glass thermometers, Bimetallic strip thermometer, Pressure thermometers. Thermocouples– Resistance Temperature Detectors (RTD); Thermistors; Pyrometers.	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)
Course Name: Practice of Manufacturing Processes & system laboratory

Course Code: PCME491

Semester of Study: 4th

Course Type: Laboratory

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME491.1	Measure the surface roughness & angles of different jobs	Measure	E
PC ME491.2	Develop simple digital logic circuit using 7400 series ICs.	Develop	P
PC ME491.3	Design and develop simple pneumatic circuits	Design	P
PC ME491.4	Acquire skill set to use precision length measuring instruments (Micro meter, Vernier, Height Gauge)	Acquire	P
PC ME491.5	Determine angles using sign bar & profile protector	Determine	P
PC ME491.6	Assess errors & correction factors of measuring devices (Micro meter, Vernier, Height Gauge)	Assess	E

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	3	2	1	-	-	-	-	2	-	-	2	2	3
CO2	-	3	2	2	-	-	-	-	2	-	-	2	2	3
CO3	-	3	2	2	-	-	-	-	2	-	-	2	2	3
CO4	-	3	2	1	-	-	-	-	2	-	-	2	2	3
CO5	-	3	2	1	-	-	-	-	2	-	-	2	2	3
CO6	-	3	2	1	-	-	-	-	2	-	-	2	2	3
Average	0.0	3.0	2.0	1.3	0.0	0.0	0.0	0.0	2.0	0.0	0.0	2.0	2.0	3.0

University Syllabus:

Course Content:

It should include about 12 experiments as outlined below:

- i) Laboratory modules of pneumatics and/or electro-pneumatics
- ii) Laboratory modules of hydraulics and/or electro-hydraulics
- iii) Study of working of Logic Gates practically
- iv) Simulation of designed pneumatics / hydraulics systems

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

- v) Measurement of surface roughness
- vi) Measurement of tapered objects using Sine Bar and using balls and rollers, etc.
- vii) Measurement of threads using three wire method
- viii) Measurement of gears
- ix) Measurement of bore diameter using micrometer and gauges
- x) Measurement of angles using bevel vernier protractor
- xi) Statistical process control system to apply to measured dimension of samples
- xii) Practicing different gauges to assess angles, thread, internal and external radius, etc.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Machine Drawing I

Course Code: PC-ME492

Semester of Study: 4th

Course Type: Practical

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially. l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME 492.1	UNDERSTAND the product symbol of standard components in mechanical, electrical & electronic engineering symbol, welding symbol and pipe joints	UNDERSTAND	U
PC ME 492.2	DRAW orthographic projection, sectional and auxiliary sections of given machine components.	DRAW	A
PC ME 492.3	DRAW assembly and detailed drawing of different mechanical components and tools such as plumber block, flange coupling etc.	DRAW	A
PC ME 492.4	UNDERSTAND the commands and GUI of AutoCAD software	UNDERSTAND	U
PC ME 492.5	DRAW orthographic and isometric projections of given mechanical components by using AutoCAD or similar software	DRAW	A

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	2	1	3	1	1	1	1	1	1	2		2	3	1
CO2	2	2	3	1	1	2	1	1	1	2		2	3	1
CO3	2	2	3	1	1	2	1	1	1	2		2	3	1
CO4	2	2	3	1	3	2	1	1	1	2		2	3	1
CO5	2	2	3	1	3	2	1	1	1	2		2	3	1
Average	2.0	1.8	3.0	1.0	3.0	1.8	1.0	1.0	1.0	2.0		2.0	3.0	1.0

University Syllabus:

Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols and pipe joints; Orthographic projections of machine elements, different sectional views- full, auxiliary sections; Isometric projection of components; Assembly and detailed drawings of a mechanical assembly, such as a plumber block, tool head of a shaping machine,

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

tailstock of a lathe, simple gear box, flange coupling, welded bracket joined by stud bolt on to a structure, welded pipe joints indicating work parts before welding, etc.

Practicing AutoCAD or similar graphics softwares and making orthographic and isometric projections of different components.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Environmental Science Course Code: MC-481(ME)

Semester of Study: 4th Sem ME

Course Type: Sessional

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

SI No.	Description of PSOs
PSO1	The ability to analyze, design and implement application specific electronic system for complex engineering problems for analog, digital domain, communications and signal processing applications by applying the knowledge of basic sciences, engineering mathematics and engineering fundamentals.
PSO2	The ability to adapt for rapid changes into old and technology with an understanding of societal and ecological issues relevant to professional engineering practice through life-long learning.
PSO3	Excellent adaptability to function in multi-disciplinary work environment, good interpersonal skills as a leader in a team in appreciation of professional ethics and societal responsibilities.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Understand the natural environment and its relationships with human activities.	Understand	L2
CO2	Apply the fundamental knowledge of science and engineering to assess environmental and health risk.	Apply	L3
CO3	Develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.	Create	L6
CO4	Acquire skills for scientific problem-solving related to air, water, noise & land pollution.	Analyse	L4
CO5	Apply the laws and protection act of India for Environmental Management and Environmental Audit.	Analyse	L4
CO6	Analyze the population growth in different perspectives of environmental scenarios.	Analyse	L4

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1					2	2	2		1		3
CO2	1					2	2	2		1		3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

CO3	1					2	2	2		1		3
CO4	1					2	2	2		1		3
CO5	1					2	2	2		1		3
CO6	1					2	2	2		1		3
Average	1					2	2	2		1		3

University Syllabus:

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

- I. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
- II. Slogan making event
- III. Poster making event
- IV. Cycle rally
- V. Lectures from experts

(6) Actual Activities:

- I. Plantation
- II. Gifting a tree to see its full growth
- III. Cleanliness drive
- IV. Drive for segregation of waste
- V. To live some big environmentalist for a week or so to understand his work
- VI. To work in kitchen garden for mess
- VII. To know about the different varieties of plants
- VIII. Shutting down the fans and ACs of the campus for an hour or so

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Heat Transfer

Course Code: PCME 501

Semester of Study: 5th

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PS02: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC-ME501.1	CLASSIFY the modes of heat transfer.	UNDERSTAND	U
PC-ME501.2	ANALYSE steady and unsteady conduction phenomena.	ANALYSE	A
PC-ME501.3	SOLVE convections problems of laminar and turbulent flow situations.	APPLY	P
PC-ME501.4	CALCULATE radiation heat transfer between surfaces, using radiative properties, view factors etc.	APPLY	P
PC-ME501.5	ILLUSTRATE and design of heat exchangers.	ANALYSE	A
PC-ME501.6	UNDERSTAND similarities between heat and mass transfer.	UNDERSTAND	U

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code : PC-ME501	Category: Professional Core Courses
Subject Name : Heat Transfer	Semester : Fifth
L-T-P : 3-1-0	Credit: 4
Pre-Requisites: Engineering Thermodynamics	

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer-approximate solution to unsteady conduction heat transfer by the use of Heissler charts.	14
2	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer- Correlations for forced and free convection Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	10
3	Interaction of radiation with materials, definitions of radioactive properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method.	9
4	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ϵ - NTU methods.	7
5	Boiling and Condensation heat transfer, Pool boiling curve.	4
6	Introduction to mass transfer, Similarity between heat and mass transfer.	4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Name: Solid Mechanics Course Code: PC-ME502

Semester of Study: 5th

Course Type: Theory

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME502.1	Understand the basic tensors, notations of the theory of elasticity including strain/displacement and Hooke's law relationship to solve the practical problems related to the theory of elasticity.	Understand	U
PC ME502.2	Discuss derivation of Cauchy's relations, principal stresses and directions.	Discuss	R
PC ME502.3	Determine plane stress & plane strain of the given axisymmetric problems by using governing equations in cartesian, cylindrical and spherical coordinates.	Determine	P
PC ME502.4	To Solve problem by using concept of solid mechanics in thick cylinders, rotating discs, torsion of noncircular cross-sections & stress concentration including thermoelasticity & 2D contact stresses.	Solve	P
PC ME502.5	Examine the influence the influence of geometric and loading parameters in plain stress and plain strain problems.	Examine	A
PC ME502.6	To Solve given structural problems by applying the concepts of potentials and energy methods and plasticity.	Solve	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	3	2	1	1	1	1	1	1	-	-	1	3	2
CO2	1	3	2	1	1	1	1	1	1	-	-	1	3	2
CO3	1	3	2	1	1	1	1	1	1	-	-	1	3	2
CO4	1	3	2	1	1	1	1	1	1	-	-	1	3	2
CO5	1	3	2	1	1	1	1	1	1	-	-	1	3	2
CO6	1	3	2	1	1	1	1	1	1	-	-	1	3	2
Average	1	3	2	1	1	1	1	1	1	-	-	1	3	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of topic	Contact Hrs
1	Introduction to Cartesian tensors, Strains: Concept of strain, derivation of small strain tensor and compatibility, Stress: Derivation of Cauchy relations and equilibrium and symmetry equations, principal stresses and directions.	12
2	Constitutive equations: Generalized Hooke's law, Linear elasticity, Material symmetry; Boundary Value Problems: concepts of uniqueness and superposition.	10
3	Plane stress and plane strain problems, introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems.	10
4	Application to thick cylinders, rotating discs, torsion of noncircular cross-sections, stress concentration problems, thermoelasticity, 2-D contact problems.	9
5	Solutions using potentials. Energy methods. Introduction to plasticity.	7

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Kinematics and Theory of Machines **Course Code:** PC ME 503
Semester of Study: 5th

Course Type: Theory

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially. l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PCME503.1	ANALYZE the motion of simple mechanisms in terms of the displacement, velocity and acceleration at any point on a rigid link. Also, determine the degree of freedom of simple mechanisms and their inversions.	ANALYZE	A
PCME503.2	SYNTHESIZE higher pair mechanisms (cam & gear systems) to generate specified output motion.	SYNTHESIZE	A
PCME503.3	Understand the relative motion of friction surfaces in contact and APPLY the knowledge during the design of the machine parts which work on the principle of rolling and sliding friction.	APPLY	P
PCME503.4	Understand basic concepts of vibration and DETERMINE vibration parameters related to problems of SDOF vibratory systems (Free, Forced with or without damping).	DETERMINE	P
PCME503.5	EXPLORE rotary and reciprocating unbalanced systems.	EXPLORE	P
PCME503.6	Understand the working principle of governors, flywheel & gyroscope and DETERMINE their operational parameters.	DETERMINE	P

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	1	3	1	2	1	1	1	1	2	2	-	2	3	2
CO2	1	3	1	2	1	2	1	1	2	2	-	2	3	2
CO3	3	3	1	2	1	1	1	1	1	1	-	1	3	1
CO4	3	3	2	2	2	2	1	1	1	1	-	2	3	1
CO5	1	3	3	2	1	2	2	1	1	1	-	2	3	1
CO6	1	2	1	3	1	2	1	1	1	1	-	2	3	1
Average	1.67	2.83	1.50	2.16	1.16	1.67	1.16	1.00	1.33	1.33	-	1.83	3.00	1.33

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module No.	Description of Topic	Contact Hrs.
1	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains. Limit positions- Mechanical advantage- Transmission angle Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms.	6
2	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics- Coincident points- Coriolis component of acceleration- introduction to linkage synthesis- three position graphical synthesis for motion and path generation.	7
3	Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers.	5
4	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.	6
5	Surface contacts- sliding and rolling friction- friction drives bearings and lubrication, Friction clutches- Belt and Rope drives Friction in brakes.	6
6	Vibrations- Free and forced vibration of undamped and damped Single DOF systems, Resonance, Transmissibility Ratio, Effect of damping, Vibration Isolation, Critical Speed of Shafts.	6
7	Balancing of Reciprocating and Rotating Masses- Static balancing, Unbalance of force or moment, Dynamic balancing of rotating masses- graphical and analytical methods; Swaying couple; Hammer blow.	4
8	Governors- Use and classification; Study and analysis of Porter, Proell and Wilson-Hartnell governors; Sensitiveness, stability, isochronism, hunting, effort and power of governors.	3
9	Flywheel- Inertia force and inertia torque in reciprocating engine, correction couple (torque), Turning moment diagram and flywheel design.	3
10	Gyroscope- Gyroscopic couple and precessional motion, Effect of gyroscopic couple on aeroplane and ship, Stability of two wheel and four wheel vehicles taking turn.	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

**Course Name: Humanities I- Effective Technical
Communication**

Course Code: HM HU 501

Semester of Study: 3rd Year, 5th Sem Course Type: Theory

.....

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO-1:

Inspiring students and preparing them for successful professional careers by applying the knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering software.

PSO-2:

Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
HM-HU501.1	Understand the dynamics of Verbal and Non Verbal aspects of technical communication	Understand	L2
HM-HU501.2	Practice multi-step writing process to plan, draft, and revise reports, correspondence, and presentations.	Remember	L1
HM-HU501.3	Illustrate and examine the knowledge of ethical aspects of engineering	Apply	L3
HM-HU501.4	Demonstrate and explain social and professional etiquettes	Analyse	L4
HM-HU501.5	Plan self-development and practice self-assessment to function on multi-disciplinary teams.	Evaluate	L5
HM-HU501.6	Organize and write business correspondence properly and correctly, using appropriate formats, grammar, vocabulary, and syntax, and demonstrate effective writing and editing skills.	Create	L6

Course Articulation Matrix:

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HM-HU501.1	3	1	1	1	1	1	1	1	1	3	1	3
HM-HU501.2	3	2	2	1	1	1	1	1	3	3	2	3
HM-HU501.3	1	2	2	1	1	1	1	3	3	3	1	2
HM-HU501.4	3	3	3	3	1	2	1	2	3	3	3	3
HM-HU501.5	2	3	3	2	2	2	2	2	3	3	3	3
HM-HU201.6	3	3	3	2	1	1	1	1	2	3	2	3
Average	2.5	2.3	2.3	1.7	1.2	1.3	1.2	1.7	2.5	3	2	2.8

University Syllabus:

Module	Chapter	Content
1.	Information Design and Development	1.1-Different kinds of technical documents 1.2- Information development life cycle 1.3- Organization structures factors affecting information and document design 1.4- Strategies for organization 1.5- Information design and writing for print and for online media.
2.	Technical Writing, Grammar and Editing	2.1- Technical writing process, forms of discourse 2.2- Writing drafts and revising 2.3- Collaborative writing creating indexes 2.4- Technical writing style and language 2.5- Basics of grammar, study of advanced grammar 2.6- Editing strategies to achieve appropriate technical style 2.7- Introduction to advanced technical communication, Usability, Human factors, 2.8- Managing technical communication projects 2.9- Time estimation, Single sourcing, Localization.
3.	Self	3.1-Self assessment, Awareness, 3.2- Perception and Attitudes, Values and belief 3.3- Personal goal setting, career

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

	Development and Assessment-	Planning, Self-esteem.3.4- Managing Time 3.5- Personal memory 3.6- Rapid reading3.7- Taking notes 3.8- Complex problem solving 3.9-Creativity
4.	Communication and Technical Writing	4.1- Public speaking 4.2-Group Discussion4.3-OralPresentation 4.4-Interviews 4.5-Graphic presentation4.6- Presentation aids 4.7-Personality Development4.8- Writing reports 4.9-Project Proposals 4.10-Brochures, newsletters, technical articles,manuals, official Notes 4.11-Business letters, memos, progress reports,minutes of meetings, event report.
5.	Ethics	5.1-Business ethics 5.2-Etiquettes in social and office settings 5.3- Email Etiquettes & Telephone Etiquettes5.4-Engineering Ethics 5.5-Managing time 5.6-Role and responsibility of engineer5.7-Work culture in jobs 5.8-Personal memory5.9-Rapid Reading 5.10-Taking notes 5.11-Complex problem solving5.12- Creativity.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Mechanical Engineering Laboratory
(Thermal) I **Course Code:** PCME 591
Semester of Study: 5th
Course Type: Practical

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PS02: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC-ME591.1	DEMONSTRATE the operation of fluid flow measuring devices.	APPLY	P
PC-ME591.2	CONDUCT experiments on water turbines and pumps.	APPLY	P
PC-ME591.3	DETERMINE the calorific value of fuels and their flash and fire points.	APPLY	P
PC-ME591.4	DETERMINE the performance parameters of four-stroke Diesel engines.	APPLY	P
PC-ME591.5	EXAMINE the thermal conductivity, emissivity and the convective heat transfer coefficient of solid and fluid materials.	APPLY	P

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Subject Code : PC-ME591	Category: Professional Core Courses
Subject Name : Mechanical Engineering Laboratory (Thermal) I	Semester : Fifth
L-T-P : 0-0-3	Credit: 1.5
Pre-Requisites: Engineering Thermodynamics and Fluid Mechanics and Fluid Machines	

Course Contents (12 experiments/ studies/ problems are to perform from the list given below or relevant others):

1. Measurement of coefficient of discharge of given Orifice and Venturimeter
2. Determination of the density & viscosity of an oil and friction factor of oil flow in a pipe
3. Determination of the performance characteristics of a centrifugal pump
4. Determination of the performance characteristics of Pelton Wheel
5. Determination of the performance characteristics of a Francis Turbine
6. Determination of the performance characteristics of a Kaplan Turbine
7. Determination of the thermal conductivity and specific heat of given objects
8. Determination of the calorific value of a given fuel and its flash & fire points
9. Determination of the p-V diagram and the performance of a 4-stroke diesel engine
10. Determination of the convective heat transfer coefficient for flow over a heated plate
11. Determination of the emissivity of a given sample
12. Determination of the performance characteristics of a vapour compression system

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project-I (Summer internship), Course Code: PW-ME581
Semester of Study: 5th Course Type: Sessional

.....

.....

Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PW-ME581.1	Develop the skills, knowledge and points of view needed by engineering professionals	Develop	P
PW-ME581.2	Develop critical thinking and problem solving skills by analysing underlying issue/s to challenges	Develop	P
PW-ME581.3	Communicate with different professionals in the work environment through written and oral means	Communicate	U
PW-ME581.4	Exhibit professional ethics by displaying positive disposition during internship	Exhibit	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	1	2	1	2	2	3	1
CO2	2	2	1	2	1	1	2	1	2	2	3	1
CO3	1	1	1	1	1	1	1	1	2	3	3	2
CO4	1	1	1	1	1	1	1	2	2	2	3	2
Average	1.5	1.5	1.25	1.5	1.25	1	1.5	1.25	2	2.25	3	1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Manufacturing Technology

Course Code: PC-ME601

Semester of Study: 6th

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME601.1	Illustrate principles of tooling design and selection for conventional and non-conventional machining processes.	Illustrate	U
PC ME601.2	Use the principle of measurement for tool wear, part quality, and inspection in manufacturing processes.	Use	P
PC ME601.3	Describe assembly practices, process planning, and material handling in manufacturing and assembly operations.	Describe	U
PC ME601.4	Discuss the understanding of NC/CNC machine tools and systems, including their components, functions, and automation capabilities.	Discuss	U
PC ME601.5	Write the part programming for CNC lathe and milling machines	Write	P
PC ME601.6	Demonstrate rapid prototyping methods and their applications in manufacturing	Demonstrate	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	2	1	1	1	2	1	2	3	2
CO2	3	1	1	1	1	1	1	1	1	2	1	2	3	2
CO3	3	1	1	1	1	1	1	1	1	2	1	2	3	2
CO4	3	1	1	1	1	1	1	1	1	2	1	2	3	2
CO5	2	2	1	1	3	1	1	1	1	2	1	2	3	2
CO6	3	1	1	1	1	1	1	1	1	2	1	2	3	2
Average	2.83	1.33	1.00	1.00	1.33	1.17	1.00	1.00	1.00	2.00	1.00	2.00	3.00	2.00

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of Topic	Contact Hrs.
1	Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; Press tools: Configuration, design of die and punch; principles of forging die design.	12
2	Metrology: Metrology in tool wear and part quality including surface integrity, alignment and testing methods; tolerance analysis in manufacturing and assembly. Process metrology for emerging machining processes such as micro-scale machining, Inspection and workpiece quality	8
3	Assembly Practices: Manufacturing and assembly, process planning, selective assembly, Material handling and devices.	6
4	NC/CNC Machine Tools and Systems Types of automation: Fixed (or hard) and programmable (or flexible); need, advantages and applications of flexible automation over fixed automation. Components and Their Functions in NC/CNC Machines MCU, DPU and CLU, Feed drives using stepper/ servo motors and recirculating ball screw-nut system, Automatic Tool Changers- Tool Turret and Tool Magazine, Automatic pallet Changer. Basic systems of NC and CNC machines Coordinate system, control— open loop and closed loop, Dimensioning— absolute and incremental, Point—to—point and contour motion, Linear and circular Interpolation. CNC Machine Tools and Integrated Automation Structure and working principle of CNC lathe, milling machine, Examples and use of CNC machines, Machining Centre (Vertical and Horizontal), Integrated Automation systems (DNC- Direct and Distributed or BTR and Dedicated system, FMS- FFMS, FMC and FMM)— characteristics and applications.	8
5	Part Programming for CNC machines Manual Part Programming using ISO G and M Codes in CNC lathe and milling machine for simple jobs, Canned cycle. Computer Aided Part Programming using MACRO statements in APT for simple jobs in CNC lathe and milling machine.	8
6	Rapid Prototyping Overview of Rapid Prototyping, Basic Process- CAD Model Creation, Conversion to STL format, Slicing the STL File, Layer by layer construction. Use of CMM and 3-D Camera for making virtual model. Principles, systems, relative advantages and applications of the common RP methods, such as Stereo lithography (SLG), Selective laser sintering (SLS), Fused deposition modelling (FDM), Laminated objects manufacturing (LOM), 3-D Printing.	6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Design of Machine Elements

Course Code: PC-ME602

Semester of Study: 6th

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC-ME602.1	Understand the failure criteria, concept of mechanics of materials, empirical design formula & safety considerations, codes & standards for design.	Understand	U
PC-ME602.2	Analyze permanent and temporary joints viz. riveted joints, welded joints and bolted joints based on design aspect.	Analyze	A
PC-ME602.3	Analyze design of shafts, belts, gears, chains and pulleys.	Analyze	A
PC-ME602.4	Solve design problems on spring, cotter joint, knuckle joint based on optimum criteria.	Solve	P
PC-ME602.5	Determine optimum design of Coupling, brakes and screw jack based on friction principle.	Determine	P
PC-ME602.6	Apply knowledge of design principles and calculations to design springs, clutches and bearings.	Apply	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	1	3	1	1	1	1	-	2	3	1
CO2	2	2	2	2	1	3	2	1	1	1	-	2	3	1
CO3	2	2	2	2	1	3	2	1	1	1	-	2	3	1
CO4	2	2	2	2	1	3	2	1	1	1	-	2	3	1
CO5	2	2	2	2	1	3	2	1	1	1	-	2	3	1
CO6	2	2	2	2	1	3	2	1	1	1	-	2	3	1
Average	2	1.8	2	2	1	3	1.8	1	1	1	-	2	3	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of Topic	Contact Hrs.
1	Design considerations; Review and selection of materials and manufacturing processes; codes and standards;	4
2	Modes of failure; Design/allowable stress; Factor of safety (FoS); Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory. Choice of Failure criteria; Design for stability : buckling analysis – Johnson and Euler columns.	4
3	Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect to fatigue failure under variable stresses; Cumulative fatigue damage – Miner's equation.	5
4	Design of (i) Cotter joint; (ii) Knuckle joint and (iii) Fillet Welded joint of brackets under different types of loading.	6
5	Bolted joints : Metric thread, standard sizes, use of lock nuts and washers; Applications in structures including brackets, turn buckle; Pre-stressed bolts; Riveted joints : Unwin's formula; Brief discussion on single, double and triple row lap joints, butt joints with single or double strap /cover plate; simple strength design; joint efficiencies.	6
6	Design of : (i) Solid and hollow shafts, strength design of shafts, design based on torsional rigidity; (ii) Shaft coupling-rigid, pin-bush and geared flexible type, alignment of coupling; (iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues, pulley (iv) Chain drives – roller chains, polygonal effect, power rating, sprocket wheel, silent chain.	10
7	Design of: (i) Transmission screw, Screw jack, (ii) Helical compression spring - stress and deflection equations, stiffness, curvature effect : Wahl's factor, springs in parallel and series; (iii) Multi-leaf springs : load-stress and load-deflection equations, Nipping.	8
8	Analysis and design of sliding and rolling contact bearings, Design of transmission elements: spur, helical, bevel and worm gears; Analysis of clutches and brakes	5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Internal Combustion Engines & Gas Turbines

Course Code: PEME601A

Semester of Study:

Course Type: Theory

.....
Program Outcome (PO):

- (1) Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.
- (2) Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- (3) Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety,
- (4) Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- (5) Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- (6) Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- (7) Graduates will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- (8) Graduate will learn the ability to understand the professional and ethical responsibility.
- (9) Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- (10) Graduate will be able to communicate effectively in both verbal and in the written form.
- (11) Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- (12) Graduate will develop confidence for self and have the ability to engage in life long learning.

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Inspiring students and preparing them for successful professional careers by applying the knowledge of applied science and fundamental Mechanical Engineering core subjects and advanced Mechanical Engineering softwares.

PSO2: Ability to co-ordinate and communicate in groups by diversifying their knowledge domain in different engineering disciplinary area.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PEME601A.1	UNDERSTAND the basic concepts, components and operations of IC Engines.	UNDERSTAND	U
PEME601A.2	ILLUSTRATE the process of curburattion and ignition of SI Engines and injections of CI Engines.	ILLUSTRATE	P
PEME601A.3	DESCRIBE the conventional and alternative fuels and combustion phenomena in SI and CI engines.	DESCRIBE	U
PEME601A.4	EVALUATE the performance parameters of IC engines.	EVALUATE	E
PEME601A.5	CLASSIFY the essential components of gas turbines along with its performance improving methods (intercooling, reheating and regenerating).	CLASSIFY	A
PEME601A.6	ILLUSTRATE the working principles of various types jet propulsive rockets.	ILLUSTRATE	P

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Subject Code: A		Category: Professional Elective Courses
Subject Name: Internal Combustion Engines and Gas Turbines		Semester: Sixth
L-T-P: 3-0-0		Credit: 3
Pre-Requisites: Thermodynamics, Heat Transfer		
Module No.	Description of Topic	Contact Hrs.
1	Introduction: Basic Engine components and Nomenclature, Classification of Engines, The working principle of Engines, Comparison of 2-Stroke and 4-Stroke Engines; CI, and SI Engines, Ideal and Actual Working Cycles and their analysis, Valve timing Diagram. Fuels: Fossil fuels, Chemical structure of Petroleum, Properties of SI and CI Engine Fuels, Fuel Ratings; Octane Number, Cetane Number.	6
2	Carburetors & Fuel Injection: Air Fuel Mixture Requirements, Construction and Working of Simple Carburetor, Calculation of Air-Fuel Ratio, Parts of Carburetor. Requirement of Injection Systems, Classification of Injection Systems, Fuel Feed pump, Injection Pumps, Working principles of Governors, Nozzles and Fuel Injector, Injection in SI and CI Engines. Combustion and Ignition Systems in SI and CI Engines: Normal and Abnormal Combustion in SI and CI Engines, Stages of Combustion, Detonation and Knocking.	7
3	Performance parameters for IC Engines: Engine Power, Engine Efficiencies, Performance Characteristics, Variables Effecting Performance Characteristics, Methods of Improving Engine Performance, Heat Balance. Modern Automotive Engines: Changes in Fuel injection Methods in S.I and C.I engines, Common Rail Direct Injection System, Gasoline Direct Injection, Variable Valve Technology, A brief review of Design changes to achieve high efficiency.	7
5	Alternate Fuels For IC Engines: Need for use of alternate fuels. Use of alcohol fuels. Biodiesel. Biogas and Hydrogen in engines.	3
6	Gas Turbine: Introduction to Gas Turbines, Development, Classification and Application of Gas Turbines, Ideal and Actual Cycles; Effect of Inter cooling, Reheating, Regeneration, Combined cycle and Cogeneration.	6

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

7	Gas Turbine Cycles for Aircraft Propulsion: Criteria of performance, Intake, and propelling nozzle efficiencies, Simple Turbojet Cycle, The turboprop engine, Thrust augmentation, Gas turbine combustion systems, Combustion chamber designs, Gas Turbine Emissions.	7

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: TURBOMACHINERY

Course Code: PE-ME602C

Semester of Study: 6th

Course Type: Theory

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE ME602C.1	To Understand energy transfer from fluid to machine and vice versa.,	Understand	U
PE ME602C.2	To Evaluate non dimensional nos. by dimensional Analysis of incompressible and compressible fluid flow machines	Evaluate	E
PE ME602C.3	To Analise incompressible fluid flow machines (both for impact and reaction type turbines.(Pelton,Francis' & Kaplan turbine) and analysis of Draft tubes. Application of velocity triangles	Analise	A
PE ME602C.4	To Analise Centrifugal Pump .	Analise	A
PE ME602C.5	Analysis of compressible fluid flow machines. choking of nozzles, illustrate rows of blades for pressure compounding and velocity compounding	Analise	A
PE ME602C.6	Evaluation of Turbo machines for performance analysis, illustrate Cavitation phenomena.	Evaluate	E

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	2	1	1	1	1	2	2	-	2
CO2	1	3	1	2	1	3	1	1	2	2	-	2
CO3	3	3	1	2	1	1	1	1	1	1	-	1
CO4	3	3	2	2	2	2	1	1	1	1	-	2
CO5	1	3	3	2	1	2	2	1	1	1	-	2
CO6	1	3	3	2	1	2	2	1	1	1	-	2
Average	1.67	3	1.83	2	1.16	1.83	1.33	1	1.33	1.33	-	1.83

University Syllabus:

Course Content:

Module No.	Description of Topic	Contact Hours
1	Introduction: Classification: Incompressible and compressible flow machines; Radial, axial and mixed flow machines; Turbines vs pumps, fans and compressors. Applications: Water supply, ventilation, power generation, propulsion.	2
2	Incompressible- Flow Machines: i) Hydraulic Turbines: Headrace, penstock, nozzle, runner, draft tube and tail race; Gross head and net head; Velocity diagrams for impulse and reaction turbines; Discharge, head, power and efficiencies.	8
3	ii) Pumps: Reservoir, foot valve, suction line, pump, delivery line and overhead tank; Static head and losses; Velocity diagrams; Discharge, head, power and efficiencies.	8
4	Compressible-Flow Machines: Static and stagnation states; Isentropic and adiabatic expansion and compression processes; Nozzle, diffuser and rows of stationary and moving blades; Efficiencies.	8
5	Dimensional Analysis: Similarity laws, volume-flow, mass-flow head and power coefficients, pressure ratio, enthalpy ratio, Reynolds number, Mach number; Specific speed and machine selection.	4
6	Testing and Performance Analysis: Measurement devices; affinity laws and unit quantities. Set up and operating characteristics of pumps, turbines; fans and turbo-compressors. Cavitation– cause of cavitation and definition of Thoma's cavitation parameter, surge and choking.	6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Mechatronics

Course Code: PE-ME602G

Semester of Study: 6th

Course Type: Theory

.....
.....
Vision of the M. E. Department

To produce professionally competent engineers to cater to the needs of the industry, society and nation.

Mission of the M. E. Department

To provide excellent opportunity for producing professionally competent engineers with the sense of social and moral responsibility by creating value added teaching and motivation for research.

PEO-1: To provide conducive learning environment and quality technical education emphasizing the mathematics and science fundamentals related to mechanical engineering program to achieve professional excellence.

PEO-2: Graduates should prepare themselves for carrying out higher studies and quality technological research & development skills to keep pace with the current technological trends through out the career, either in industry or in entrepreneurship and ready to take leadership & capable of working as a member of multi discipline team.

PEO-3: To foster a sense of responsibility, professionalism, team work and ethical values by developing skills in, management and allied studies through well balanced courses which will help to develop a symbiotic relationship between the institution, society and the community.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

(A) PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

(a) **Engineering Knowledge:** Graduate will possess strong **fundamental knowledge** on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.

(b) **Problem Analysis:** Graduate will develop confidence and will be able to **design** and conduct experiment on it as well as to **analyze** the problem and interpret data.

(c) **Design/Development of solutions:** Graduate will have the ability to design components, **fluid & thermal** systems, **manufacturing** processes and **conduct testing experiment** on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.

(d) **Investigation of Complex problems:** Graduate will possess fundamental knowledge and will have the ability to investigate **complex problems** with **multidisciplinary team** effort.

(e) **Modern Tool Usage:** Graduate will possess knowledge of using **Modern tools** e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.

(f) **The Engineer and Society:** Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and **global impact** of Engineering on **society**.

(g) **Environment and Sustainability:** Graduates will be able to develop an **environment friendly and cost effective** new system and also have serious concern for the society.

(h) **Ethics:** Graduate will learn the ability to understand the **professional and ethical responsibility**.

(i) **Team Work:** Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

(j) **Communication:** Graduate will be able to **communicate** effectively in both verbal and in the written form.

(k) **Project Management and Finance:** Graduate will possess **managerial skills** and also

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

(1) **Life-Long Learning:** Graduate will develop confidence for self and have the ability to engage in life-long learning.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

2. Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb/Bloom's Level	Knowledge Category/Level
After completion of this course the students will			
PE ME602G.1	<i>review</i> the basics of Electrical and electronics devices for various applications signal and data processing devices.	R (Remember)	C
PE ME602G.2	<i>understand</i> the design philosophy of mechatronics, basic principles of control engineering and sensor technology having required knowledge to analyze the system in time domain.	U (Understand)	C, FD
PE ME602G.3	be able to <i>apply</i> electrical and electronics devices and sensors, and different drive systems including electrical, mechanism, and pneumatic and hydraulic drives and actuators.	P (Apply)	CS PC
PE ME602G.4	be able to <i>analyze</i> the control systems using frequency domain analysis, stability analysis, in state space etc. and analyze the performance of drive systems, microprocessor program.	A (Analyze)	P
PE ME602G.5	be able to <i>evaluate</i> any mechatronic control system, performance of drive systems and control programs.	E (Evaluate)	P
PE ME602G.6	be able to <i>design</i> and <i>fabricate</i> microprocessor-microcontroller based Mechatronics control system, PLC based systems using proper drive system.	C (create)	DI

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	3	1	1	1	1	2	1		1	3	2
CO2	1	1	1	3	1	2	1	1	2	1		1	3	2
CO3	1	1	1	3	1	2	1	1	2	1		1	3	2
CO4	1	1	1	3	1	2	1	1	2	1		1	3	2
CO5	1	1	1	3	1	2	1	1	2	1		1	3	2
CO6	1	1	1	3	1	2	1	1	2	1		1	3	2
Average	1	1	1	3	1	1.8	1	1	2	1		1	3	2

Subject Code: G (PE-ME602G)	Category: Professional Elective Courses
Subject Name: Mechatronics	Semester: Sixth
L-T-P: 3-0-0	Credit: 3
Pre-Requisites: Fluid Mechanics and Fluid Machinery, Kinematics and Theory of Machines, Basic Electrical Engineering, Basic Electronics Engineering	

Course Objectives:

To provide knowledge on electrical circuits, signal conditioning.

To make familiar about control system and power electronics in designing mechatronic system

Course Contents (Syllabus and CO Mapping):

Module No.	Description of Topic	Contact Hrs.	CO Mapping
1	Introduction to Mechatronics: Definition, Mechatronics in design and manufacturing, Comparison between Traditional and Mechatronic approach; Concurrent engineering	3	CO2, CO3
2	Review of fundamentals of electronics: Logic gates and their operations, Signal processing devices, Data conversion devices, Input and output devices. Sensors and Transducers, Actuators, Limit switches, Relays	6	CO1
3	Control Systems: Open loop and closed loop control, block diagrams, transfer functions, Laplace transforms.	3	CO2
4	Electrical Drives: Stepper motors, servo drives.	2	CO3
5	Mechanical Drives: Different mechanisms, Ball screws, Linear motion bearings, Transfer systems.	3	CO3
6	Pneumatic and Hydraulic Drives: Elements of pneumatic and hydraulic drives, comparison between them. Design of pneumatic and hydraulic circuits, symbolic representations of such circuits indicating different valves, actuators, etc.	4	CO6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

7	Basics of 8085 microprocessor, programmable register architecture, buses, memory mapping, clock pulse and data transfer operations, and simple assembly and mnemonic programming on 8085 microprocessor.	5	CO3, CO6
8	Use of On-Off, PI and PID controllers to control different drives, Programming in PLC controller using Ladder diagram.	4	CO6
9	Mathematical modeling of physical systems, such as spring-mass vibration system, linear and rotory motion and its Laplace Transform.	2	CO5
10	Basics of time domain analysis, Introduction to discrete-time systems and Z-transform.	2	CO5
11	Introduction to Mechatronic systems, such as automatic brake, door closing and opening, robot, CNC machine, AGV, etc.	2	CO3, CO6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Mechanical Engineering Laboratory II (Design)

Course Code: PC-ME691

Semester of Study: 6th

Course Type: Practical

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially. l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME 691.1	DEMONSTRATE kinematic characteristics of mechanisms (Cam-Follower, 4 BAR linkages)	DEMONSTRATE	U
PC ME 691.2	ANALYZE rotating balancing problem and vibration characteristics of different undamped and damped system (free, forced)	ANALYZE	A
PC ME 691.3	CONDUCT the experiment of hardness and toughness of given materials and apply them practically	CONDUCT	A
PC ME 691.4	DETERMINE elastic parameters of given materials in tension/compression and in shear test	DETERMINE	A
PC ME 691.5	PREPARE standard metallographic heat treated samples for the given engineering materials to examine microstructure.	PREPARE	A
PC ME 691.6	MEASURE strain of the given materials by using strain gauge rosettes.	MEASURE	U

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	1	2	1	3	1	1		1	2	1		2	3	2
CO2	1	2	1	3	1	1		1	2	1		2	3	2
CO3	2	2	1	3	1	1		1	2	1		2	3	2
CO4	2	2	1	3	1	1		1	2	1		2	3	2
CO5	1	2	3	3	1	1		1	2	1		2	3	2
CO6	1	2	2	3	1	1		1	2	1		2	3	2
Average	1.67	2	1.5	3	1.0	1.0		1.0	2.0	1.0		2.0	3.0	2.0

University Syllabus:

1. Uniaxial tension test on mild steel rod
2. Torsion test on mild steel rod
3. Impact test on a metallic specimen
4. Brinnell/ Vickers and Rockwell hardness tests on metallic specimens

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

5. Bending deflection test on beams
6. Strain measurement using Rosette strain gauge, or like.
7. Microscopic examination of heat-treated and untreated metallic samples
8. Determination of velocity ratios of simple, compound, epicyclic and differential gear trains
9. Studying kinematics of four bar, slider crank, crank rocker, double crank, double rocker and oscillating cylinder mechanisms
10. Studying kinematics of typical mechanisms like pantograph, some straight line motion mechanisms, wiper, drafter, etc.
11. Motion studies of different cams & followers
12. Single degree of freedom Spring-mass-damper system: determination of natural frequency and damping coefficient
13. Determination of torsional natural frequency of single and double rotor system undamped and damped natural frequencies
14. Studying machine vibration using sensor
15. Solving simple balancing problems experimentally

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project-II (Summer internship), Course Code: PW-ME681
Semester of Study: 6th Course Type: Sessional

.....

.....

Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PW-ME681.1	Develop the skills, knowledge and points of view needed by engineering professionals	Develop	P
PW-ME681.2	Develop critical thinking and problem solving skills by analysing underlying issue/s to challenges	Develop	P
PW-ME681.3	Communicate with different professionals in the work environment through written and oral means	Communicate	U
PW-ME681.4	Exhibit professional ethics by displaying positive disposition during internship	Exhibit	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	1	2	1	2	1	3	3
CO2	2	2	1	2	1	1	2	2	1	1	2	3
CO3	1	1	1	1	1	1	1	2	1	1	2	3
CO4	1	1	1	1	1	1	1	3	1	1	2	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Advanced Manufacturing Technology Course Code: PC-ME701

Semester of Study: 7th

Course Type: Theory

.....
.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME701.1	Identify different non traditional machining processes and their applications.	Identify	U
PC ME701.2	Describe the basic working principles and mechanism of metal removal in ultrasonic machining and Abrasive jet machining and Assess its effectiveness in various applications	Describe	A
PC ME701.3	Apply the knowledge of process parameters, tool selection, and working medium to achieve desired MRR and accuracy in ECM & EDM	Apply	P
PC ME701.4	Illustrate the characteristics and applications of laser beam machining, electron beam machining, ion beam machining, and plasma arc machining.	Illustrate	U
PC ME701.5	Discuss the working principles, process variables, and performance of advanced finishing processes such as abrasive flow machining (AFM), magnetic abrasive finishing (MAF), and chemomechanical polishing.	Discuss	U
PC ME701.6	Describe the principles of micromachining, including chip formation and size effect, and Identify the challenges associated with micro-machining and its applications	Describe	U

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1	1	1	2	1	1	1	2	1	2	3	2
CO2	3	1	1	1	1	2	1	1	1	2	1	2	3	2
CO3	3	1	1	2	1	1	1	1	1	2	1	2	3	2
CO4	3	1	1	2	1	2	1	1	1	2	1	2	3	2
CO5	3	1	1	1	1	1	1	1	1	2	1	2	3	2
CO6	3	1	1	1	1	1	1	1	1	2	1	2	3	2
Average	3.0	1.0	1.0	1.3	1.0	1.5	1.0	1.0	1.0	2.0	1.0	2.0	3.0	2.0

University Syllabus:

Module	Description of topic	Contact Hrs
1	Mechanical Advanced Machining Processes: Need and classification of nontraditional machining processes – Materialremovalin traditional and nontraditional machining processes - considerations inprocess selection. Ultrasonic machining – Working principle, mechanism of metal removal – Theory of Shaw, elements of the processes, tool feed mechanism, effect of parameters, applications andnumerical. Abrasive jet machining, Water jet machining and abrasive water jet machine - Basic principles, equipments, process variables, mechanicsof metal removal, MRR, application and limitations	6
2	Electro–Chemical Processes: Principle of ECM process, chemistry of the ECM processes, Parametersof the process, determination of themetal removal rate, dynamicsof ECM process, polarization, tool design, advantages and disadvantages, application, electrochemical grinding, electrochemical honing, electrochemical deburring, Application of ECM for deepphole drilling - electrostream drilling and shaped tube electrolytic machining. Chemical machining - Fundamental principle, typesof chemical machining, maskants, etchants, advantages, disadvantages, applications	6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

3	Electric Discharge Machining: Working principle of EDM, Power circuits for EDM - RC pulse generator and controlled pulse generator – Analysis of R-C Circuits – Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, surface finish and machining accuracy, characteristics of spark eroded surface and recent development in EDM. Wire EDM – Working principle, process variables, process characteristics and applications. Electric discharge grinding and electric discharge diamond grinding - working principle, process capabilities and applications.	6
4	Laser, Electron Beam, Ion Beam and Plasma Arc Machining: General working principle of laser beam machining – Generation of Laser, types of Lasers, process characteristics and applications. Electron Beam Machining - Equipment for production of Electron Beam, theory of EBM, thermal and non-thermal type, process characteristics and applications. Ion Beam Machining - Mechanism of metal removal and associated equipments, process characteristics and applications. Plasma Arc Machining - Metal removal mechanism, process parameters, process characteristics, types of torches, applications.	6
5	Advanced Finishing Processes: Abrasive flow Machining (AFM)- working principle, AFM system, process variables, process performance and applications. Magnetic abrasive finishing (MAF)- working principle, MAF system, material removal and surface finish, process variables and applications. Chemomechanical polishing, working principle, material removal and surface finish and applications.	6
6	Micro-Machining: Need- evolution- fundamentals and trends in micro technologies Consequences of the technology and society- challenges to manufacturing technology- evolution of precision in manufacturing, tooling and current scenario, requirements and applications Theory of micromachining- Chip formation- Size effect in micromachining- microturning- microdrilling.	6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Advanced Welding Technology

Course Code: PE-ME701H

Semester of Study: 7th

Course Type: Theory

Course Designation: Elective

.....
.....

Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE-ME701H.1	Understand the principles and characteristics of various welding processes and their parametric influences.	Understand	U
PE-ME701H.2	Discuss appropriate welding techniques and joint design for different types of materials and welding processes.	Discuss	R
PE-ME701H.3	Apply the knowledge of power sources, polarity, and electrode characteristics for the selection of suitable arc welding technique.	Apply	P
PE-ME701H.4	Explain critical and precision welding processes, such as USW, PAW, LBW, and EBW, in terms of their advantages and limitations.	Explain	U
PE-ME701H.5	Assess the weldability of different materials, including plain carbon steel, stainless steel, cast iron, and aluminium alloys, based on their metallurgical properties and behaviour during welding.	Assess	P
PE-ME701H.6	Identify common welding defects, understand their causes and remedies, and Select appropriate inspection and testing methods for welded joints.	Identify	A

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O 1	PS O 2
CO1	2	2	3	2	1	1	1	1	1	1	1	2	2	2
CO2	2	2	3	2	1	2	2	1	1	1	1	2	2	2
CO3	2	2	2	3	2	2	1	1	2	1	1	2	2	3
CO4	2	2	3	3	1	2	1	1	1	1	1	2	2	1
CO5	2	2	3	3	1	2	1	1	1	1	1	2	2	3
CO6	2	2	3	2	1	2	1	1	1	1	1	2	2	3
Average	2.0	2.0	2.8	2.5	1.2	1.8	1.2	1.0	1.2	1.0	1.0	2.0	2.0	2.3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of topic	Contact Hrs
1	Review of welding processes, joint design	3
2	Descriptions and Parametric influences on Welding processes: Arc Welding- SMAW, Stud Arc welding, SAW, GMAW, GMAW-P, FCAW, GTAW, GTAW-P. Resistance Welding processes- Spot, Butt, Seam, Projection. Solid State Welding processes- Forge welding, Friction welding, Friction Stir welding, Diffusion welding, Roll welding.	6
3	Arc Welding- Different types of equipment, Power sources, Choice of Polarity, Arc characteristics, Modes of Metal Transfer, Welding Positions, Electrode selection.	5
4	Critical and Precision Welding processes- USW, PAW, LBW, EBW. Underwater Welding- Wet Welding and Dry Welding: Hyperbaric and Cavity. Welding of Plastics- Hot Gas Welding, Hot Tool Welding, Hot Press Welding, Friction Welding, Ultrasonic Welding. Joining of Ceramics and Composites	8
5	Welding Metallurgy, HAZ, Effect of different process parameters on the characteristics of weldment. Weldability of Plain Carbon Steel, Stainless Steel, Cast Iron, Aluminium and its Alloys.	8
6	Welding Defects- Types, Causes, Inspection and Remedial Measures. Testing of Welded Joints- Visual Inspection, Dye-Penetration (DP) Test, Ultrasonic Test and Radiography Test.	3
7	Welding Fixtures, Welding Automation and Robotic Welding. Safe Practices in Welding.	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Automobile Engineering, Course Code: PEME701A

Semester of Study: 7TH

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE ME701A.1	Understand the basic lay-out of an automobile and engines for two-wheelers, three wheelers, four wheelers, & other passenger and commercial vehicles.	Describe	U
PE ME701A.2	Explain the operation of engine cooling, lubrication, ignition, electrical, electronics and air conditioning systems.	Explain	U
PE ME701A.3	Illustrate the principles of transmission, suspension, steering and braking systems and construction of wheels and tyres.	Illustrate	A
PE ME701A.4	Determine the tractive effort and power requirements & learn the use of torque-speed curve.	Determine	P
PE ME701A.5	Learn automobile restraint system.	Illustrate	P
PE ME701A.6	Know the latest developments in automobiles.	Tell	R

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	2	1	2	2	2	1	2	1	1	2
CO2	2	3	2	1	2	2	2	2	2	1	1	2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

CO3	2	3	2	1	2	1	1	1	2	1	1	2
CO4	2	3	2	1	2	1	1	1	2	1	1	2
CO5	2	3	2	1	2	2	1	2	2	1	1	2
CO6	2	3	2	1	2	2	1	2	2	1	1	2
Average	2	3	2	1	2	1.66	1.33	1.5	2	1	1	2

Module No.	Description of the Topic	contact Hrs
1	Introduction: Hrs. History & Development of Automobiles. Various subsystems of Automobiles.	1
2	Prime Movers: Engine for Two-Wheeler & Three-Wheeler vehicles, Engine for passenger cars, commercial and other vehicle, Fuel system for carburetted engine, MPFI engine and Diesel engine, Lubrication and cooling system.	5
3	Auto Electrical: Electric Motor as prime mover, Battery, generator, Ignition system, Starting system, lighting & signaling	6
4	Steering System: Devis steering & Ackerman steering system. Rack & pinion, cam & lever, worm & sector system.	3
5	Transmission System: Flywheel & clutch. Gearbox sliding and constant mesh type, Automatic Transmission, Universal joint, Propeller shaft.	6
6	Differential & Axle: Construction & function of differential, Different types of front & rear axles.	3
7	Suspension System: Conventional and independent suspension system, application.	3
8	Brake System: Disc & drum brake, Hydraulic brake, Parking brake. Stopping distance.	3
9	Power Requirement: Various resistances such as air resistance, gradient resistance, rolling resistance. Tractive effort. Torque- Speed curve. Horse power calculation.	3
10	Automotive air conditioning: Ventilation, heating, air condition, refrigerant, compressor and evaporator.	3

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

	Wheels and tyres: Wheel quality, assembly, types of wheels, wheel rims. Construction of tyres and tyre specifications. Automotive Restraint Systems: Seat belt, automatic seat belt tightener system, collapsible steering column and air bags.	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: CAD/CAM

Course Code: PE-ME702J

Semester of Study: 7th

Course Type: Theory

Course Designation: Professional Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

j. Graduate will be able to communicate effectively in both verbal and in the written form.

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE-ME702J.1	Understand overview of CAD/CAM (process, benefits & applications).	Understand	U
PE-ME702J.2	Illustrate aspects of geometric modeling viz. wireframe, surface and solid modeling.	Illustrate	P
PE-ME702J.3	Analyze stress using FEM.	Analyze	A
PE-ME702J.4	Write part programme using the knowledge of CNC machines, tools & work handling system.	Write	P
PE-ME702J.5	Illustrate types, anatomy, drives and application of robotics.	Illustrate	P
PE-ME702J.6	Explain components of computer aided manufacturing including Group Technology, Reverse Engineering, Computer-aided process planning, Control systems and Automatic inspection systems.	Explain	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	3	1	1	1	1	1	-	1	1	3
CO2	2	2	2	2	3	1	1	1	1	1	-	1	1	3
CO3	2	2	2	2	3	1	1	1	1	1	-	1	1	3
CO4	2	2	2	2	3	1	1	1	1	1	-	1	1	3
CO5	2	1	2	2	3	1	1	1	1	1	-	1	1	3
CO6	2	1	2	2	3	1	1	1	1	1	-	1	1	3
Average	2	1.6	2	2	3	1	1	1	1	1	-	1	1	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Module	Description of Topic	Contact Hrs.
1	Fundamentals of CAD- Design process, benefits of computer aided design, graphics standards	3
2	Geometric modeling- wire-frame, surface and solid modeling Transformation- translation and rotation exercise problems and programming. Stress analysis- basics of FEM, formation of stiffness matrix for two elements.	6
3	Introduction to computer aided manufacturing (CAM) systems, basic building blocks of computer integrated manufacturing (CIM).	4
4	Toolings of CNC machines, tool and work handling systems involving robot, AGV, RTV, AS/RS, ATC, APC.	3
5	Robotics; types, anatomy, drives and applications.	3
6	Computer aided production planning and control, Manufacturing from product design- CAD/CAM interface, concept of group technology (GT), CAPP.	6
7	Control systems, Process monitoring, Adaptive control systems, etc.	2
8	Automatic inspection systems, use of CMM, Reverse Engineering.	1

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Selection and Testing of Materials **Course Code:** PE-ME-702E

Semester of Study: 7th Semester

Course Type: Theory

Course Designation: Elective

.....
Program Outcome (PO):

1. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
2. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
3. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
4. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
5. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems..
6. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
7. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
8. Graduate will learn the ability to understand the professional and ethical responsibility.
9. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
10. Graduate will be able to communicate effectively in both verbal and in the written form.
11. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
12. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE-ME-702E.1	Understand properties and application of Engineering Materials viz. ceramic, composites, polymers, elastomers	Understand	U
PE-ME-702E.2	Select Materials based on Ashby Material Selection Chart for Engineering Applications	Select	P
PE-ME-702E.3	Explain material properties.	Explain	U
PE-ME-702E.4	Analyze material properties and defects using suitable testing technique.	Analyze	A
PE-ME-702E.5	Understand Macroscopic and Microscopic observation through material characterization techniques	Understand	U
PE-ME-702E.6	Analyze Material properties through thermal and chemical testing	Analyze	A

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE-ME-702E.1	2	3	2	2	1	1	1	1	1	1	0	1	2	3
PE-ME-702E.2	2	3	2	2	1	1	1	1	1	1	0	1	2	3
PE-ME-702E.3	2	3	2	2	1	1	1	1	1	1	0	1	2	3
PE-ME-702E.4	2	3	2	2	1	1	1	1	1	1	0	1	2	3
PE-ME-702E.5	2	3	2	2	1	1	1	1	1	1	0	1	2	3
PE-ME-702E.6	2	3	2	2	1	1	1	1	1	1	0	1	2	3
Avg.	2	3	2	2	1	1	1	1	1	1	0	1	2	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Module No.	Description of Topic	Contact Hrs.
1	Engineering Materials Introduction – classification of engineering materials – selection of materials for engineering purposes –selection of materials and shape –classification metal and alloys, polymers, ceramics and glasses, composites, natural materials,-non metallic materials- smart materials - physical, metrical properties of metals.	5
2	Material Properties Mechanical properties - fatigue strength - fracture Toughness - Thermal Properties - Magnetic Properties - Fabrication Properties - electrical, optical properties - Environmental Properties, Corrosion properties - shape and size - Material Cost and Availability– failure analysis.	3
3	Materials Selection Charts and Testing Ashby material selection charts-Testing of Metallic Materials - Selection of Materials for Biomedical Applications - Medical Products - Materials in Electronic Packaging - Advanced Materials in Sports Equipment - Materials Selection for Wear Resistance - Advanced Materials in Telecommunications - Using Composites - Manufacture and Assembly with Plastics, fiber and Diamond Films	6
4	Mechanical Testing Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.	6
5	Non Destructive Testing Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.	6
6	Material Characterization Testing Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.	6
7	Other Testing Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermomechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.	4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Machine Learning

Course Code: OE-ME701H

Semester of Study: 7th

Course Type: Theory

Course Designation: Open Elective

.....
.....
Vision of the M. E. Department

To produce professionally competent engineers to cater to the needs of the industry, society and nation.

Mission of the M. E. Department

To provide excellent opportunity for producing professionally competent engineers with the sense of social and moral responsibility by creating value added teaching and motivation for research.

PEO-1: To provide conducive learning environment and quality technical education emphasizing the mathematics and science fundamentals related to mechanical engineering program to achieve professional excellence.

PEO-2: Graduates should prepare themselves for carrying out higher studies and quality technological research & development skills to keep pace with the current technological trends throughout the career, either in industry or in entrepreneurship and ready to take leadership & capable of working as a member of multi discipline team.

PEO-3: To foster a sense of responsibility, professionalism, team work and ethical values by developing skills in, management and allied studies through well balanced courses which will help to develop a symbiotic relationship between the institution, society and the community.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

(A) PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

- (a) **Engineering Knowledge:** Graduate will possess strong **fundamental knowledge** on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.
- (b) **Problem Analysis:** Graduate will develop confidence and will be able to **design** and conduct experiment on it as well as to **analyze** the problem and interpret data.
- (c) **Design/Development of solutions:** Graduate will have the ability to design components, **fluid & thermal** systems, **manufacturing** processes and **conduct testing experiment** on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- (d) **Investigation of Complex problems:** Graduate will possess fundamental knowledge and will have the ability to investigate **complex problems** with **multidisciplinary team** effort.
- (e) **Modern Tool Usage:** Graduate will possess knowledge of using **Modern tools** e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- (f) **The Engineer and Society:** Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and **global impact** of Engineering on **society**.
- (g) **Environment and Sustainability:** Graduates will be able to develop an **environment friendly and cost effective** new system and also have serious concern for the society.
- (h) **Ethics:** Graduate will learn the ability to understand the **professional and ethical responsibility**.
- (i) **Team Work:** Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- (j) **Communication:** Graduate will be able to **communicate** effectively in both verbal and in the written form.
- (k) **Project Management and Finance:** Graduate will possess **managerial skills** and also

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

(1) **Life-Long Learning:** Graduate will develop confidence for self and have the ability to engage in **life-long learning**.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

2. Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb/Bloom's Level	Knowledge Category/Level
After completion of this course the students will			
PE ME602G.1	Gain <i>knowledge</i> in graphical models, Classification of Machine learning and different machine learning algorithms and they have to <i>recall</i> foundational mathematics.	R (Remember)	C
PE ME602G.2	Be able to <i>understand</i> concept learning, machine learning model, linear models, different algorithms, neural networks and associated algorithms, concept of over fitting and under fitting.	U (Understand)	C, FD
PE ME602G.3	Be able to <i>apply</i> different machine learning algorithms and find out applications with different case studies.	P (Apply)	CS PC
PE ME602G.4	Be able to <i>analyze</i> and <i>interpret</i> the efficiency, accuracy of different algorithms.	A (Analyze)	P
PE ME602G.5	Be able to <i>evaluate</i> the performance of different algorithms.	E (Evaluate)	P
PE ME602G.6	Be to <i>create</i> various neural networks, decision trees, support vector models, Bayesian models, Logistic regression and others for solution to various problems.	C (create)	P

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	3	2	1	1	1	1	1		1	3	2
CO2	1	1	1	3	2	1	1	1	1	1		1	3	2
CO3	1	1	1	3	2	1	1	1	1	1		1	3	2
CO4	1	2	2	3	3	1	1	1	1	1		1	3	2
CO5	1	2	2	3	3	1	1	1	1	1		1	3	2
CO6	1	2	2	3	3	1	1	1	1	1		1	3	2
Average	1	1.5	1.5	3	2.5	1	1	1	1	1		1	3	2

University Syllabus:

Subject Code : H	Category: Open Elective Courses
Subject Name : Machine Learning	Semester : Seventh
L-T-P : 3-0-0	Credit: 3
Pre-Requisites: Mathematics- IB, Mathematics- IIB, Mathematics- III	

Course Content:

Module No.	Description of Topic	CO-Mapping	Contact Hrs.
1	Introduction: Learning– Types of Machine Learning– Supervised Learning– The Brain and the Neuron– Design a Learning System– Perspectives and Issues in Machine Learning– Concept Learning Task– Concept Learning as Search– Finding a Maximally Specific Hypothesis– Version Spaces and the Candidate Elimination Algorithm– Linear Discriminants– Perceptron– Linear Separability– Linear Regression.	CO1	8
2	Linear Models: Multi-layer Perceptron– Going Forwards– Going Backwards: Back Propagation Error– Multilayer Perceptron in Practice– Examples of using the MLP– Overview– Deriving Back Propagation– Radial Basis Functions and Splines– Concepts– RBF Network– Curse of Dimensionality– Interpolations and Basis Functions– Support Vector Machines.	CO4	7
3	Tree and Probabilistic Models: Learning with Trees– Decision Trees– Constructing Decision Trees– Classification and Regression Trees– Ensemble Learning– Boosting– Bagging– Different ways to Combine Classifiers– Probability and Learning– Data into	CO3	7

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

	Probabilities– Basic Statistics– Gaussian Mixture Models– Nearest Neighbor Methods– Unsupervised Learning– K means Algorithms– Vector Quantization– Self Organizing Feature Map.		
4	Dimensionality Reduction and Evolutionary Models: Dimensionality Reduction– Linear Discriminant Analysis– Principal Component Analysis– Factor Analysis– Independent Component Analysis– Locally Linear Embedding– Isomap– Least Squares Optimization. Evolutionary Learning– Genetic algorithms– Genetic Offspring– Genetic Operators– Using Genetic Algorithms– Reinforcement Learning– Overview– Getting Lost Example– Markov Decision Process.	CO2, CO1	7
5	Graphical Models: Markov Chain Monte Carlo Methods– Sampling– Proposal Distribution– Markov Chain Monte Carlo– Graphical Models– Bayesian Networks– Markov Random Fields– Hidden Markov Models– Tracking Methods.	CO2	7

Learning Resources:

1. Jeeva Jose, Introduction of Machine Learning, Khanna Publishing House, 2019.
2. S. Marsland-, Machine Learning– An Algorithmic Perspective, 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. T.M. Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
4. P. Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
5. J. Bell, Machine learning– Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014.
6. E. Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), 3rd Edition, MIT Press, 2014

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Water Resource Engineering

Course Code: OEME 701I

Semester of Study: 7th

Course Type: Theory

Course Designation: Elective

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
OEME 701I.1	UNDERSTAND the basic concept of fluid dynamics in water resource engineering	UNDERSTAD	U
OEME 701I.2	APPLY conservation laws in water flow system and concept to solve fluid mechanics problems	APPLY	P
OEME 701I.3	DESIGN fluid flow system in open channel and pipe networking system	CREATE	C
OEME 701I.4	SOLVE non-dimensional parameters in fluid machines using dimensional analysis	APPLY	P
OEME 701I.5	ANALYSE the surface water hydrology problems	ANALYSE	A
OEME 701I.6	EVALUATE aquifer parameters using graphical and analytical approaches and apply the equations of groundwater flow to analyze groundwater systems in both unconfined and confined aquifers	EVALUATE	E

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEME701I.1	1	2	3	1	1	1	1	1	1	1	-	2
OEME701I.2	1	3	2	1	1	1	1	1	1	1	-	1
OEME701I.3	1	3	2	1	1	2	1	1	2	1	-	2
OEME701I.4	1	2	3	1	1	2	1	1	2	1	-	1
OEME701I.5	1	2	3	1	1	2	1	1	1	1	-	1
OEME701I.6	1	1	3	1	1	2	1	1	1	1	-	2
Average	1	2.2	2.7	1	1	1.7	1	1	1.3	1		1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code: I	Category: Open Elective Courses
Subject Name: Water Resource Engineering	Semester: Seventh
L-T-P: 3-0-0	Credit: 3
Pre-Requisites: Fluid Mechanics	

Course Objectives:

The objective of this course is to provide an understanding of the concepts of closed conduit flow, open channel flow, surface water hydrology and rainfall, and also groundwater hydrology and its characteristics.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Fluid Mechanics: Review of fluid statics, Review of fluid dynamics; dimensional analysis.	4
2	Closed Conduit Flow: Closed conduit flow, Design of water distribution systems, pipe network analysis: Hardy Cross Method, Design of Network Reservoir pipeline.	9
3	Open Channel Flow: Continuity, momentum equations, Chezy, Mannings and energy equations, Water surface profiles.	9
4	Surface Water Hydrology: Rainfall depth, duration, distribution, determination of average rainfall depth by Arithmetic, Mean Method, Thiessen Polygon Method and Isohyetal Method, Rainfall/runoff equations, Rainfall/ runoff models, unit hydrograph, hydrologic routing models.	10
5	Groundwater Hydrology: Porosity and water content, Equations of ground water flow (unconfined aquifers/ confined, aquifers/ unsaturated flow), Estimation of aquifer parameters using graphical and analytical approach.	4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Economics for Engineers

Course Code: HM-HU 701

Semester of Study: 8th

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially. l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
HM HU 701.1	EXPLAIN principles of decision making in fixed and variable cost, life cycle cost, estimating models, improvement and learning curve.	EXPLAIN	U
HM HU 701.2	ANALYZE economic conditions viz. inflation, deflation, economic criterion and present worth.	ANALYZE	A
HM HU 701.3	ANALYZE cash flow, rate of return, cost ratio, and break even analysis.	ANALYZE	A
HM HU 701.4	UNDERSTAND depreciation, types of property, tax regulation and capital allowance.	UNDERSTAND	A
HM HU 701.5	DESCRIBE inflation, price change, types of index and use of price index.	DESCRIBE	U
HM HU 701.6	UNDERSTAND accounting, balance sheet, income statement, cost accounting, direct and Indirect cost.	UNDERSTAND	U

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	1	2	2	2		2	2	1	1	1	3	2	1	3
CO2	1	2	2	2		2	2	1	1	1	3	2	1	3
CO3	1	2	2	2		2	2	1	1	1	3	2	1	3
CO4	1	2	2	2		2	2	1	1	1	3	2	1	3
CO5	1	2	2	2		2	2	1	1	1	3	2	1	3
CO6	1	2	2	2		2	2	1	1	1	3	2	1	3
Average	1.0	2.0	2.0	2.0		2.0	2.0	1.0	1.0	1.0	3.0	2.0	1.0	3.0

University Syllabus:

Module No.	Description of Topic	Contact Hrs.
1	Economic Decisions Making- Overview, Problems, Role, Decision making process.	2
2	Engineering Costs & Estimation- Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring and Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types of Estimate, Estimating Models - Per- Unit Model, Segmenting Model, Cost Indexes, Power- Sizing Model, Improvement & Learning Curve, Benefits.	4

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

3	Present Worth Analysis: End-of-Year Convention, Viewpoint of Economic Analysis Studies, Borrowed Money Viewpoint, Effect of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.	4
4	Cash Flow & Rate of Return Analysis- Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Break Even Analysis. Economic Analysis in the Public Sector- Quantifying and Valuing Benefits & drawbacks.	4
5	Depreciation- Basic Aspects, Deterioration & Obsolescence, Depreciation and Expenses, Types of Property, Depreciation Calculation Fundamentals, Depreciation and Capital Allowance Methods, StraightLine Depreciation Declining Balance Depreciation, Common Elements of Tax Regulations For Depreciation and Capital Allowances.	4
6	Inflation and Price Change- Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes in Engineering Economic Analysis, Cash Flows that inflate at different Rates.	3
7	Accounting- Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Mechanical Engineering Laboratory III (Manufacturing)

Course Code: PC-ME791, Semester of Study: 7th

Course Type: Practical

Course Designation: Compulsory

.....
.....

Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PC ME791.1	Perform Part Programming on CNC Lathe for Multi Stepped Shaft & Single Stepped Shaft with Round End.	Perform	P
PC ME791.2	Apply Part Programming on CNC Milling for Single Slot, Curve Slot and Square Loop.	Apply	P
PC ME791.3	Demonstrate various axes movement of vertically articulated robot arm.	Demonstrate	U
PC ME791.4	Determine cutting forces in turning by using Dynamometer	Determine	P
PC ME791.5	Conduct experiment in MMA welding and Examine dye penetration test for determination of welding joint defect.	Conduct	P
PC ME791.6	Determine fineness number, AFS clay content and permeability number of moulding sand.	Determine	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	2	2	2	3	1	2	1	1	1	1	2	3	2
CO2	2	2	2	2	3	1	2	1	1	1	1	2	3	2
CO3	2	2	2	2	3	1	2	1	1	1	1	2	3	1
CO4	2	2	3	2	1	1	1	1	1	1	1	2	2	1
CO5	2	2	3	2	1	1	2	1	1	1	1	2	2	1
CO6	2	2	3	2	1	1	1	1	1	1	1	2	2	1
Average	2.0	2.0	2.5	2.0	2.0	1.0	1.7	1.0	1.0	1.0	1.0	2.0	2.5	1.3

Course Contents (12 Experiments/ Problems/ Studies are to do):

1. Measurement of Cutting Force in Turning
2. Study of the effect of parametric variation in arc welding
3. Testing of moulding sand
4. Testing for Weld Quality
5. Study of and Solving problems on geometry of robot manipulator, actuators and grippers
6. Programming on CNC Lathe using G and M Codes
7. Programming on CNC Lathe using APT
8. Programming on CNC Milling Machine using G and M Codes
9. Programming on CNC Milling Machine using APT
10. Programming on CNC machine Simulator and to observe virtual machining
11. Robot Programming
12. Experiments on AJM/ USM/ WEDM/ EDM/ ECM/ LBM
13. Design and manufacture of products using Additive Manufacturing

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project III Course Code: PWME 881

Semester of Study: 7th

Course Type: Sessional

Course Designation: Project

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

(Formerly West Bengal University of Technology)

(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Specific Outcome (PSO):

PS02: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PWME 781.1	Selecting topic of the project & Generating its objectives	Create	C
PWME 781.2	Practice finding relevant course material on the Internet and non-electronic sources	Create	C
PWME 781.3	Preparing work plan and Preliminary report	Create	C
PWME 781.4	Preparing presentation and explaining it to the audience	Create	C
PWME 781.5	Selecting topic of the project & Generating its objectives	Create	C

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Analysis And Performance Of Fluid Machines

Course Code: PEME 801A

Semester of Study: 8th

Course Type: Theory

Course Designation: Elective

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PEME 801A.1	UNDERSTAND of the fluid properties and conservation laws in fluid machines	UNDERSTAND	U
PEME 801A.2	ANALYSE the dimensional analysis principle to design and select fluid machinery	ANALYSE	A
PEME 801A.3	ILLUSTRATE heads, losses and efficiencies for pumps, fans and turbines.	ANALYSE	A
PEME 801A.4	EVALUATE the Interaction between pumps and Turbines and systems in both series and parallel connections and the Performance characteristics of pumps and turbines.	EVALUATE	E
PEME 801A.5	ASSESS about Cavitation: NPSH, Thoma's cavitation parameter and suction specific speed also know to design hydraulic machine design.	EVALUATE	E
PEME 801A.6	Apply the principle of flow through special devices propellers and windmills and jet propulsion and to determine the parameters like work done, efficiency of propeller, jet propulsion etc.	APPLY	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEME801A.1	1	2	2	1	1	1	1	1	1	1	-	2
PEME801A.2	1	3	2	1	1	1	1	1	1	1	-	1
PEME801A.3	1	3	2	2	1	1	1	1	2	1	-	2
PEME801A.4	1	2	3	1	1	2	1	1	2	1	-	1
PEME801A.5	1	2	3	1	1	2	1	1	2	1	-	2
PEME801A.6	1	2	3	1	1	1	1	1	1	1	-	1
Average	1	2.3	2.5	1.2	1	1.3	1	1	1.5	1		1.5

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Subject Code : A	Category: Professional Elective Courses
Subject Name : Analysis and Performance of Fluid Machines	Semester: Eighth
L-T-P : 3-0-0	Credit: 3
Pre-Requisites: Fluid Mechanics and Fluid Machinery	

Course Objective:

1. To know about the dimensional analysis for fluid machinery.
2. To learn about different heads, losses and efficiencies for pumps, fans and turbines.
3. To know about the Interaction of pumps and Turbines and systems.
4. To know about the Performance characteristics of pumps and turbines.
5. To learn about Cavitation: NPSH, Thoma's cavitation parameter and suction specific speed.
6. To know about the Analysis of flow through propellers and windmills and jet propulsion.

Course Content:

Module No.	Description of Topic Contact	Hrs.
1.	Dimensional analysis for fluid machinery: Dimensionless quantities and their use in design, selection and testing.	3
2.	Different heads, losses and efficiencies for pumps, fans and turbines.	3
3.	Interaction of pumps and Turbines and systems: Series and Parallel operation of Pumps, Performance and selection of Pumps for different systems characteristics, Surging in Pipelines.	12
4.	Performance characteristics: Pumps and Fans-Radial, Mixed flow and Axial flow. Turbines-Francis, Kaplan and Pelton wheel-operating characteristics and Muschel curves, Governing of Turbines.	8
5.	Cavitation: NPSH, Thoma's cavitation parameter and suction specific speed.	4
6.	Special Devices: Analysis of flow through propellers and windmills, Slipstream and actuator disc theory; Jet propulsion devices.	6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Power Plant Engineering Course Code: PEME 801B

Semester of Study: 8th

Course Type: Theory

Course Designation: Professional Elective

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PEME801B.1	Analyze the vapour power cycles and their modifications.	Analyze	A
PEME801B.2	Understand boilers & calculate its performance parameters.	Understand	U
PEME801B.3	Analyze the combustion phenomenon of fuels.	Analyze	A
PEME801B.4	Determine the performance parameters of steam nozzles and steam turbines.	Determine	P
PEME801B.5	Illustrate and Design the condensers and cooling towers.	Design	C
PEME801B.6	Determine power plant economic parameters and know about the Diesel and gas plants, pollution and its control.	Determine	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	3	2	1	1	1	1	1	2	1	1	2	2	3
CO2	2	3	2	1	2	2	2	2	2	1	2	2	2	3
CO3	2	3	2	1	1	1	1	1	2	1	1	2	2	3
CO4	2	3	2	1	2	1	1	1	2	1	2	2	2	3
CO5	2	3	3	1	2	2	2	2	2	1	2	2	2	3
CO6	2	3	2	1	1	2	2	2	2	1	2	2	2	3
Average	2	3	2.16 6666 667	1	1.5	1.5	1.5	1.5	2	1	1.666 66666 7	2	2	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of topic	Contact Hrs
1	Analysis of Steam Cycles: Introduction to the course, Power plant layout and essential feature of Rankine cycle, Reheating and regeneration, Problems on Rankine Cycle, Combined cycle power generation, Binary vapour cycles.	3
2	Boilers: Definition, classification, fire tube and water tube boilers, mountings and accessories. Draft in boilers, performance of boiler - boiler efficiency, equivalent evaporation, Losses in boilers. Coal and combustion: Properties of coal, ultimate analysis and proximate analysis, combination calculation. Super heater, economizer and air pre heater. Handling of coal and ash.	8
3	Fuel bed firing, PF firing and Fluidized bed boilers. Introduction to boiling and circulation in boilers. Power station boilers - Benson, Lamont. Supercritical boiler.	4
4	Steam turbine: i) parts and classification, ii) nozzle types, flow through nozzles and nozzle efficiency. Impulse turbine - velocity diagram, work done and blade efficiency.	6
5	Turbines: Pressure compounding and velocity compounding of steam turbine. Impulse reaction turbine - Velocity diagram, degree of reaction and Parsons turbine. Governing in Steam turbine.	6
6	Condensers: Direct Contact Condenser Surface Condensers, Effect of various parameters on condenser performance, Design of condensers, cooling towers and cooling ponds.	6
7	Power plant economics and other issues:	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Maintenance Engineering

Course Code: PE ME 802I

Semester of Study: 8th

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially. l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE ME 802I.1	UNDERSTAND maintenance systems through condition monitoring; Maintainability, failure pattern, availability of equipment / systems and design for maintainability.	UNDERSTAND	U
PE ME 802I.2	ANALYZE the Total Productive Maintenance (TPM).	ANALYZE	A
PE ME 802I.3	UNDERSTAND the Organizational structures for maintenance.	UNDERSTAND	U
PE ME 802I.4	ANALYZE the Economic Aspect of Maintenance.	ANALYZE	
PE ME 802I.5	UNDERSTAND the Function and use of Maintenance Equipment.	UNDERSTAND	U
PE ME 802I.6	UNDERSTAND the lubrication, Repair & Maintenance Procedures	UNDERSTAND	U

Course Articulation Matrix:

	PO a	PO b	PO c	PO d	PO e	PO f	PO g	PO h	PO i	PO j	PO k	PO l	PSO 1	PSO 2
CO1	1	-	1	3	1	2	1	1	1	1	2	2	2	3
CO2	1	-	1	3	1	2	1	1	1	1	2	2	2	3
CO3	1	-	1	3	1	2	1	1	1	1	2	2	2	3
CO4	1	-	1	2	1	2	1	1	1	1	2	2	2	2
CO5	1	-	1	3	1	2	1	1	1	1	2	2	2	3
CO6	1	-	1	3	1	2	1	1	1	1	2	2	2	3
Average	1.0	-	1.0	3.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	3.0

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Definitions of repair and maintenance; Importance of maintenance; Different maintenance systems- breakdown, preventive, planned; predictive maintenance through condition monitoring; Maintainability, failure pattern, availability of equipment/ systems, design for maintainability.	5
2	Total Productive Maintenance (TPM): definition, objective & methodology; Implementation of TPM; Lean maintenance; Overall equipment effectiveness (OEE).	3
3	Organizational structures for maintenance: Objective; Maintenance functions and activities; Organizational requirements; Types of maintenance organizations, Manpower planning; Engineering stores & inventory management.	4
4	Economic Aspect of Maintenance: Life cycle costing; Maintenance cost & its impact; Maintenance budget; Cost control; Maintenance audit- Procedure, tools, planning, reports.	4
5	Function and use of Maintenance Equipment, Instruments & Tools: Facilities like NDT, painting, coating and cladding, Gas cutting and welding, crack detection, vibration monitor, balancing equipment, compressor, basic machine tools, lubricators and lubricants, chain pulley block, Tools like different types of wrenches, torque wrench, pipe wrench, plier, screw driver, dimension measuring instruments, feeler gauge, scraper, fitting shop tools, spirit level, hand grinder & drill, screw jack, etc.	6
6	Lubrication: Purpose & importance; Type of lubricants, Properties of lubricants; Types of lubrication and their typical applications, lubrication devices, centralized lubrication system; Gasket, packing and seals.	4
7	Repair & Maintenance Procedures: Repair of cracks, threads, worn shafts, keyways, bush bearing, damaged gear tooth. Assembly and dismantling of antifriction bearing; Maintenance of bearing, clutches, coupling, brakes, Alignment of shafts, belt and chain drives, gear drives, centrifugal pump, pipe and pipe fittings, electrical wiring, isolators and main switches, small induction motors; Steps for installation of a machine.	10

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: 3D Printing and Design

Course Code: PE-ME802F

Semester of Study: 8th

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
- h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

j. Graduate will be able to communicate effectively in both verbal and in the written form.

k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PE-ME802F.1	Understand the working principles and process parameters of additive manufacturing processes.	Understand	U
PE-ME802F.2	Describe the CAD and data format for 3D printing purpose.	Describe	R
PE-ME802F.3	Analyze materials suitable for 3D printing.	Analyze	A
PE-ME802F.4	Illustrate additive manufacturing equipments.	Illustrate	P
PE-ME802F.5	Identify suitable post processing operation based on product repair requirement	Identify	P
PE-ME802F.6	Describe the quality of 3D printed products.	Describe	A

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	2	2	1	1	1	1	1	1	2	2	3
CO2	2	2	2	2	3	1	2	1	2	2	1	1	2	3
CO3	2	2	2	2	2	3	2	1	1	1	2	3	2	3
CO4	2	2	2	3	2	2	2	1	1	1	1	2	2	3
CO5	2	2	2	3	2	2	2	1	1	1	1	2	2	3
CO6	2	2	2	2	2	2	3	2	2	1	1	2	2	3
Average	2.0	1.8	2.2	2.3	2.2	1.8	2.0	1.2	1.3	1.2	1.2	2.0	2.0	3.0

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

University Syllabus:

Module	Description of Topic	Contact Hrs.
1	3D Printing (Additive Manufacturing): Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.	2
2	CAD for Additive Manufacturing: CAD Data formats, Data translation, Data loss, STL format	3
3	Additive Manufacturing Techniques: 3.1 Stereo-Lithography, LOM, FDM, SLS, SLM, Binder Jet technology. 3.2 Process, Process parameter, Process Selection for various applications. 3.3 Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools	10
4	Materials: 4.1 Polymers, Metals, Non-Metals, Ceramics 4.2 Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. 4.3 Support Materials	7
5	Additive Manufacturing Equipment: 5.1 Process Equipment- Design and process parameters 5.2 Governing Bonding Mechanism 5.3 Common faults and troubleshooting 5.4 Process Design	8
6	Post Processing: Requirement and Techniques	3
7	Product Quality: 7.1 Inspection and testing 7.2 Defects and their causes	3

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Industrial Pollution and Control Course Code: OEME 801D

Semester of Study: 8th

Course Type: Theory

Course Designation: Open Elective

.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
OEME801D.1	Describe types of pollution caused by the industries and their effects on the environment	Describe	U
OEME801D.2	Explain the physical effects, sampling method of air pollution	Explain	U
OEME801D.3	Discuss the processes and control techniques of air pollution	Discuss	U
OEME801D.4	Demonstrate the causes, processes and control techniques of water pollution	Demonstrate	P
OEME801D.5	Learn the physics of sound generation, transmission and physical characteristics of noise	Learn	U
OEME801D.6	Illustrate measuring instruments, assesment processes and techniques to control the noise pollution	Illustrate	P

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	2	2	-	-	3	1	1	1	-	1	3	2
CO2	1	1	2	2	-	-	3	1	1	1	-	1	3	2
CO3	1	1	2	2	-	-	3	1	1	1	-	1	3	2
CO4	1	1	2	2	-	-	3	1	1	1	-	1	3	2
CO5	1	1	2	2	-	-	3	1	1	1	-	1	3	2
CO6	1	1	2	2	-	-	3	1	1	1	-	1	3	2
Average	1	1	2	2	0	0	3	1	1	1	0	1	3	2

University Syllabus:

Module	Description of topic	Contact Hrs
1	Introduction; classification of pollution; effects of pollution on human beings, plants and animals.	8
2	Air pollution: physical effects; atmospheric dispersion and diffusion;	10

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

	method of sampling and analysis; modeling technique; practical control of air pollution and abatement.	
3	Water pollution: water quality parameters; dispersion and diffusion of pollutants in water; control and abatement of water pollution.	9
4	Noise pollution: physics of sound generation and transmission; physical characters of noise; physiological effects of noise; measuring instruments and technique; assessment of noise; noise control principle, practice and laws.	9

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Waste to Energy: An Overview, Course Code: OEME801F

Semester of Study: 8TH

Course Type: Theory

Course Designation: Elective

.....

Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
OE ME801F.1	Understand the types of bio-wastes like Agro based, Forest residue, Industrial waste, Municipal Solid Wastes.	Describe	U
OE ME801F.2	Classify the biomass resources and biomass conversion devices.	Classify	A
OE ME801F.3	Describe about biomass pyrolysis, the products and by-products.	Describe	U
OE ME801F.4	Illustrate gasification and, gasifiers & its construction and operation.	Illustrate	P
OE ME801F.5	Analyze the biomass combustion and combustors.	Analyze	A
OE ME801F.6	Analyze biogas plants and their productions.	Analyze	A

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
 (Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	1	3	1	2	1	1	2
CO2	2	2	2	2	2	2	3	2	2	1	2	2
CO3	2	2	2	2	1	1	3	1	2	1	1	2
CO4	2	2	2	2	2	1	3	1	2	1	2	2
CO5	2	2	3	2	2	2	3	2	2	1	2	2
CO6	2	2	2	2	1	2	3	2	2	1	2	2
Average	2	2	2	2	1.5	1.5	3	1.5	2	1	1.66	2

Module No.	Description of the Topic	Contact Hrs
1	Introduction to Energy from Waste: Classification of waste as fuel– Agro based, Forest residue, Industrial waste- MSW– conversion devices– Incinerators, gasifiers, digesters	6
2	Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods – Yields and application – Manufacture of pyrolytic oils and gasses, yields and applications	5
3	Biomass Gasification: Gasifiers– Fixed bed system– Downdraft and updraft gasifiers– Fluidized bed gasifiers– Design, construction and operation	5
4	Biomass Combustion: Biomass stoves– Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors.	4
5	Biogas: Properties of biogas (Calorific value and composition)- Biogas plant technology and status– Bio energy system- Design and constructional features- Biomass resources and their classification– Biomass conversion processes- Thermo chemical conversion- Direct combustion- biomass gasification- pyrolysis and liquefaction- biochemical conversion- anaerobic digestion– Types of biogas Plants.	10

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Data Sciences

Course Code: OE-ME802L

Semester of Study: 8th

Course Type: Theory

Course Designation: Open Elective

.....
.....
Vision of the M. E. Department

To produce professionally competent engineers to cater to the needs of the industry, society and nation.

Mission of the M. E. Department

To provide excellent opportunity for producing professionally competent engineers with the sense of social and moral responsibility by creating value added teaching and motivation for research.

PEO-1: To provide conducive learning environment and quality technical education emphasizing the mathematics and science fundamentals related to mechanical engineering program to achieve professional excellence.

PEO-2: Graduates should prepare themselves for carrying out higher studies and quality technological research & development skills to keep pace with the current technological trends throughout the career, either in industry or in entrepreneurship and ready to take leadership & capable of working as a member of multi discipline team.

PEO-3: To foster a sense of responsibility, professionalism, team work and ethical values by developing skills in, management and allied studies through well balanced courses which will help to develop a symbiotic relationship between the institution, society and the community.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

(A) PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

(a) **Engineering Knowledge:** Graduate will possess strong **fundamental knowledge** on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.

(b) **Problem Analysis:** Graduate will develop confidence and will be able to **design** and conduct experiment on it as well as to **analyze** the problem and interpret data.

(c) **Design/Development of solutions:** Graduate will have the ability to design components, **fluid & thermal** systems, **manufacturing** processes and **conduct testing experiment** on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.

(d) **Investigation of Complex problems:** Graduate will possess fundamental knowledge and will have the ability to investigate **complex problems** with **multidisciplinary team** effort.

(e) **Modern Tool Usage:** Graduate will possess knowledge of using **Modern tools** e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.

(f) **The Engineer and Society:** Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and **global impact** of Engineering on **society**.

(g) **Environment and Sustainability:** Graduates will be able to develop an **environment friendly and cost effective** new system and also have serious concern for the society.

(h) **Ethics:** Graduate will learn the ability to understand the **professional and ethical responsibility**.

(i) **Team Work:** Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

(j) **Communication:** Graduate will be able to **communicate** effectively in both verbal and in the written form.

(k) **Project Management and Finance:** Graduate will possess **managerial skills** and also

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

(1) **Life-Long Learning:** Graduate will develop confidence for self and have the ability to engage in **life-long learning**.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

2. Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb/Bloom's Level	Knowledge Category/Level
After completion of this course the students will			
PE ME602G.1	Students will Gain knowledge in Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting.	R (Remember)	C
PE ME602G.2	<i>learn</i> the use of programming tools and be able to <i>visualize</i> data and be able to work with data, and they will <i>understand</i> the mathematical foundations.	U (Understand)	C, FD
PE ME602G.3	be able to <i>apply</i> different machine learning algorithms and find out applications with different case studies.	P (Apply)	CS PC
PE ME602G.4	be able to <i>analyze</i> and <i>interpret</i> the efficiency, accuracy of different algorithms.	A (Analyze)	P
PE ME602G.5	be able to <i>evaluate</i> the performance of different algorithms, and also <i>evaluate</i> results of various problems related to statistics, probability and other correlated mathematical problems.	E (Evaluate)	P
PE ME602G.6	be able to <i>create</i> various neural networks, decision trees, support vector models, Bayesian models, Logistic regression and others for solution to various problems.	C (create)	P

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	2	3	2	1	1	1	1		1	3	2
CO2	1	1	1	2	3	2	1	1	1	1		1	3	2
CO3	1	1	1	2	3	2	1	1	1	1		1	3	2
CO4	1	2	2	3	3	2	1	1	1	1		1	3	2
CO5	1	2	2	3	3	2	1	1	1	1		1	3	2
CO6	1	2	2	3	3	2	1	1	1	1		1	3	2
Average	3	2	2	2.5	3	2	1	1	1	1		1	3	2

University Syllabus:

Subject Code : L (OE-ME802L)	Category: Open Elective Courses
Subject Name : Data Sciences	Semester : Eighth
L-T-P : 3-0-0	Credit: 3
Pre-Requisites: Introduction to Programming, Probability	

Course Objective:

The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.

Course Content:

Module No.	Description of Topic	Contact Hrs.	Co Mapping
1	Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting.	3	CO2
2	Introduction to Programming Tools for Data Science: 2.1 Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK 2.2 Visualizing Data: Bar Charts, Line Charts, Scatter plots 2.3 Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.	5	CO3
3	Mathematical Foundations:	10	CO2

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

	3.1 Linear Algebra: Vectors, Matrices, 3.2 Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation 3.3 Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem 3.4 Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, P- hacking, Bayesian Inference		
4	Machine Learning: Overview of Machine learning concepts– Over fitting and train/test splits, Types of Machine learning– Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks - Learning and Generalization, Overview of Deep Learning.	12	CO1, CO2, CO3, CO4, CO5, CO6
5	Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.	4	CO5, CO4, CO5, CO6

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Automation and Control

Course Code: OE-ME802G

Semester of Study: 8th

Course Type: Theory

Course Designation: Open Elective

.....
.....

Vision of the M. E. Department

To produce professionally competent engineers to cater to the needs of the industry, society and nation.

Mission of the M. E. Department

To provide excellent opportunity for producing professionally competent engineers with the sense of social and moral responsibility by creating value added teaching and motivation for research.

PEO-1: To provide conducive learning environment and quality technical education emphasizing the mathematics and science fundamentals related to mechanical engineering program to achieve professional excellence.

PEO-2: Graduates should prepare themselves for carrying out higher studies and quality technological research & development skills to keep pace with the current technological trends throughout the career, either in industry or in entrepreneurship and ready to take leadership & capable of working as a member of multi discipline team.

PEO-3: To foster a sense of responsibility, professionalism, team work and ethical values by developing skills in, management and allied studies through well balanced courses which will help to develop a symbiotic relationship between the institution, society and the community.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

(A) PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

(a) **Engineering Knowledge:** Graduate will possess strong **fundamental knowledge** on applied mathematics, applied sciences and foundational Engineering concept for application in discipline.

(b) **Problem Analysis:** Graduate will develop confidence and will be able to **design** and conduct experiment on it as well as to **analyze** the problem and interpret data.

(c) **Design/Development of solutions:** Graduate will have the ability to design components, **fluid & thermal** systems, **manufacturing** processes and **conduct testing experiment** on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.

(d) **Investigation of Complex problems:** Graduate will possess fundamental knowledge and will have the ability to investigate **complex problems** with **multidisciplinary team** effort.

(e) **Modern Tool Usage:** Graduate will possess knowledge of using **Modern tools** e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO 2.0 & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.

(f) **The Engineer and Society:** Graduate will be able to provide engineering solution, design solution which are society friendly and in this context graduates will also be able to analyze the local and **global impact** of Engineering on **society**.

(g) **Environment and Sustainability:** Graduates will be able to develop an **environment friendly and cost effective** new system and also have serious concern for the society.

(h) **Ethics:** Graduate will learn the ability to understand the **professional and ethical responsibility**.

(i) **Team Work:** Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.

(j) **Communication:** Graduate will be able to **communicate** effectively in both verbal and in the written form.

(k) **Project Management and Finance:** Graduate will possess **managerial skills** and also

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.

(1) **Life-Long Learning:** Graduate will develop confidence for self and have the ability to engage in **life-long learning**.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

2. Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb/Bloom's Level	Knowledge Category/Level
After completion of this course the students will			
PE ME602G.1	Gain the <i>knowledge</i> for definition and classification of control systems, <i>recall</i> the foundational mathematics, and <i>remember</i> masons gain formula and stability criteria.	R (Remember)	C
PE ME602G.2	Be able to understand the theory of control systems, mathematical modeling and behavior of the system in time domain and frequency domain.	U (Understand)	C, FD
PE ME602G.3	Be able to <i>apply</i> their knowledge for solving problems related to control engineering.	P (Apply)	CS PC
PE ME602G.4	Be able to <i>analyze</i> control system in time-domain and frequency domain and also analyze performance of control systems.	A (Analyze)	P
PE ME602G.5	Be able to <i>evaluate</i> the performance and parameters of control systems, steady state error etc.	E (Evaluate)	P
PE ME602G.6	Be able to <i>design</i> and <i>create</i> control system using the acquired knowledge of time-domain, frequency domain, Bode plot, Nyquist plot etc.	C (create)	P

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	3	1	1	1	1	1	1		2	3	2
CO2	1	1	1	3	1	1	1	1	1	1		2	3	2
CO3	1	1	1	3	1	1	1	1	1	1		2	3	2
CO4	1	1	1	3	1	1	1	1	1	1		2	3	2
CO5	1	1	1	3	1	1	1	1	1	1		2	3	2
CO6	1	1	1	3	2	1	1	1	1	1		2	3	2
Average	1	1	1	3	1.17	1	1	1	1	1		2	3	2

University Syllabus:

Subject Code : G	Category: Open Elective Courses
Subject Name : Automation and Control	Semester : Eighth
L-T-P : 3-0-0	Credit: 3
Pre-Requisites: Basic Electronics Engineering, Mathematics	

Course Objective:

To know about various types of control systems used in different industries.

To learn about mathematical representation and analysis of control systems.

Course Content:

Module	Description of Topic	CO Mapping	Contact Hrs.
No.			
1	Introduction to control system: Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servo mechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function. Mathematical modeling of dynamic systems: Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring–Mass-Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason’s gain formula. Control system components: Potentiometer, Synchros, Resolvers, Position encoders.	CO1 CO2	8
2	Time domain analysis: Time domain analysis of a standard second order closed loop system. Concept of undamped natural frequency, damping, overshoot, rise	CO3, CO4	8

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

	time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. Error Analysis: Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants.		
3	State variable Analysis: State variable model of Linear Time invariant system, properties of the State transition matrix, State transition equation, Definition of transfer function & Characteristic equation, definition of controllability and observability.	CO3	8
4	Stability Analysis using root locus: Importance of Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. Frequency domain analysis of linear system: Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichols chart. M circle and M-Contours in Nichols chart	CO3, CO5, CO6	12
5	Control System performance measure: Improvement of system performance through compensation. Lead, Lag and Lead-lag compensation, PI, PD and PID control.	CO5, CO6	4

Learning Resources:

1. K. Ogata, Modern Control Engineering, 4th Edition, Pearson Education, 2010.
2. I.J. Nagrah and M. Gopal, Control System Engineering, New Age International, 2009.
3. D. Roy Choudhury, Control System Engineering, PHI, 2005.
4. B.C. Kuo and F. Golnaraghi, Automatic Control Systems, 8th Edition, PHI, 2014.
5. M.N. Bandyopadhyay, Control Engineering Theory & Practice, PHI, 2002.
6. K.R. Varmah, Control Systems, Mc Graw Hill, 2010.
7. Norman Nise, Control System Engineering, 5th Edition, John Wiley & Sons, 2010.
8. R.C. Dorf and R.H. Bishop, Modern Control System, 11th Edition, Pearson Education, 2011.
9. C.G. Graham, F. Graebe, F. Stefan, S.E. Mario, Control System Design, PHI, 2009.
10. N.F. Macia and G.J. Thaler, Modeling & Control of Dynamic System, Thompson, 2004.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

11. C.T. Kilian, Modern Control Technology Components & Systems, 3rd Edition, Cengage Learning, 2005.
12. Y. Singh and S. Janardhanan, Modern Control Engineering, Cengage Learning, 2010.
13. R. Anandanatarajan and R. Ramesh Babu, Control System Engineering, Scitech, 2015.
14. W.A. Wolovich, Automatic Control system, Oxford University Press, 1995.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Project-IV

Course Code: PWME 881

Semester of Study: 8th

Course Type: Sessional

Course Designation: Project

.....
Program Outcome (PO):

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering

(Applicable from the academic session 2023-2024)

11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PS02: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PWME 881.1	DEMONSTRATING qualitative solutions to research/industry problems involving contemporary issues.	Create	C
PWME 881.2	FORMULATING hypothesis/design/methodology	Create	C
PWME 881.3	ACQUIRING the knowledge of the techniques, skills, and modern engineering tools necessary for Mechanical Engineering practice	Create	C
PWME 881.4	PRESENTING features of the developed project to the targeted group through written and oral communication.	Create	C
PWME 881.5	CONTRIBUTING in a team in development of technical seminar.	Create	C

Course Articulation Matrix:

[illegible]

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Course Name: Comprehensive Viva-Voce, Course Code: PW-ME882
Semester of Study: 8th Course Type: Sessional
Course Designation: Compulsory

.....
.....
Program Outcome (PO):

- a. Graduate will possess strong fundamental knowledge on applied mathematics, applied sciences, and fundamental engineering concept for application in discipline.
- b. Graduate will develop confidence and will be able to design and conduct experiment on it as well as to analyze the problem and interpret data.
- c. Graduate will have the ability to design components, fluid & thermal systems, manufacturing processes and conduct testing experiment on it and interpret data for its development to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety.
- d. Graduate will possess fundamental knowledge and will have the ability to investigate complex problems with multidisciplinary team effort.
- e. Graduate will possess knowledge of using Modern tools e.g. CAD/CAM and other Mechanical Engineering software like Inventor, Auto-CAD, CREO & ANSYS and have the ability to apply their knowledge from these for the solution of Mechanical Engineering problems.
- f. Graduate will be able to provide engineering solution, design solution which is society friendly and in this context graduates will also be able to analyze the local and global impact of Engineering on society.
- g. Graduate will be able to develop an environment friendly and cost effective new system and also have serious concern for the society.
 - h. Graduate will learn the ability to understand the professional and ethical responsibility.
- i. Graduate will learn the ability to function individually and on multidisciplinary teams to solve complex Engineering problems by mutually sharing the knowledge with other team members.
- j. Graduate will be able to communicate effectively in both verbal and in the written form.
- k. Graduate will possess managerial skills and also have the knowledge of contemporary issues and will be able to perform in a project team. Graduate will gather the ability to calculate average cost of component, system and are capable of handling the project financially.
- l. Graduate will develop confidence for self and have the ability to engage in lifelong learning.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Mechanical Engineering
(Applicable from the academic session 2023-2024)

Program Specific Outcome (PSO):

PSO1: Graduates will demonstrate the knowledge of applied mathematics and advanced software tools for design specification, development such as fabrication, analysis such as testing and operation of the physical systems, components and processes involved in mechanical engineering.

PSO2: Graduates will demonstrate the knowledge, skill and attitude to analyze the cause and effects on machine elements, processes and systems.

Course Outcome:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
PW-ME882.1	Demonstrate systematic understanding of knowledge related to 4 years study of B. Tech. in ME	Demonstrate	U
PW-ME882.2	Apply critical thinking skills to analyze and evaluate complex engineering problems.	Apply	P
PW-ME882.3	Demonstrate effective communication skills in presenting technical concepts and ideas to both technical and non-technical audiences.	Demonstrate	U
PW-ME882.4	Demonstrate confidence and versatility in answering the varieties of questions posed by a group of interviewer in a moderately short duration.	Demonstrate	U

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	2	1	2	1	2	3
CO2	3	3	3	3	3	2	2	1	2	1	2	3
CO3	1	1	1	1	1	1	1	1	1	3	1	3
CO4	2	2	2	2	2	1	1	1	1	2	1	3

University Syllabus:

The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and all Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the courses he/ she studied during the 4 years B. Tech. programme.



Principal

Regent Education & Research Foundation
Bara Kanthalia, P.O.-Sewli Telinipara
Barrackpore, Kolkata-700121

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
(Formerly West Bengal University of Technology)
Syllabus of MBA
(Effective from 2023-2024 Admission Session)

CURRICULUM STRUCTURE for MBA
(proposed from 2023-24)

Core Courses (Six / Semester)

Semester – I (Total Credits:4*6=24)

MB – 101	Economics for Managers
MB – 102	Organizational Behavior (Individual, Group, and organization)
MB – 103	Business Laws, Ethics and Governance
MB – 104	Accounting for Managers
MB – 105	Research Methodology & Business Statistics
MB – 106	Entrepreneurship and Digital Transformation

Semester – II (Total Credits:4*6=24)

MB-201	Operations Research
MB-202	Financial Management
MB-203	Marketing Management
MB-204	Operations and Project Management
MB-205	Management Information System
MB-206	Human Resource Management

Semester - III (Total Credits:4*6=24+6(Sessional)=30)

Compulsory Paper

- MB 301: Corporate Strategy (Credit:4)
MB 381: SIP & Viva Voce (Sessional- 100 Marks)(Credit:6)

**Elective Papers: Three from any one Functional Area (Major basket) and
Two fixed minor papers from other functional area (Minor basket)**

FM/ MM/HR/OM/BA/ MIS/ HCM– 301 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 302 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 303 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 302 (Minor)
FM/ MM/HR/OM/BA/ MIS/ HCM – 303 (Minor)

Semester – IV (Total Credits:4*6=24+6(Sessional)=30)

Compulsory Paper

- MB 481: Comprehensive Viva Voce (Sessional- 100 Marks) (Credit:6)

**Elective Papers: Four from any one Functional Area (Major basket) and
Two fixed minor papers from other functional area (Minor basket)**

FM/ MM/HR/OM/BA/ MIS/ HCM– 401 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 402 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 403 (Major)
FM/ MM/HR/OM/BA/ MIS/ HCM – 404 (Major)
FM/ MM/HR/OM/BA/ MIS/HCM – 403 (Minor)
FM/ MM/HR/OM/BA/ MIS/HCM – 404 (Minor)

****The Major and Minor Functional areas will be same in the 4th Sem as chosen in the 3rd Semester.**

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
(Formerly West Bengal University of Technology)
Syllabus of MBA
(Effective from 2023-2024 Admission Session)

Elective Papers for Third Semester
Functional Specialization – Major

MARKETING		OPERATIONS	
MM 301	Marketing Research and Analytics	OM 301	Operations Strategy
MM 302	Integrated Marketing Communication	OM 302	Supply Chain and Logistics Management
MM 303	Consumer Behaviour	OM 303	Quality Toolkit for Managers
FINANCE		HUMAN RESOURCE	
FM 301	Security Analysis and Portfolio Management	HR 301	HR Analytics and Applications
FM 302	Taxation	HR 302	Manpower Planning, Recruitment, and Selection
FM 303	Financial Market and Services	HR 303	Learning & Development
SYSTEM MANAGEMENT		BUSINESS ANALYTICS	
SM 301	System Development and Project Management	BA 301	Data Visualization for Managers
SM 302	Relational Database Management System	BA 302	Modelling Techniques
SM 303	Business Decisions Using Advanced Excel	BA 303	Data Science using R
HEALTH CARE			
HCM 301	Hospital Support Services		
HCM 302	Concept of Health, Disease and Healthcare		
HCM 303	Hospital Planning and Organising		

Functional Specialization – Minor

MARKETING		OPERATIONS	
MM 302	Integrated Marketing Communication-Minor	OM 302	Supply Chain and Logistics Management -Minor
MM 303	Consumer Behaviour -Minor	OM 303	Quality Toolkit for Managers -Minor
FINANCE		HUMAN RESOURCE	
FM 302	Taxation-Minor	HR 302	Manpower Planning, Recruitment, and Selection-Minor
FM 303	Financial Market and Services -Minor	HR 303	Learning & Development -Minor
SYSTEM MANAGEMENT		BUSINESS ANALYTICS	
SM 302	Relational Database Management System -Minor	BA 302	Modelling Techniques -Minor
SM 303	Business Decisions using Advanced Excel -Minor	BA 304	Data Science using R -Minor
HEALTH CARE			
HCM 302	Concept of Health, Disease and Healthcare -Minor		
HCM 303	Hospital Planning and Organising-Minor		

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
(Formerly West Bengal University of Technology)
Syllabus of MBA
(Effective from 2023-2024 Admission Session)

Compulsory Paper

MB 481: Comprehensive Viva Voce (Sessional- 100 Marks)

Functional Specialization – Major

MARKETING		OPERATIONS	
MM 401	Product and Brand Management	OM 401	Operations Research Applications
MM 402	Retail Management	OM 402	Supply Chain Analytics
MM 403	Sales & Distribution Management	OM 403	Sales and Operations Planning
MM 404	Service Marketing	OM 404	Management of Manufacturing System
FINANCE		HUMAN RESOURCE	
FM 401	Derivatives and Risk Management	HR 401	Employee Relations & Labour Laws
FM 402	Financial Modelling and Corporate Valuation	HR 402	Managing Diversity, Equity Inclusion (DEI) and Change
FM 403	Managing Bank and Financial Institutions	HR 403	Strategic HRM
FM 404	Personal Financial Planning	HR 404	Performance and Compensation Management
SYSTEM MANAGEMENT		BUSINESS ANALYTICS	
SM 401	Business Intelligence and Big Data	BA 401	Big Data Technology
SM 402	Managing Digital and Social Media Platforms	BA 402	Data Mining
SM 403	Strategic Management for IT	BA 403	Data Analytics using Python
SM 404	E-commerce and Digital Markets	BA 404	Application of Analytics in Business
HEALTH CARE			
HCM 401	Financial Management in Healthcare Sector		
HCM 402	HR and Marketing in Hospitals and Healthcare Organizations		
HCM 403	Quality Assurance and Technology in Healthcare		
HCM 404	Legal Aspects of Healthcare Administration		

Functional Specialization – Minor

MARKETING		OPERATIONS	
MM 403	Sales & Distribution Management -Minor	OM 403	Sales and Operations Planning -Minor
MM 404	Service Marketing -Minor	OM 404	Management of Manufacturing System -Minor
FINANCE		HUMAN RESOURCE	
FM 403	Managing Bank and Financial Institutions-Minor	HR 403	Strategic HRM -Minor
FM 404	Personal Financial Planning -Minor	HR 404	Performance and Compensation Management - Minor
SYSTEM MANAGEMENT		BUSINESS ANALYTICS	
SM 403	Strategic Management for IT -Minor	BA 403	Data Analytics using Python -Minor
SM 404	E-commerce and Digital Markets -Minor	BA 404	Application of Analytics in Business -Minor
HEALTH CARE			
HCM 403	Quality Assurance and Technology in Healthcare -Minor		
HCM 404	Legal Aspects of Healthcare Administration -Minor		



MASTER OF COMPUTER APPLICATION

Syllabus w.e.f. the Academic Session 2021-2022



MAULANA ABUL KALAM AZAD
UNIVERSITY OF TECHNOLOGY,
WEST BENGAL



MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY
WEST BENGAL

Objective:

To conduct software industry, corporate sector, academia, research-oriented MCA program following the AICTE model for MCA

Eligibility:

Candidates with the following eligibility can take admission in the 2-year MCA program approved by AICTE:

- A. Students who have passed Bachelor of Computer Application or Bachelor's degree in Computer Science Engineering or equivalent degree
- B. Students who have passed Bachelor of Science, Bachelor of Commerce or Bachelor of Arts with mathematics at 10+2 or at the graduation level with additional bridge courses as per the norms of the concerned university
- C. Candidates must have obtained at least 50 percent marks, or 45 percent marks in the case of candidates belonging to reserved categories, in the qualifying examination

Duration:

2 Years (4 Semesters)

Program Educational Objectives (PEOs)

- PEO 01: Technical Expertise:** Develop the ability to plan, analyze, design, code, implement, test and maintain the software product for real time systems that are technically sound, economically feasible and socially acceptable
- PEO 02: Successful Career:** Exhibit professionalism, ethical attitude with updated technologies in Computer Application based career and capability to set up their own enterprise in various sectors of Computer Applications
- PEO 03: Soft Skills:** Develop communication skills, team work and leadership quality in their professional multidisciplinary projects and adapt to current trends by engaging in lifelong learning
- PEO 04: Life Long Learning:** Prepare the students to pursue higher studies by acquiring knowledge in mathematical, computing and engineering principles in the field of computing and related fields and to work in the fields of teaching and research

Program Specific Outcomes (PSOs)

The post-graduates of Master of Computer Application Program will demonstrate:

- PSO 01: Software System Design and Development:** The ability to apply software development life cycle principles to design and develop the application software that meets the automation needs of society and industry.
- PSO 02: Computing and Research ability:** The ability to employ modern computer languages, environments and platforms in creating innovative career paths in SMAC (Social, Mobile, Analytics and Cloud) technologies.
- PSO 03: Professionalism and Ethics:** Efficient team leaders, effective communicators and capable of working in multi-disciplinary environment following ethical values.

Program Outcomes (POs)

On Completion of MCA program, the post-graduates are expected to

- PO 01: Engineering Knowledge:** Ability to apply knowledge of computing, science, mathematics and engineering fundamentals appropriate to the discipline
- PO 02: Problem Analysis:** Ability to identify, critically analyze, formulate the computing requirements appropriate to its solution and develop computer applications
- PO 03: Design/Development of Solutions:** Ability to design, implement and evaluate a computer-based complex system, process, component, or program to meet desired needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations
- PO 04: Conduct Investigations of Complex Problems:** Use of research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions and develop Software with complete satisfaction to the Customer.
- PO 05: Modern Tool Usage:** Ability to apply current technologies, skills, and modern IT tools necessary for computing practice with an understanding of the limitations.
- PO 06: The Engineer and Society:** Ability to understand the impact of system solutions in a contemporary, global, economical, environmental and societal context for sustainable development.
- PO 07: Environment and Sustainability:** Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO 08: Ethics:** Ability to discharge their duties with professional and ethical responsibilities as an individual as well as in multidisciplinary teams with positive attitude.
- PO 09: Individual and Team Work:** Ability to function individually in effective manner and on teams, including diverse and multidisciplinary, to accomplish a common goal.
- PO 10: Communication:** Ability to communicate effectively with a range of audiences and be customer friendly.
- PO 11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments and should be economically feasible.
- PO 12: Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological changes.

Program Structure:

SEMESTER	THEORY		PRACTICAL		SESSIONAL		Semester Credits [A+B+C]
	Courses	Credits [A]	Courses	Credits [B]	Courses	Credits [C]	
I	4(C) + 1(E)	19	3	6	-	-	25
II	4(C) + 1(E)	19	3	6	-	-	25
III	3(C) + 2(E)	18	1	2	1	5	25
IV	1(O)	3	-	-	2	22	25
TOTAL CREDIT→							100

- * C → Compulsory Courses
- * E → Elective Courses
- * O → Open Elective Courses

Project: Dissertation + Presentation + Project viva

Session:

- Odd Semester/ 1st and 3rd: July - December
- Even Semester/2nd and 4th): January - June
- Lecture Hour: 1 Hour
- Subject wise Lecture per Week: 4

Examination System:

Subject wise Total Marks:	100
Semester Grade Point Average:	SGPA
Yearly Grade Point Average:	YGPA
Degree Grade Point Average:	DGPA

Teaching Methodology:

Lecture, Discussion, Presentation, Case Studies, Group Task, Assignment, Projects, Special Lecture by Industry Professionals

General Guidelines:

The 2-year MCA curriculum will be applicable w.e.f. the academic year 2020 – 2021.

All rules and regulation regarding admission, examination, registration, migration and others shall exist according to MAKAUT norms.

PART – I

COURSE STRUCTURE

Semester – I							
THEORY							
Sl. No	Paper Code	Paper Name	Contact Hours / Week				Credit
			L	T	P	Total	
1	MCAN-101	Programming Concept with Python	3	1	-	4	4
2	MCAN-102	Relational Database Management System	3	1	-	4	4
3	MCAN-103	Computer Organization and Architecture	3	1	-	4	4
4	MCAN-104	Discrete Mathematics	3	1	-	4	4
5	Elective I		3	-	-	3	3
	MCAN-E105A	Environment and Ecology					
	MCAN-E105B	Management Accounting					
	MCAN-E105C	Constitution of India					
	MCAN-E105D	Stress Management through Yoga					
	MCAN-E105E	Ethics in Business Profession					
	MCAN-E105F	Managerial Economics					
PRACTICAL							
1	MCAN-190	Soft Skill and Interpersonal Communication	-	-	4	4	2
2	MCAN-191	Python Programming Lab	-	-	4	4	2
3	MCAN-192	Relational Database Management System Lab	-	-	4	4	2
Total Weekly Contact Hours and Credit						31	25
BRIDGE COURSE							
[Only for Students of Category “B” stated in the “Eligibility” Section]							
A minimum 8-week Online Course on Fundamentals of ‘Computer Science’ or ‘Computer Application’ or ‘Information Technology’ or so							

Semester - II							
THEORY							
Sl. No.	Paper Code	Paper Name	Contact Hours / Week				Credit
			L	T	P	Total	
1	MCAN-201	Data Structure with Python	3	1	-	4	4
2	MCAN-202	Operating System	3	1	-	4	4
3	MCAN-203	Object Oriented Programming with JAVA	3	1	-	4	4
4	MCAN-204	Networking	3	1	-	4	4
5	Elective II		3	-	-	3	3
	MCAN-E205A	Numerical and Statistical Analysis					
	MCAN-E205B	Computer Graphics					
	MCAN-E205C	Probability and Statistics					
	MCAN-E205D	Introduction to Cyber Security					
	MCAN-E205E	Introduction to IoT					
	MCAN-E205F	Automata Theory and Computational Complexity					
PRACTICAL							
1	MCAN-291	Data Structure Lab with Python	-	-	4	4	2
2	MCAN-292	Operating System Lab (Unix)	-	-	4	4	2
3	MCAN-293	Object Oriented Programming Lab using JAVA	-	-	4	4	2
Total Weekly Contact Hours and Credit						31	25
BRIDGE COURSE							
[Only for Students of Category “B” stated in the “Eligibility” Section]							
A minimum 8-week Online Course on Fundamentals of ‘Software Engineering’ or ‘Systems Analysis and Design’ or ‘Business Systems Applications’ or so							

Semester – III								
THEORY								
Sl. No.	Paper Code	Paper Name	Contact Hours / Week				Credit	
			L	T	P	Total		
1	MCAN-301	Software Engineering using UML	3	1	-	4	4	
2	MCAN-302	Artificial Intelligence	3	1	-	4	4	
3	MCAN-303	Design and Analysis of Algorithm	3	1	-	4	4	
4	Elective III		3	-	-	3	3	
	MCAN-E304A	Image Processing						
	MCAN-E304B	Web Enabled JAVA Programming						
	MCAN-E304C	Cloud Computing						
	MCAN-E304D	Web Technology using PHP						
	MCAN-E304E	Android Application Development						
	MCAN-E304F	Basic Data Science						
5	Elective IV		3	-	-	3	3	
	MCAN-E305A	Information Retrieval						
	MCAN-E305B	Data Warehousing and Data Mining						
	MCAN-E305C	Introduction to Big Data Analytics						
	MCAN-E305D	Graph Theory						
	MCAN-E305E	Operation Research and Optimization Techniques						
	MCAN-E305F	Pattern Recognition						
	MCAN-E305G	Machine Learning						
PRACTICAL								
1	MCAN-E394 (A/B/C/D/E/F)	Elective III Lab	-	-	4	4	2	
SESSIONAL								
1	MCAN-381	Minor Project and Viva-voce	-	-	8	8	5	
Total Weekly Contact Hours and Credit						30	25	

Semester IV

THEORY

Sl. No.	Paper Code	Paper Name	Contact Hours / Week				Credit
			L	T	P	Total	
1	Open Elective						
	MCAN-OE401	Open Elective [1] Open Electives preferably be opted from the NPTEL/SWAYAM Platform. [2] While opting for a course for pursuing the Open Elective, a student needs to ensure that: i) The duration of the course must minimum of 12-Weeks. ii) The course must not be covered in previous semesters of the program. iii) Date of Exam and publication of result should be within the tenure of the MCA 4 th Semester i.e. January to June of every Year. [3] Student must submit the course details at the time of 4 th semester enrollment	-	-	-	-	3
SESSIONAL							
1	MCAN-481	Compressive Viva-voce	-	-	-	-	2
2	MCAN-482	Major Project and Viva-voce	-	-	28	28	20
Total Weekly Contact Hours and Credit						28	25



Principal

Regent Education & Research Foundation
Bara Kanthalia, P.O.-Sewli Telinipara
Barrackpore, Kolkata-700121