



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: Chemistry

Credit: 4

Lecture Hours: 42

Subject Code: BSCCH202

Pre-requisite: Basic knowledge of Chemistry in Class- XI and XII level

Relevant Links:

Study [Material](#)

[Coursera](#)

[NPTEL](#)

[IEM Learning](#)

COURSE OBJECTIVES:

1. To acquaint the students with the basic phenomenon/concepts of chemistry, the student faces during course of their study in the Industry and Engineering field.
2. The student with the knowledge of the basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering field.
3. The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology.
4. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

COURSE OUTCOMES:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. The course will enable the student to:

CO1: Analyze nano- structures, intermolecular forces and microscopic properties in terms of orbital concept of hydrogen atoms and bands of solid extending to Crystal field of transition metal ions using quantum mechanical approach.

CO2: Rationalize bulk properties using thermodynamic considerations and equilibrium conditions predicting the interactions in different systems.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels and its subsequent applications.

CO4: Able to apply stereo chemical approach for structure prediction and drug design in fundamental organic reactions.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Books
1	Atomic and molecular structure	Schrödinger equation. Particle in a box solution and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	International Academia: MIT- https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-i-the-atom/ https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-ii-chemical-bonding-structure/lecture-13/ Stanford University- https://explorecourses.stanford.edu/search?view=catalog&filter=coursestatus-Active=on&page=0&catalog=&academicYear=&q=crystal+field+theory&collapse= AICTE-prescribed syllabus:	7	1. Estimation of Hardness of water sample by Complexometric titration. 2. Synthesis of Nanoparticles	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 1

			https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: A Python Program for Solving Schrödinger's Equation in Undergraduate Physical Chemistry Journal of Chemical Education (acs.org) https://in.mathworks.com/matlabcentral/fileexchange/125425-matlab-support-package-for-quantum-computing			
2	Spectroscopic techniques and applications	Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications.	International Academia: https://ocw.mit.edu/courses/5-80-small-molecule-spectroscopy-and-dynamics-fall-2008/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/f	5	1. Food dyes and Beers law using UV-vis spectroscopy. 2. Estimation of metal ions using UV-vis spectroscopy. 3. Studies on	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 2

			iles/Model Curriculum /AICTE%20-%20UG%20CSE.pdf Industry Mapping: HORIBA Scientific's Lab Spec 6 Spectroscopy Suite provides an intuitive, powerful software platform for imaging and spectroscopy by Raman, photoluminescence (PL), cathodoluminescence (CL) and AFM-Raman. https://www.horiba.com/int/scientific/products/detail/action/show/Product/labspec-6-spectroscopy-suite-software-1843/		the synthesis of Nanoparticles using UV-vis spectroscopy.	
3	Intermolecular forces and potential energy surfaces	Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H ₃ , H ₂ F and HCN and trajectories on these surfaces.	International Academia: MIT- Unit III: Thermodynamics & Chemical Equilibrium Principles of Chemical Science Chemistry MIT Open Course Ware	3	1. Determination of surface tension of liquids using Stalagmometer Instrument 2. Determination of	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 3

			Stanford University- Stanford University Explore Courses AICTE Syllabus: Final ECE.pdf (aicte-india.org) Industry Mapping: The equations of state for gases are essential in various engineering applications, including the design and operation of chemical processes, HVAC systems, and the petroleum industry.		viscosity of liquids using Ostwald Viscometer.	
4	Use of free energy in chemical equilibria	Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	International Academia: MIT- https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/resources/lecture-13-gibbs-free-energy/ https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-iii-	11	1. Acid base titration (Colorimetric) 2. Acid base titration (Conductometric) 3. Acid base titration (pH metric) 4. Potentiometric Titration 5. Determination of the partition coefficient of a substance between	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 5, 6, 7, 18

			<u>thermodynamics-chemical-equilibrium/lecture-16/</u> <u>https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/pages/lecture-notes/</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf</u> Industry Mapping: Energy, entropy and free energy concepts come from thermodynamics and are applicable to all fields of science and engineering. Instruments Used in Industries: Potentiometer, Conductivity meter, pH-meter		two immiscible liquids (Heterogeneous Equilibrium). 6. Determination of hardness of water sample 7. Determination of alkalinity of water sample	
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			athWorks-Teaching-Resources/Thermodynamics			
5	Periodic properties	Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf International Standards: https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-ii-chemical-bonding-structure/lecture-9/ Industry Mapping: Stanford AI recreates chemistry's periodic table of elements https://news.stanford.edu/press-releases/2018/06/25/ai-recreates-chemistrys-periodic-table-elements/	3	Periodic table and Graph Part-1: study the structure of the Periodic Table of Elements and use it to find information about elements. Part-2: create a graph on excel or on the graph paper out of the given data sets. https://www.coursehero.com/file/179637355/Lab-3-Periodic-Table-Graph-2pdf	Chemistry- I, Second Edition, Gourkrishna Das mohapatra, chapter- 5
6	Stereochemistry	Representations of 3 dimensional structures, structural isomers and	International Standards : (https://ocw.mit.edu/courses/5-12-organic-	3	1. Determination of specific rotation of sugar solution by	Engineering Chemistry by Jain and Jain, Dhanpat

		stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf) Industry Mapping: Chem Draw software		polarimeter	Rai Publishing Co.17th edition, chapter 27	
7	Organic reactions and synthesis of a drug molecule	Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	International Academia: https://ocw.mit.edu/courses/5-12-organic-chemistry-i-spring-2003/resources/5_12_outline_1st_half/ https://explorecourses.stanford.edu/m_search?page=0&q=CHEM&filter-coursestatus-Active=on&filter-catalognumber-CHEM=on https://catalog.mit.edu/subjects/5/	8	Determination of the rate constant of an organic reaction Thin layer chromatography https://vlab.amrita.edu/?sub=3&amrbrch=63&amrsim=154&amrcnt=2	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 26

			<i>AICTE-prescribed syllabus:</i> https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf) Industry Mapping: Chem Draw software, Chem3D software Drug Design and Lead Molecule Discovery using Structure Based Virtual Screening and Molecular Docking. Introduction to Generative Chemistry- Application of Generative AI in Chemistry. <i>Industry Tool:</i> Screening of drug molecules using Popular Industrial Software using AutoDock, AutoDock Vina, Open Babel,			
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			Biovia Discovery Studio			
8	Advanced Proficiency Module	Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.	AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf	2		Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 2

TEXT BOOK:

1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition
2. Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, Vikas Publishing House Private Limited.

REFERENCE BOOKS:

1. Physical Chemistry, P.C. Rakshit, Sarat Book distributors, Calcutta, 7th Edition
2. Physical Chemistry, G.W. Castellan, Narosa Publishing House, 3rd Edition
3. Fundamentals of Molecular Spectroscopy by C. N. Banwell & E.M. McCash, McGraw Hill Education India Publishers, 5th Edition
4. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes, Pearson Publishers, 6th Edition
5. Inorganic Chemistry, Part- I & II, R.L Dutta, The New Book Stall Publishing House



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Syllabus for B.Tech Admission Batch 2026

Subject Name: Mathematics and Basic Statistics

Credit: 4

Lecture Hours: 48

Subject Code: BSCM203B

Pre-requisite: High School Mathematics

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#) [NPTEL](#) [NPTEL](#) [NPTEL](#)

[Linkedin Learning](#)

[Infosys Springboard](#)

COURSE OBJECTIVES:

1. To give an exposure of basic concepts related to matrices, ordinary differential equations, vector space as well as basic statistics 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 modelling with application to real life problems.

COURSE OUTCOMES:

CO 1: Identify different types of matrices and relate the concept of rank for solving linear system of equations and apply the concept of eigenvalues, eigenvectors, and diagonalization of matrices.

CO 2: Appraise the idea of vector space and inner product spaces and orthogonalization for understanding physical and engineering problems.

CO 3: Appraise different techniques to solve first and second order ordinary differential equations with its formulation to address the modeling of systems and problems of engineering sciences.

CO 4: Explain the concept of Basic Statistics with their properties and applications in physical and engineering environment.

Module number	Topic	Sub-topics	Mapping with Textbooks	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	Linear Algebra-I	Vector Space, Vector Subspace, Linear Independence and Dependence of Vectors, Basis, Dimension; Rank of a Matrix, Application to Linear Systems of Equations, Eigenvalues and Eigenvectors; Eigenvalues of some special matrices; Cayley-Hamilton Theorem; Similarity Matrix.	T2: Chapter 15 T1: Chapter 2 Secs. 2.7, 2.9, 2.10, 2.13 – 2.16	<i>International Academia:</i> Syllabus Engineering Math: Differential Equations and Linear Algebra Mechanical Engineering MIT OpenCourseWare Part III: Linear Algebra Calculus Revisited: Complex Variables, Differential Equations, and Linear Algebra Supplemental Resources MIT OpenCourseWare Linear Algebra, Calculus, &	10	1. Write a function that takes a matrix, a row number and a column number. Beginning with the row number passed to the function, scroll down the column passed to the function and return the row number that contains the largest absolute value in the column. Page 2

				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/ Generative AI: Microsoft Math Solver https://math.microsoft.com/en		2. Using MATLAB, find the determinant and rank of a matrix. 3. Check the consistency of a linear system of equations, and solve, if possible. 4. Write a program of check the independence of any three vectors in $\mathbf{R}^3$. 5. Compute eigenvalues and eigenvectors of a matrix $A \in \mathbf{R}^{n \times n}$.
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2	Linear Algebra-II	Linear Transformations (maps), Range and Kernel of a Linear Map, Rank and Nullity, Inverse of a Linear Transformation, Rank Nullity Theorem, Composition of Linear Maps, Matrix associated with a Linear Map; Inner Product Spaces, Gram-Schmidt Orthogonalization.	T2: Chapters 25 & 27	International Academia: Linear Algebra, Calculus, & Applications I Stanford Online Part III: Linear Algebra Calculus Revisited: Complex Variables, Differential Equations, and Linear Algebra Supplemental Resources MIT OpenCourseWare Syllabus Engineering Math: Differential Equations and Linear Algebra Mechanical Engineering MIT OpenCourseWare AICTE prescribed syllabus: Untitled 1-min.pdf (aicte-india.org) Industry Mapping: MATLAB	14	- Find the inner product of any two vectors of $\mathbf{R}^3$. - Using Gram-Schmidt Orthogonalization, find the orthonormal vectors for any three vectors in $\mathbf{R}^3$.
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3	Ordinary Differential Equations	First order first degree equations: Exact equations, Rules for finding Integrating Factors, Linear and Bernoulli's equations. Equations of first order but not of first degree: Equations solvable for p, Equations solvable for x, Equations solvable for y and Clairaut's type. Second Order Linear Differential Equations with constant coefficients, D-operator Method, Method of Variation of Parameters.	T1: Chapter 11 Secs. All Chapter 13 Secs. 13.1-13.8-I, 13.9	International Academia: Syllabus Engineering Math: Differential Equations and Linear Algebra Mechanical Engineering MIT OpenCourseWare Part III: Linear Algebra Calculus Revisited: Complex Variables, Differential Equations, and Linear Algebra Supplemental Resources MIT OpenCourseWare <i>AICTE prescribed syllabus:</i> Untitled_1-min.pdf (aicte-india.org) <i>Industry Mapping:</i> MATLAB	14	1. Solve any initial valued ordinary differential equation. 2. Solve any boundary valued ordinary differential equation
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4	Basic Statistics	Measures of Central Tendency- Mean, Median & Mode; Measures of Dispersion – Variance and Standard Deviation; Moments, Skewness, Kurtosis; Correlation & Regression, Rank Correlation.	T1: Chapter 25	<i>International Academia:</i> <u>Theory of Probability Course I Stanford Online</u> <u>Statistical Methods in Engineering & Physical Sciences I Stanford Online</u> <i>AICTE prescribed syllabus:</i> <u>Untitled_1-min.pdf (aicte-india.org)</u> <i>Industry Mapping:</i> MATLAB	10	1. Plot Scatter diagram, Histogram, Frequency Polygon, Ogive (two types) for any given data. 2. Find mean, median, mode for ungrouped data. 3. Find the correlation and rank correlation between two variables. 4. Find the regression line between two variables.
5	Advanced Proficiency Module	Diagonalization of matrices (From Module-1), Cauchy-Euler Equation (From Module-3)				

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/>

- **Electric Circuits:** Apply Kirchhoff's laws and solve the resulting system using matrices.
- **Signal Processing:** Apply Gram-Schmidt Orthogonalization to orthogonalize signals in communication systems.
- **Epidemiology (SIR Model):** Model disease spread in a population using coupled ODEs.
- **Stock Market Analysis:** Apply regression and correlation to analyze stock price trends.

Text Book:

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 Mallik & 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	3	3	3	2	3	-	-	-	1	1	2	1
CO2	3	3	3	2	3	-	-	-	1	1	2	1

CO3	3	3	3	2	3	-	-	-	1	1	2	1
CO4	3	3	3	2	3	-	-	-	1	1	2	1



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Syllabus for B.Tech. Batch 2026-2030

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

Subject Code: ESME202B

Pre-requisite: High School Mathematics

Relevant Links:

[Study Material](#)

[Coursera](#)

[NPTEL](#)

COURSE OBJECTIVES:

1. To build foundational understanding of equilibrium of forces and moments in mechanical systems.
2. To enable students to determine the center of gravity and moment of inertia for regular and composite bodies.
3. To develop a conceptual understanding of dynamic equilibrium and the motion of rigid bodies using Newtonian and D'Alembert frameworks.
4. To apply particle and rigid body motion, and understand the relationship between work, energy, and power for mechanical systems.

COURSE OUTCOMES:

CO 1: Apply principles of force and moment equilibrium to access the static behavior of mechanical systems.

CO 2: Determine the center of gravity and moment of inertia for regular and composite bodies using standard analytical techniques.

CO 3: Analyze dynamic equilibrium and rigid body motion by employing Newtonian and D'Alembert formulations.

CO 4: Apply work-energy and power relations to interpret and solve particle and rigid body motion problems in mechanical systems.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	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, Equations of Equilibrium of Coplanar Systems, Lami's Theorem.	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
2	Centre of Gravity & Moment of Inertia	Centre of Gravity and its implications; Centroid of simple figures from first principle, centroid of composite sections; Area moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Concept of Mass moment inertia.	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	5	Solving numerical problems on CG & MI in MATLAB and validating with analytical solutions	B.B. Ghosh, S. Chakrabarti, S. Ghosh "Engineering Mechanics", Part I - Chapter 5, 6

3	Brief Introduction to Dynamic Equilibrium	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/FinalMechanical%20Engg.pdf Industry Mapping: MATLAB, Tensorflow , PyTorch	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
4	Work, Energy & Power	Work-energy principle for particles, Kinetic energy, potential energy, and conservation of energy	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/FinalMechanical%20Engg.pdf Industry Mapping: MATLAB, Blender	4	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 – Chapter 4

5	Dynamics of Rigid Bodies	Translation and rotation of rigid bodies; instantaneous center of rotation and velocity analysis. Force, torque, and moment of inertia; plane motion types - translation, rotation, and general motion. Application of Newton's laws or D'Alembert's principle for dynamic equilibrium; equations of motion for translation, rotation, and combined 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%20Engg.pdf Industry Mapping: ANSYS Mechanical	6	Model a rigid body in Open Modelica with specified rotation and translation parameters. Observe the effect of applied torques and forces on its motion, and plot angular velocity and acceleration over time.	S.S. Bhavikatti “Engineering Mechanics – Vector and Classical Approach” - Chapter 8
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TEXT BOOKS:

1. B.B. Ghosh, S. Chakrabarti, S. Ghosh, “Engineering Mechanics”, Vikas Publishing House ((Part I - Chapters 1, 3, 5, 6, Part II – Chapters 4)
2. S.S. Bhavikatti “Engineering Mechanics – Vector and Classical Approach” New Age International Publishers (Chapter 8)
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



University of Engineering and Management



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

Syllabus of Basic Electronics Engineering for Batch 2026-2030

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Syllabus Structure

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Engineering Science Course	ESCEC201	Basic Electronics Engineering	3	1	0	4	4
2	Engineering Science Course	ESCEC291	Basic Electronics Engineering Laboratory	0	0	2	2	1
				Total Credit points				5



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Syllabus of Basic Electronics Engineering for Batch 2026-2030

Subject Name: Basic Electronics Engineering Credit: 3 Lecture Hours: 36

Subject Code: ESCEC201

Pre-requisite: Basic Knowledge in Physics in Class 12 level

Relevant Links:

Study Material [Coursera](#) [NPTEL](#) [Linkedin Learning](#)

COURSE OBJECTIVES:

1. To introduce basic concept of Electronics
2. To study semiconductor, its band-structure, p-type and n-type semiconductor
3. To introduce the concept of P-N junction diode, Zener diode.
4. To learn the concept of BJT, FET and OPAMP.
5. To illustrate the basic concept of logic gates

COURSE OUTCOMES:

CO 1: To conceptualize the fundamentals of semiconductor physics, including the band structures.

CO 2: To be able to understand the basics of p-n junction diode and Zener diode and their applications.

CO 3: To be able to understand the concept of Transistors working principles, characteristics and their applications.

CO 4: To study the basics of digital electronics including basic gates, universal gates and truth tables

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Textbook Mapping	Corresponding Lab Assignment
1	Semiconductor Physics	Classification of Metal, insulator and semiconductor, Introduction to active and passive components, intrinsic and extrinsic semiconductor, n-type and p-type semiconductors and their Band structure, carrier concentration, scattering and drift of electrons and holes, drift current, diffusion mechanism, Introduction to compound III-V semiconductors (GaAs), Einstein's Relation, generation and recombination and injection of carriers.	International Academia: (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009) (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: TCAD Software	6	Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky Chapter - 1	1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, millimetres etc. 2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
2	P-n Junction diode and Zener diode	Diodes: Semiconductor p-n junction formation, forward and reverse bias, V-I characteristics of p-n junction diode, Current equation, Derivation for Forward and Reverse current, piece-wise linear diode characteristics, Diode as a switch, Application of diode in Clipper and Clamper Circuits, Zener Diodes, V-I characteristics of Zener Diodes, application of junction diode as a rectifier, Half-Wave and Full-Wave	International Academia: (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009) (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/) AICTE-prescribed syllabus:	6	Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky Chapter - 2	1. Circuit designing using p-n junction diodes. i. Study the I-V characteristics of a p-n junction diode ii. Design and implement clipper circuits using a diode and observe their effect on the output waveform. iii. Design and implement

		Rectifier Circuits, Schottky Diode Characteristics.	(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: TCAD Software			clamping circuits using a diode and observe their effect on the output waveform. 2. Study of I-V characteristics of Zener diodes. 3. Design and implement voltage over-protection circuit using a Zener diode 4. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
3	Bipolar Junction Transistors	Bipolar Junction Transistor (BJT): Type, Operation, Physical mechanism, current gain, minority current distribution; Punch-through and avalanche effect, V-I Characteristics, region of operation, input & output characteristics for CB, CE & CC mode, current amplification factors α for CB mode and β for CE mode, BJT as amplifier and switch, small signal analysis,	International Academia: (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009) (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: TCAD Software, SPICE Software	6	Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky Chapter - 3	1. Study of Characteristic curves for CB, CE mode configuration and find the respective hybrid parameters.
4	Field effect	Junction Field Effect Transistor	International Academia: (https://ocw.mit.edu/courses	6	Electronic Devices and Circuits Theory by Robert	1. Study of I-V characteristics of Field Effect Transistors

	transistors	(JFET): Construction, Types, Operation, V-I characteristics, Regions of operation. Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier, CMOS technology.	6-012-microelectronic-devices-and-circuits-fall-2009) (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: TCAD Software, SPICE Software		L. Boylestad, Louis Nashelsky Chapter - 6	and show the characteristics in LTSpice.
5	OPAMP	Ideal Op-AMP, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Inverting Configuration, Noninverting configuration, DC imperfections, difference amplifiers, circuits based on Op-amps: Integrators, differentiators, logarithmic amplifiers, Comparator, Schmitt trigger.	International Academia: (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009) (https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/) AICTE-prescribed syllabus: (https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf) Industry Mapping: TCAD Software, SPICE Software	6	Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky Chapter - 10,11	1. Design and simulate Inverting and Non-inverting amplifiers using Op-amp and draw waveforms in LTSpice 2. Design and simulate Adder and Subtractor circuits using Op-amp and draw waveforms in LTSpice 3. Design and simulate Differentiator and Integrator circuits using Op-amp and draw waveforms in LTSpice 4. Determination of input-offset voltage, Offset null of Op-amps, etc.

6	Digital Logic gates	Boolean Algebra and Logic Gates, Basic Logic AND, OR, NOT Gates and Universal gates, XOR and XNOR gate, their symbols and Truth tables, De Morgan's Theorems, Combinational Circuit (adders/subtractors, magnitude comparator, multiplexer, demultiplexers, encoders, decoders). International Academia: https://web.stanford.edu/class/archive/ee/ee108a/ee108a.1082/schedule.html AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: Hardware Chipsets Software-TinkerCad, EDA Playground	6	Digital Logic Design 4th Edition by M . Morris Mana and Michael D. Ciletti Chapters - 1,2,4	1. Study of Logic Gates and realization of Boolean functions using Logic Gates. 2. Show NAND and NOR gates are universal gates. 3. Write a VHDL code to describe the functionality of various gates. Compile and simulate the code to obtain the timing waveform.
7	Advanced Proficiency Module	Density of state function and dimensional problem quantization, Frequency dependent negative resistance and solution of differential equations, Small signal analysis using h-parameter, to formulate current gain, voltage gain, input impedance and output impedance. International Academia: https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2009/ https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: TCAD Software, SPICE Software		Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky Chapter - 1,3,10,11	

TEXT BOOKS:

1. Basic Electronics, Debashis De, Kamakhya Prasad Ghatak, Pearson Education India.

REFERENCE BOOKS:

1. Streetman, Solid State Electronic Devices, Pearson Education India.
2. Donald Neamen, Semiconductor Physics and Devices, McGraw-Hill Higher Education.
3. Electronic Devices and Circuits Theory by Robert L. Boylestad, Louis Nashelsky.
4. Simon M. Sze, Yiming Li, Kwok K. Ng, Physics of Semiconductor Devices, John Wiley & Sons .
5. Millman, Grabel, Microelectronics, McGraw Hill.
6. Digital Logic Design 4th Edition by M . Morris Mano and Michael D. Ciletti.
7. Sedra, Smith, Microelectronic Circuits, Oxford University Press.

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



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

Subject Name: English

Credit: 2

Lecture Hours: 24

Subject Code: HSMC201

Pre-requisite: Basic English Proficiency, Listening and Speaking Skills, Reading and Writing Skills, Academic and Social Contexts, and Familiarity with Corporate Ethics.

Relevant Links:

[STUDY MATERIAL](#)

[Coursera](#)

[NPTEL](#)

[IEM Learning](#)

COURSE OBJECTIVES:

1. Demonstrate the ability to apply grammar, syntax, and vocabulary fundamentals in written and spoken communication.
2. Communicate effectively in both academic and social contexts by adapting language skills to different situations.
3. Apply language skills in professional settings, showcasing readiness for the industry, and demonstrate an understanding of corporate ethics in communication and decision-making.
4. Demonstrate basic proficiency in English by reading, listening, comprehending, writing, and speaking effectively in various contexts.

COURSE OUTCOMES:

CO1. Achieve competence in grammar, syntax, and vocabulary fundamentals.

CO2. Effectively communicate in academic and social contexts.

CO3. Develop readiness for the industry and understand corporate ethics.

CO4. Acquire basic proficiency in English encompassing reading, listening, comprehension, writing, and speaking skills.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Textbook Mapping	Corresponding Lab Assignment
1.	Vocabulary Building	1.1 The concept of vocabulary and word formation (Ch-1.1, page 3) 1.2 Root Words from foreign languages (Ch- 1.2, page 2) 1.2	International Academia: https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/	3	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i> .2024. Publisher(s): Aryan Publishing House	Activities on vocabulary building and Lexigraphy games. Exercises involve creating and using industry-specific vocabulary and

		1.3 Acquaintance with Prefixes and Suffixes (Ch-1.3, page 11) 1.4 Synonyms, antonyms, and Standard abbreviations (Ch-1.4, page 15)	https://ocw.mit.edu/courses/24-901-language-and-its-structure-i-phonology-fall-2010/ AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Business writing and corporate documents.			understanding jargon.
2.	Basic Writing Skills	2.1 Sentence Structures (Ch-2.1, page 54) 2.2 Use of phrases (Ch-2.2, page 66) 2.3 Importance of proper punctuation (Ch- 2.3, page 62) 2.4 Creating coherence (Ch-2.4, page 65) 2.5 Organizing principles of paragraphs in documents (Ch-2.5, page 68)	International Academia https://ocw.mit.edu/courses/21w-011-writing-and-rhetoric-rhetoric-and-contemporary-issues-fall-2015/ AICTE Prescribed Syllabus: https://www.aicte-	3	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i>.2024. Publisher(s): Aryan Publishing House	Presentation activities and interactive activities with punctuation.

		2.6 Techniques for writing precisely (Ch-2.6, page71)	india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Formal business Correspondence, project, and business writing.			
3.	Identifying Common Errors in Writing	3.1-Subject – Verb agreement (Ch-3.1, page- 85) 3.2- Noun-Pronoun Agreement (Ch-3.2, page 89) 3.3- Misplaced modifiers (Ch-3.3, page 93) 3.4- Articles and Prepositions (Ch-3.4, 97) 3.5-Redundancies and Clichés (Ch-3.5, page 102)	International Academia: https://ocw.mit.edu/courses/24-900-introduction-to-linguistics-spring-2022/ AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Formal business Correspondence.	4	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i> .2024. Publisher(s): Aryan Publishing House	Presentation skills on grammar and related topics on modifiers and redundancies.

4.	Nature and Style of Sensible Writing	4.1- Describing, Defining and Classifying (Ch- 4.1, page- 123) 4.2- Providing examples or evidence (Ch-4.2, page- 125) 4.3- Writing introduction and conclusion (Ch- 4.3, page- 129)	International Academia: https://ocw.mit.edu/courses/21w-794-graduate-technical-writing-workshop-january-iap-2019/ AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Email writing and writing other relevant corporate documents.	3	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i>.2024. Publisher(s): Aryan Publishing House	Creative writing skills on descriptive essays, expository writing, persuasive writing, and Narrative writing.
5.	Writing Practices	5.1- Comprehension (Ch-5.1, page- 142) 5.2- Precis Writing (Ch-5.2, page- 149)	International Academia: https://ocw.mit.edu/course/21g-225-	5	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i>.2024. Publisher(s): Aryan Publishing House	Activities on reading comprehension and creative writing skills and assignments on concise writing.

		5.3- Essay Writing (Ch-5.5, page- 152) 5.4 Business Correspondence (Letter Writing, Business Letter, Cover Letter, Memos, Email) (Ch- 5.5, page- 156) 5.5- CV Writing (Ch-5.5, page- 166)	advanced-workshop-in-writing-for-science-and-engineering- els-spring- 2016/ AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Project writing and documentation			
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6.	Listening and Speaking Practices	6.1- Listening Comprehension (Ch- 6.1, page-182) 6.2- Pronunciation, intonation, Stress, and rhythm (Ch-6.2, page-182) 6.3- Common everyday situation: Conversations and dialogues (Ch- 6.3, page- 184) 6.4-Communication at Workplace (Ch- 6.4, page-188) 6.5- Interviews & Group Discussions (Ch- 6.5, page- 188) 6.6- Formal Presentations (Ch- 6.6, page- 188)	International Academia: https://ocw.mit.edu/courses/21g-223-listening-speaking-and-pronunciation-fall-2004/ https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/ https://online.stanford.edu/courses/gsb-x0011-sharpen-your-communication-skills AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf Industry Mapping: Campus Interviews and recruitment drives.	4	Das Biswas, Samapika & Riya Barui. <i>Mastering the Art of English</i>.2024. Publisher(s): Aryan Publishing House	Interactive Practice sessions in language lab.
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7.	Teaching Language through Literature	7.1 – <i>Tiger, Tiger, Burning Bright</i> 7.2 - <i>There Will Come Soft Rains</i> 7.3 – <i>Harrison Bergeron</i>	Industry Mapping: Aligns with industry expectations by fostering communication proficiency, creativity, and information-processing skills that support employability in diverse professional sectors.	2	1.Ruskin Bond 2.Ray Bradbury 3. Kurt Vonnegut	Activities on reading comprehension and creative writing skills and assignments on concise writing.
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Tools Used:

Generative AI: Chatgpt, Gemini, Meta AI

Image generator: Dall-E, Nvidia, Canva

Plagiarism checker: GptZero, Ithenticate

ATS Resume Checker

TEXTBOOKS:

1. Das Biswas, Samapika & Riya Barui. *Mastering the Art of English*.2024. Publisher(s): Aryan Publishing House.
2. Raman, Meenakshi. *Technical Communication Principles*. Oxford University Press.
3. Prasad, P. *Universal English in the Twenty-First Century*. Katson Books, Published by S.K. Kataria and Sons. AICTE Approved.

REFERENCE BOOKS:

1. Rizvi, M. Ashraf. *Effective Technical Communication*. Publishers: McGraw Hill, Education.
2. Kumar, Sanjay & Pushp Lata. *Communication Skills*. Oxford University Press.
3. Chauhan, Gajendra Singh, Smita Kashiramka, and L. Thimmesha. *Functional English*. Published by Cengage Learning India Private Limited.
4. *Tiger, Tiger, Burning Bright* by Ruskin Bond
5. *There Will come Soft Rains* by Ray Bradbury
6. *Harrison Bergeron* by Kurt Vonnegut