



**University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus**

Syllabus for B.Tech. Admission Batch 2026

Subject Name: Physics

Credit: 4

Lecture Hours: 42

Subject Code: BSCPH201

Pre-requisite: Physics of Higher Secondary Standard

Relevant Links:

Study Material

Coursera

NPTEL

[IEM Learning](#)

COURSE OBJECTIVES:

1. To train the students to grasp the concepts of different areas of physics, appropriate for applications in different branches of engineering.
2. To expand their knowledge of Physics, which will be suitable for different engineering streams.
3. Learn to apply the different theories of physics in real life problems.
4. Try to think new problems of physics for applications in engineering.

COURSE OUTCOMES:

CO1: Develop an understanding of the fundamental theories of physics such as optics, electromagnetic theory, classical mechanics, quantum mechanics and statistical mechanics for engineering applications in societal and environmental contexts.

CO2: Study the wave nature of light by means of phenomena like interference, diffraction and LASER and to study the Maxwell's equations to understand the concepts of electromagnetic theory.

CO 3: Using the concepts of classical mechanics to study the motion of particles and systems, learning the postulates of quantum mechanics to analyze the behavior of particles in quantum levels and understanding the behavior of physical systems by statistical methods.

CO4: Develop an ability to analyze and solve theoretical problems of physics.

Module number	Topic	Sub-topics	Books to be referred	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Mechanics	Part A: Vector Calculus Representation of a Vector, Some Important Definitions about Vectors, Resolution of a Vector into Components, Addition and Subtraction of Vector in Component Form, Product of Two Vectors, Triple Product – Scalar and Vector, Scalar and Vector Fields, Partial Derivative of Vectors, Gradient of Scalar Field, Divergence of Vector Field, Curl of a Vector Field, Curl in the Context of Rotational Motion.	Engineering Physics , Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 1	International Academia: https://catalog.mit.edu/subjects/8/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Matlab software	8	To determine the Rigidity modulus of the Material of a wire by Dynamic Method To determine the Rigidity modulus of the Material of a wire by Static Method To determine the Acceleration due to Gravity using Bar Pendulum

		Part B: Classical Mechanics Revision of Newton's Law of Motion, Inertial and Non-Inertial Frame of References : Pseudo Force, Friction, Problems including constraints and Friction, conservation Laws, Rigid Body, Angular Velocity Vector, Moment of Inertia, Acceleration of a Rigid Body Rolling Down an Inclined plane, Central Force, Kepler's laws, Planets and Satellites				
2	Oscillations	Oscillations: Introduction, Relation of Simple Harmonic Motion with Circular Motion, Differential Equation of Simple Harmonic Motion, Various Characteristics of SHM, Periodic, Oscillatory and SHM - Characteristics and Different Energy, Energy of a Particle Executing SHM and Law of Conservation of Energy, Differential Equation of Free or Undamped Vibrations, Damped vibrations, Solution of the Equation of a Damped Oscillator and its Analysis, Electrical Analogy of SHM and DV, Analysis of Forced Vibration, Resonance, Energy of a Forced Vibrator, Sharpness of Resonance, Quality Factor, Forced Vibration in an LCR Circuit	Engineering Physics , Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 2.	International Academia: https://catalog.mit.edu/subjects/8/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Matlab software	5	To generate parametric oscillations in a string using Melde's experimental set-up.

3	Optics	Interference : Introduction, Wave Propagation and the Wave Equation, Principle of superposition of waves, Huygens' Wave Theory, Interference of mechanical waves, Young's experiment on Interference of Light Waves (Double Slit Experiment), Theory of Interference (Analytical Treatment), Intensity Distribution Curve and Energy Conservation, Condition for Permanent Interference: Coherent Sources, Classification of Interference Phenomena, Calculation of Fringe Width, , Coherence, Newton's Ring. Diffraction: Introduction, Different types of diffraction phenomena, difference between interference and diffraction, Fraunhofer diffraction due to a single slit(no derivation), Fraunhofer diffraction due to a double slit(no derivation), Difference between Single slit and a double slit diffraction pattern, Diffraction due to Plane Diffraction Grating (no derivation), Rayleigh's Criteria on Resolution, Resolving Power of a Grating, Application of Diffraction Grating. Laser: Introduction, Characteristics of laser, Absorption and emission of radiations by matter, Einstein's A and B Coefficients, working principle of	Physics, B.K.Pandey, Monoj K Harbola et. al., Cengage, Chapter 2. Engineering Physics, Sujay Kumar Bhattacharya , Mc Graw Hill Education, Chapter 3.	International Academia: https://catalog.mit.edu/subjects/8/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Matlab software	10	To determine the radius of curvature of a plano convex lens by formation of Newton's ring method. To determine the wavelengths of a given light source by diffraction grating method.
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		laser, population inversion in laser, basic components of laser system, optical resonator and Q value, threshold condition for sustaining of laser action, typical lasers, application of lasers.	Engineering Physics, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 5.			
4	Introduction to Electromagnetic Theory	Maxwell's equations: Introduction, Magnetic flux, Faraday's law of electromagnetic induction, electromotive force, Integral form of Faraday's law, Displacement current, Ampere's Circuital law, Modified Ampere's law, Continuity property of current, Maxwell's Equations, Wave Equation in Free Space, Transverse Nature of Electromagnetic Field	Engineering Physics, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 7.	International Standards: AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	6	Determination of electron charge to mass ratio (e/m) Determination of Hall coefficient. Conversion of vibration to voltage using piezoelectric materials

5	Quantum Mechanics	Quantum Mechanics: Introduction, Wave function and its physical Significance, Normalization of wave functions and Orthogonality of wave functions, Operators in Quantum Mechanics, Fundamental postulates of Quantum mechanics, Time-dependent Schrodinger's equation, Time-independent Schrodinger's wave equation, Application of Schrodinger's equation, Infinite Rectangular Potential Well , Quantum Harmonic Oscillator	Engineering Physics , Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 10.	International Standards: https://catalog.mit.edu/subjects/8/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Matlab software	7	Determination of Planck's constant by photoelectric emission process Determination the excitation potential of a given gas by Franck-Hertz experiment Determination of Planck's Constant using LED Determination of the band-gap of a semiconductor by measuring the resistivity at different Temperatures by four-probe method To study the different characteristics of a solar cell
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TEXT BOOK:

1. [Engineering Physics by Sujay Kumar Bhattacharya, McGraw-Hill Education](#)

REFERENCE BOOKS:

1. Theory and problems of Theoretical Mechanics by Murray R. Spiegel SI(Metric)edition
2. Advanced Acoustics by Dr. D.P. Raychaudhuri, The new bookstall, RevisedNinthEdition,2009
3. A text book on Optics, B. Ghosh and K.G. Majumder, Sreedhar Publishers, fifth edition
4. Introduction to Electrodynamics by David J. Griffiths 3rdEdition
5. Concepts of Modern Physics (Sixth Edition) by Arthur Beiser (Published by McGraw-Hill)



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Syllabus for B.Tech Admission Batch 2026

Subject Name: Mathematics-Calculus

Credit: 4

Lecture Hours: 48

Subject Code: BSCM203A

Pre-requisite: High School Mathematics

Relevant Links:

[Study Material](#)

[Coursera](#)

[Coursera](#)

[NPTEL](#)

[NPTEL](#)

[NPTEL](#)

[Linkedin Learning](#)

[Infosys Springboard](#)

COURSE OBJECTIVES:

1. To give an exposure to some advanced concepts related to differential and integral calculus for functions of single variable, sequence and series and also lay the concept of multivariable differentiation and integration to the students enrolled in the first year of B.Tech. program.
2. To lay the foundation of various applications of mathematics in their further course of study.
3. To solve and analyze various situations of interest in engineering.
4. To imbibe the idea of mathematical modeling with application to real life problems.

COURSE OUTCOMES:

- CO 1: Demonstrate the domain of applications of mean value theorems and apply the concepts and techniques of differential and integral calculus to determine curvature and evaluate different types of improper integrals.**
- CO 2: Develop the knowledge for addressing real-life problems that comprise several variables or attributes and identify extremum points of different surfaces of higher dimensions.**
- CO 3: Recognize the methods for evaluating multiple integrals and apply to different physical problems.**
- CO 4: Use the tools of power series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.**

Module number	Topic	Sub-topics	Mapping with Textbooks	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Calculus (Differentiation)	Rolle's Theorem, Mean Value Theorems, Taylor's and Maclaurin's Theorems with Remainders; Taylor's Series, Series for Exponential, Trigonometric and Logarithm Functions; Indeterminate forms and L' Hospital's Rule.	T1: Chapter 4, Secs. 4.3 - 4.5, 4.10 – 4.12	International Academia: https://ocw.mit.edu/courses/18-01-Calculus-I-Single-Variable-Calculus https://ocw.mit.edu/courses/18-01-Single-Variable-Calculus AICTE-prescribed syllabus: Untitled_1-min.pdf (aicte-india.org) Industry Mapping & Simulation: MATLAB/Mathematica https://in.mathworks.com/ https://www.wolfram.com/mathematica/ MATLAB File Exchange:	8	1. Plotting of the following special graphs: - Sketch the graph of sine and cosine functions in $[-2\pi, 2\pi]$ - Plot a graph for e^x on $\mathbf{R}$ - Draw the greatest integer and least functions in the interval $[0, 5]$. 2. Draw the graph of the evolute of a parabola.

				<i>Cleve_Lab: A Mathematical Exportium</i> https://in.mathworks.com/matlabcentral/fileexchange/59085-cleve_lab?s_tid=srchtitle <i>Drawing Code for Mathematical Benchmark Functions</i> https://in.mathworks.com/matlabcentral/fileexchange/125645-drawing-code-for-mathematical-benchmark-functions?s_tid=srchtitle <i>Generative AI:</i> Photomath		
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2	Calculus (Integration)	Evaluation of Improper Integrals; Beta and Gamma Functions and their properties; Applications of Definite Integrals to evaluate surface area and volume of revolutions.	T1: Chapter 6, Secs. 6.12–6.13 Chapter 7, Secs. 7.14 – 7.16	International Academia: https://ocw.mit.edu/courses/18-01-Calculus-I-Single-Variable-Calculus https://ocw.mit.edu/courses/18-01-Single-Variable-Calculus AICTE prescribed syllabus: Untitled_1-min.pdf (aicte-india.org) Industry Mapping & Simulation : MATLAB/Mathematica https://in.mathworks.com/ https://www.wolfram.com/mathematica/ MATLAB File Exchange: Cleve_Lab: A Mathematical Exportium https://in.mathworks.com/matlabcentral/fileexchange/59085-cleve_lab?s_tid=srchtitle Drawing Code for Mathematical Benchmark Functions https://in.mathworks.com/matlabcentral/fileexchange/125645-drawing-code-for-mathematical-benchmark-functions?s_tid=srchtitle Generative AI: Photomath	6	1. Evaluate definite integrals.
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3	Multivariable Calculus (Differentiation)	Limit, Continuity and Partial Derivatives; Homogeneous Functions, Euler's Theorem of first and second order (Statement only); Change of variables, Composite function, Derivative of implicit functions, Total Derivative; Jacobian; Maxima, Minima and Saddle points; Method of Lagrange multipliers; Gradient, Directional Derivatives, Tangent Plane and Normal Line, Curl and Divergence.	T1: Chapter 5 Secs. 5.1 – 5.8, 5.11, 5.12 Chapter 8, Secs. 8.4 – 8.9	International Academia: Syllabus Calculus of Several Variables Mathematics MIT OpenCourseWare Linear Algebra, Calculus, & Applications I Stanford Online AICTE prescribed syllabus: Untitled_1-min.pdf (aicte-india.org) Industry Mapping & Simulation: MATLAB/Mathematica https://in.mathworks.com/ https://www.wolfram.com/mathematica/ MATLAB File Exchange: Cleve_Lab: A Mathematical Exportium https://in.mathworks.com/matlabcentral/fileexchange/59085-cleve_lab?s_tid=srchtitle Drawing Code for Mathematical Benchmark Functions https://in.mathworks.com/matlabcentral/fileexchange/125645-drawing-code-for-mathematical-benchmark-functions?s_tid=srchtitle Generative AI: Photomath	12	- Find partial differentiation of any function of two or three variables. - Find gradient, divergence and curl of any vector valued function. - Find the directional derivative of any vector. - Write a code to find the tangent plane and draw the surface.

4	Multivariate Calculus (Integration)	Multiple Integration: Double Integrals (Cartesian), Change of Order of Integration in Double Integrals, Change of Variables (Cartesian to Polar), Applications: Areas and Volumes, Centre of Mass and Gravity (constant and variable densities); Triple Integrals (Cartesian), Cylindrical and Spherical Coordinates, Change of Variables (Cartesian to Cylindrical and Spherical), Simple applications involving cubes, sphere and rectangular parallelepiped; Scalar Line Integrals, Vector Line Integrals, Scalar Surface Integrals, Vector Surface Integrals, Theorems of Green, Gauss and Stokes.	T1: Chapter 7 Secs. 7.1 – 7.13 Chapter 8 Secs. 8.10 - 8.17	International Academia: Syllabus Calculus of Several Variables Mathematics MIT OpenCourseWare Linear Algebra, Calculus, & Applications I Stanford Online AICTE-prescribed syllabus: Untitled_1-min.pdf (aicte-india.org) Industry Mapping: MATLAB	12	1. Evaluate double integral of any multivariate function. 2. Evaluate triple integral of any multivariate function.
5	Sequences and Series	Basic ideas on Sequence; Concept of Monotonic and Bounded sequence; Convergence and Divergence of Sequence; Algebra of Sequences (Statement only). Basic idea of an Infinite Series; Notion of Convergence and Divergence; Series of Positive Terms - Convergence of infinite G.P. series and p-series (Statement only); Tests of	T2: Chapter 18	International Academia: https://ocw.mit.edu/courses/18-01-Calculus-I-Single-Variable-Calculus AICTE prescribed syllabus: Untitled_1-min.pdf (aicte-india.org) Industry Mapping & Simulation: MATLAB/Mathematica	10	1. To evaluate the sum of an infinite series. 2. To check the convergence or divergence of an infinite series.

		Convergence [Statement only] – Comparison Test, D’Alembert’s Ratio Test, Raabe’s Test and Cauchy’s Root test.		https://in.mathworks.com/ https://www.wolfram.com/mathematica/		
6	Advanced Proficiency Module	Evolutes and Involutives (From Module-1), Alternating Series - Leibnitz’s test [Statement only], Absolute and Conditional Convergence.(From Module-5)				

Digital Twins:

- **MATLAB/Simulink**
Provides a range of tools for modeling, simulation, and analysis of dynamic systems using mathematical methods.
<https://www.mathworks.com/>
- **GAMS (General Algebraic Modeling System):**
A high-level modeling system for mathematical programming and optimization.
<https://gams.com/>

Mathematical modeling with application to real life problems:

- **Traffic Flow Modeling** – Using derivatives to study rate of change of vehicles along a highway.
- **Pharmaceutical Drug Dosage** – Using definite integrals to determine total drug concentration in bloodstream over time.
- **Machine Learning** – Gradient, divergence, and curl in optimization algorithms (e.g., gradient descent).
- **Heat & Mass Transfer** – Applying Gauss’ theorem for flux calculations.
- **Financial Mathematics** – Compound interest, annuities, and EMIs modeled by geometric series.

Text Books:

T1: B. S. Grewal, “Higher Engineering Mathematics”, 44th Edition (2021), Khanna Publishers.

T2: B. K. Pal & K. Das, “Engineering Mathematics” - Vol. 1, 10th Edition (2021), U. N. Dhur & Sons.

Reference Books:

1. **Biswadip Basu Mallick & Krishanu Deyasi**, “Engineering Mathematics” – Vol. 1A, 2B, 1st Edition (2020), Cengage Learning.
2. **Erwin Kreyszig**, “Advanced Engineering Mathematics”, 10th Edition (2017), John Wiley & Sons.
3. **R. K. Jain and S. R. K. Iyengar**, “Advanced Engineering Mathematics”, 5th Edition (2016), Narosa Publication House
4. **B. V. Ramana**, “Higher Engineering Mathematics”, 11th Reprint (2017), Tata McGraw Hill.
5. **Amos Gilat**, “Matlab: An Introduction with Applications”, 6th Edition (2016), John Wiley & Sons.
6. **Rudra Pratap**, “Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers”, 7th Edition (2019), Oxford University Press.

CO-PO Mapping:

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



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Syllabus for B.Tech Batch 2026-2030

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Text Books and Reference Books	14

Syllabus Structure:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Theory	BSCBE204	Biology For Engineers	3	0	2	5	4



University of Engineering and Management
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Syllabus for B.Tech Batch 2026-2030

Subject Name: Biology for Engineers

Credit: 3

Lecture Hours: 36

Subject Code: BSCBE204

Pre-requisite: Basic knowledge of Physics, Chemistry and Mathematics

Course Objective:

1. To introduce the fundamental differences between science and engineering
2. To impart knowledge on how biological observations of the 18th Century led to major discoveries
3. To impart knowledge on enzymes and their varied properties and functions
4. To impart knowledge on DNA as genetic material

Course Outcomes:

The concepts developed in this course will help the students in their higher studies. The course will enable the student to:

CO1: Identify the major biological discoveries that revolutionized science like the classification of organisms based on criteria such as morphology and ecology. Highlighting the identification and classification of microorganisms.

CO2: Convey that all forms of life have the same building blocks and yet the manifestations areas diverse as the classification of enzymes and their varied properties and functions which distinguish one from the other.

CO3: Analyze biological processes at the reductionist level and apply thermodynamic principles to biological systems.

CO4: Identify DNA as genetic material in the molecular basis of information transfer, impart the concept of recessiveness and dominance during the passage of genetic material from parent to offspring.

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Infosys SpringBoard](#)

Detailed Syllabus:

Module number	Topic	Sub-topics	Text Book Mapping	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Introduction	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 do we need to study biology? Discuss how biological observations of the 18th Century lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics refer to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	Biology for Engineers Chapter:1	No corresponding material	2	There are no corresponding labs.
2	Classification	Hierarchy of life forms at the phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b)ultrastructure- prokaryotes or eukaryotes.	Biology for Engineers Chapter:1	International standard https://ocw.mit.edu/courses/7-014-introductory-biology-spring-2005/resources/17-carbon-and-energy-	3	1. Phylogenetic tree construction (Bioinformatics)

		(c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitat- aquatic or terrestrial (f) 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. elegans, A. thaliana, M. musculus.		metabolism/ AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: NIL		
3	Genetics	To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences” 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 given 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	Campbell Biology: Campbell, N.A.; Reece, J.B.; Urry, L.; Cain, M.L.; Wasserman, S.A.; Minorsky, P.V.; Jackson, R. 12th Edition Chapter: 14	International standard (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/genetics/) (https://pll.harvard.edu/course/principles-genetics) AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)	3	1. Study of Genetic Variation (Alien Genetics Biology CK-12 PLIX Series https://www.labxchange.org/)

		human genetics.		efault/files/Model Curriculum/Final ECE.pdf IndustryMapping: (https://www.global-engage.com/life-science/8-free-tools-genetic-engineering-molecular-synthetic-biology/) https://web.stanford.edu/group/pritchardlab/structure.html)		
	Biomolecules	Molecules of life: In this context discuss monomeric units and polymeric structures. Discuss sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Pioneering work in interpreting the genetic code and its function in protein synthesis was carried out by Nobel Laureates Hargobind Khorana, Marshall Nirenberg, and Robert Holley. Two carbon units and lipids. Structure of protein-PDB viewer, Protein structure prediction- AlphaFold	Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co Chapter: 3,5,11,12	International Standards: (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/resource-index/) https://harvard.simplesyllabus.com/en-US/doc/sy2y033op) AICTE prescribed syllabus: https://www.aicte-	5	1. Protein structure elucidation- PDBViewer (https://www.rcsb.org/) 2. Estimation of protein using Bradford assay 3. Identification of protein through SDS PAGE 4. Protein structure prediction using AlphaFold

				india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: https://guides.lib.byu.edu/c.php?g=216337&p=1428369 https://www.computabio.com/applications-of-pymol-software.html https://phd.leeds.ac.uk/project/173-computer-simulations-of-biological-macromolecules https://spdbv.unil.ch/		
5.	Enzymes	Enzymology: How to monitor Enzyme catalyzed reactions. How does an enzyme catalyse reactions? 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	Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co Chapter: 8	International Standards: https://ocw.mit.edu/search/?q=Enzymes&type=resourcefile https://harvard.simplesyllabus.com/en-US/doc/sy2y033op	5	1. Enzyme kinetics using UV-Vis spectrophotometer

				- AICTE prescribesyllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) IndustryMapping: (https://kintekcorp.com/software) (https://bio.tools/icekat)		
6.	Information Transfer	The molecular basis coding and decoding genetic information is the universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from 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. Mutation, The DNA Technology (Use and Application), Sequence alignment- Pairwise and BLAST.	Campbell Biology:Campbell, N.A.; Reece, J.B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P. V.; Jackson. 12th Edition Chapter 16,17	International Standards: (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/dna-structure-classic-experiments/) (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/dna-replication/) (https://ocw.mit.edu)	5	1.Sequence alignment- Pairwise (Global and Local) and BLAST 2.Identification of DNA using Agarose gel electrophoresis

				du/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/transcription-translation/ -AICTE prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: (https://web.expasy.org/translate/) https://blast.ncbi.nlm.nih.gov/Blast.cgi		
7.	Macromolecular analysis	Examining biological processes at the reductionist level involves a comprehensive analysis of proteins, with a particular focus on their structure and function. This investigation encompasses the hierarchical organization of protein structures, spanning primary, secondary, tertiary, and quaternary levels. Additionally, proteins are explored in various roles, serving as enzymes, transporters, receptors, and essential structural elements within biological systems.	Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co. Chapter: 3, 13	International Standards: (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/biochemistry/proteins-levels-of-structure-non-covalent-forces/) AICTE	3	Membrane Channels (Membrane Channels - LabXchange)

				prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3090454/) (https://nmr.science.oregonstate.edu/macromolecular-analysis) (https://moduler.au.dk/course/2019-2020/K-KEM-K2-48?lang=en-GB)		
8.	Metabolism	Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Gibb's energy. Concept of Keq and its relation to standard free energy. Spontaneity, Energy yielding and energy consuming reactions. Concept of Energy charge Respiration: Breakdown of glucose to CO₂ + H₂O (Glycolysis and Gluconeogenesis and Krebs cycle). Electron transport chain	Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman Chapter: 16,17,18,19,20	International Standards: (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/resource-index/) (https://ocw.mit.edu/courses/20-10j-thermodynamics)	5	Bioenergetics (https://www.labxchange.org/)

		and Oxidative phosphorylation Photosynthesis: Synthesis of glucose from CO₂ and H₂O. Cyclic and non-cyclic photophosphorylation. Calvin cycle. CAM cycle.	-of-biomolecular-systems-fall-2005/pages/lecture-notes) (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/biochemistry/respiration-and-fermentation/) (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/biochemistry/chemiosmotic-principle-photosynthesis/) https://harvard.simplesyllabus.com/en-US/doc/sy2y033op) AICTE prescribes syllabus: https://www.aicte-	
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				india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping : https://www.genome.jp/kegg/pathway.html		
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.	Biology for Engineers. Chapter: 9	International Standards: https://ocw.mit.edu/courses/20-106j-systems-microbiology-fall-2006/pages/readings/ AICTE prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: https://pages.primuslabs.com/primuslabs-new-	3	1. Microscopic analysis of a living cell 2. Identification of bacteria through Gram staining 3. Digital Twin Experiment: digital Twin of Bacterial Growth (Microbiology Focus): Create a virtual model of bacterial growth to stimulate and predict how factors like nutrients or temperature affect proliferation, mirroring real cultures like <i>E.coli</i> .

				client-usa.html?qclid=CjwKCAiA9ourBhAVEiwA3L5RFieYQ2c6mskEkqLq0_vaDlTGfqq7Ah5YAt_vHdeawcqIhQ3ItsjM3BoChLIQAvD_BwE		
10.	Advanced topics	Pioneering work in interpreting the genetic code and its function in protein synthesis by Nobel Laureates Hargobind Khorana, Marshall Nirenberg, and Robert Holley. Structure of protein-PDB viewer, Protein structure prediction-AlphaFold. Sequence alignment-Pairwise and BLAST (Basic Concepts)		International Standards: https://ocw.mit.edu/courses/hst-508-genomics-and-computational-biology-fall-2002/ https://ocw.mit.edu/courses/7-88j-protein-folding-and-human-disease-spring-2015/download/	2	1.Sequence analysis with Bioinformatics tools 2. Protein's 3D structure prediction with the help of Alpha Fold (AI system developed by Google DeepMind)

				Industry Mapping: (https://web.expasy.org/translate/) (https://blast.ncbi.nlm.nih.gov/Blast.cgi) https://guides.lib.byu.edu/c.php?g=216337&p=1428369 https://www.computabio.com/applications-of-pymol-software.html https://phd.leeds.ac.uk/project/173-computer-simulations-of-biological-macromolecules https://spdbv.unil.ch/		
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Experiential Learning:

1. Microscopic image analysis and enzyme kinetics simulation using MATLAB.

Text Books:

1. Biology for Engineers. Wiley and Sons
2. Campbell Biology: Campbell, N.A.; Reece, J.B.; Urry, Lisa; Cain, M.L.; Wasserman, S.A.; Minorsky, P.V.; Jackson. 12th Edition
3. Biochemistry: Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co

Reference Books:

1. Molecular Genetics (Second edition), Stent, G.S and Calendar R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
2. Microbiology, Prescott, L.M.J.P. Harley and C.A. Klein 1995. 2nd edition Wm C. Brown Publishers
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M.M. W.H. Freeman and Company
4. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus

1st Semester Syllabus for B. Tech Batch 2026-2030

- **Subject Name:** Basic Electrical Engineering
- **Subject Code:** ESCEE201
- **Credit:** 4
- **Lecture Hours:** 42
- **Pre-requisite:** Basic knowledge of Physics and Mathematics in Class- XI and XII level

- **Relevant Links:**

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin Learning](#)

- **Course Objective:**

1. **CO1:** Students can recognize different network elements, identify different network connections, and understand the concept of voltages and currents in AC or DC circuits.
2. **CO2:** Students can apply and relevant laws of electricity, network theorems to analyze electrical and magnetic circuits.
3. **CO3:** Students will be acquainted with the operations and characteristics of machines, converter circuits and new technology of energy generation and storage system. They can understand the realistic applications of these machines. They will gain knowledge on requirement of deferent electrical safety tools which are mandatory during electric installations.
4. **CO4:** Develop an ability to analyze and solve theoretical problems of Basic Electrical Engineering.

- **Course Outcomes:**

CO1: Students can recognize different network elements, identify different network connections, and understand the concept of voltages and currents in AC or DC circuits.

CO2: Students can apply and relevant laws of electricity, network theorems to analyze electrical and magnetic circuits.

CO3: Students will be acquainted with the operations and characteristics of machines, converter circuits and new technology of energy generation and storage system. They can understand the realistic applications of these machines. They will gain knowledge on requirement of deferent electrical safety tools which are mandatory during electric installations.

CO4: Develop an ability to analyze and solve theoretical problems of Basic Electrical Engineering.

• Detailed Syllabus:

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	DC Circuits	Electrical circuit elements (R, L and C), voltage and current sources, Fundamentals of linear systems, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems.	International Academia: https://catalog.mit.edu/subjects/6/ AICTE-prescribed syllabus: https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	8	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 11,12,13,14	Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2	AC Circuits	Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series- parallel circuits; Resonance; Three Phase A.C. Circuits covering, Necessity and Advantages of three phase systems, Generation of three phase	International Academia: https://catalog.mit.edu/subjects/6/ AICTE-prescribed syllabus: https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	10	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 11,12,13,14	Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits– impedance calculation and

		power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method;				verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3	Transformer	Basics of Electromagnetism, Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency.	<i>International Academia:</i> https://catalog.mit.edu/subjects/6/ <i>AICTE-prescribed syllabus:</i> https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	6	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 6, 7, 32, 33	Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

4	Electrical Machines	AC machine: Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter. Introduction to Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation; DC machine: DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;	<i>International Academia:</i> https://catalog.mit.edu/subjects/6/ <i>AICTE-prescribed syllabus:</i> https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	10	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 26, 27, 28, 29, 30, 34, 35	Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding -slip ring arrangement) and single-phase induction machine. Torque Speed Characteristic of separately excited dc motor. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
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5	Overview of Electrical Power Generation System	Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geothermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation	<i>Coursera link: Coursera Electrical Power Generation Page. [1]</i> <i>International Academia: https://catalog.mit.edu/subjects/6/</i> <i>AICTE-prescribed syllabus: https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf</i>	6	Power Electronics By P.S. Bhimbra New Age Publication Chapter 11 Basic Electrical Engineering By B.L. Theraja S.Chand Publication Chapter 24	Demonstration of (a) PV module, (b) Battery energy storage system
6	Advanced Proficiency Module	Introduction to Synchronous Generators covering, Principle of operation; Power in balanced three phase circuits, measurement of power by two wattmeter method; Concept of cogeneration and distributed generation	<i>AICTE-prescribed syllabus: https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf</i>	2	--	--

• Reference Books:

TEXT BOOK:

1. Basic Electrical Engineering (Vol. 1 & 2) - B.L.Theraja; S.Chand Publication

REFERENCE BOOKS:

1. Basic Electrical Engineering –Dr. Jagadish Pal; Aryan Publication
2. Basic Electrical engineering- 1St Edition Paperback – P.V. Prasad | S. Sivanagaraju | K. R. Varmah | Chikku Abraham
3. Basic Electrical and Electronics Engineering – 2nd Edition Dr. Vinoth Kumar K; Dr. Saravanakumar R; Dr. Jegathesan, Wiley Publication

NPTEL Link:

<https://nptel.ac.in/courses/108105053>- NPTEL course link

<https://nptel.ac.in/courses/108106172>- NPTEL course link

<https://nptel.ac.in/courses/108108076>- NPTEL course link

<https://nptel.ac.in/courses/117106108>- NPTEL course link

MATLAB Assignment:

Design an R-L-C series circuit using MATLAB Simulation (values of R,L,C may be advised in class)
Design an R-L-C parallel circuit using MATLAB Simulation (values of R,L,C may be advised in class)

BTECH 2026 ADMISSION BATCH ONWARDS

2nd Semester – 1st year (All streams)

DATA STRUCTURES & ALGORITHMS – 3 credits

DATA STRUCTURES & ALGORITHMS LAB (using C and Python) – 2 credits

Topics to be studied

Introduction: Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithm efficiency and analysis. Time and space complexity analysis of algorithms – order notations. (Preferably, only step count method and Big – Oh notation)

Linear Data Structures

Array: Revision of 1D array & Multidimensional array, Memory address calculation, Different representations – row-major, column-major, Accessing array through pointers, Pointer to array, Array of pointers, Sparse matrix - its implementation and usage, Array representation of polynomials.

Searching & Sorting: Linear search, Binary search, Bubble sort, Selection sort, Insertion sort, Shell sort, Merge sort, Quick sort, Radix sort, Bucket sort.

Linked List: Revision of structure and structure pointer, Singly linked list (Creation, Insertion of nodes at different positions, Deletion of nodes at different positions, Searching of a specific node, Reversing a list, Sorting of linked list, Joining of two linked list), circular linked list (Creation, Insertion of nodes at different positions, Deletion of nodes at different positions), doubly linked list (Creation, Insertion of nodes at different positions, Deletion of nodes at different positions), linked list representation of polynomials and applications.

Stack: Concepts of basic operations (push, pop, peek) and Implementation using array and linked list. Infix to postfix conversion & evaluation of postfix expression, Concepts of multiple stacks and its implementation, Concepts of different types of recursion and applications.

Queue: Concepts of basic operations (insertion, deletion), Implementation of linear queue using array and linked list, Concepts and implementation of circular queue using array and linked list, Concepts and implementation multiple queue, double ended queue using array, Concepts and implementation of priority queue using linked list.



University of Engineering and Management
Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town Campus



Syllabus for B.Tech. Batch 2026-2030

Subject Name: Engineering Mechanics-Principles Credit:2 Lecture Hours: 24

Subject Code: ESME202A

Pre-requisite: High School Mathematics

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

[Linkedin Learning](#)

COURSE OBJECTIVES:

1. To introduce students to the fundamental concepts of force, moment, and equilibrium in two- and three-dimensional systems.
2. To develop the ability to model and analyze mechanical systems using vector operations and free-body diagrams.
3. To understand and evaluate frictional effects and structural behavior of trusses under various loading conditions.
4. To apply principles of kinematics and kinetics to describe and solve particle motion problems in engineering contexts

COURSE OUTCOMES:

CO 1: Apply vector operations to represent forces and moments for solving basic engineering problems.

CO 2: Analyse force systems to determine conditions of equilibrium using free-body diagrams.

CO 3: Evaluate the effects of static and kinetic friction in various mechanical systems.

CO 4: Apply kinematic and kinetic principles to solve particle motion problems using rectilinear framework

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	Introduction to Vectors	Basic concepts, types of forces, scalars and vectors, Vector addition and subtraction in component form, Vector operations - Force and moment representation using vectors	International Academia: https://ocw.mit.edu/course/s/1-050-engineering-mechanics-i-fall-2007/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf Industry Mapping: MATLAB	2	Solving vector mechanics problems in MATLAB	B.B. Ghosh, S. Chakrabarti, S. Ghosh “Engineering Mechanics”, Part I - Chapter 2
2	Force & Equilibrium Systems	Basic concepts, ; Rigid Body equilibrium (2-D & 3-D); 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, Concept of Free body diagrams, Lami’s Theorem, Equations of Equilibrium of Coplanar Systems.	International Academia: https://ocw.mit.edu/course/s/1-050-engineering-mechanics-i-fall-2007/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf Industry Mapping: MATLAB	4	Solving force equilibrium problems in MATLAB and validating with analytical solutions.	B.B. Ghosh, S. Chakrabarti, S. Ghosh “Engineering Mechanics”, Part I - Chapter 1, 3

3	Friction	Laws of Friction, Static and Dynamic Friction; Application of Friction in various systems.	International Academia: https://ocw.mit.edu/course/s/1-050-engineering-mechanics-i-fall-2007/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Enqq.pdf Industry Mapping: MATLAB	4	Solving numerical problems involving friction in MATLAB and validating the analytical solutions.	B.B. Ghosh, S. Chakrabarti, S. Ghosh “Engineering Mechanics”, Part I- Chapter 4
4	Kinematics of Particles	Definitions and basic concepts of particle motion, Rectilinear motion: equations of motion for constant and variable acceleration, Projectile motion, Introduction to relative motion.	International Academia: https://ocw.mit.edu/course/s/2-003sc-engineering-dynamics-fall-2011/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Enqq.pdf Industry Mapping: Mujoco, PyBullet	5	Use Mujoco or PyBullet to simulate a particle's trajectory under different initial velocities and accelerations. Analyze how changes in parameters affect the path	B.B. Ghosh, S. Chakrabarti, S. Ghosh “Engineering Mechanics” - Part II – Chapters 1,2

5	Kinetics of Particles	Application of Newton's laws and D' Alembert's principles to solve motion problems	International Academia: https://ocw.mit.edu/course/s/2-003sc-engineering-dynamics-fall-2011/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf Industry Mapping: Mujoco, PyBullet	5	Create a ML model to predict a particle's final velocity given varying forces and masses	B.B. Ghosh, S. Chakrabarti, S. Ghosh "Engineering Mechanics" - Part II – Chapter 3
6	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.	International Academia: https://ocw.mit.edu/course/s/1-050-engineering-mechanics-i-fall-2007/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf Industry Mapping: ANSYS Mechanical	4	Solving numerical problems on Trusses in ANSYS Mechanical and verifying with analytical calculations	Engineering Mechanics (Statics & Dynamics), D.S. Kumar – Chapter 5

TEXT BOOKS:

1. B.B. Ghosh, S. Chakrabarti, S. Ghosh, “Engineering Mechanics”, Vikas Publishing House (Part I - Chapters 1, 2, 3, 4 Part II – Chapters 1, 2, 3)
2. D.S. Kumar, “Engineering Mechanics (Statics & Dynamics)”, S K Kataria and Sons
3. I. H. Shames, “Engineering Mechanics (Statics and Dynamics)”, Prentice Hall of India

REFERENCE BOOKS:

1. J. L. Meriam and L. G. Kraige, “Engineering Mechanics: Statics”, Wiley.
2. J. L. Meriam and L. G. Kraige, “Engineering Mechanics: Dynamics”, Wiley.
3. Timoshenko, Young, Rao, Pati, “Engineering Mechanics,” McGraw Hill