B.Tech. 1st Year Course Structure : 2026-2027 – Odd Semester									
Semester 1 (Group – A)									
Sl. No.	**Type of Course**	**Subject code**	**Subject name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
THEORY									
1	**Basic Science Course**	**BSCPH101**	**Physics**	**3**	**1**	**0**	**0**	**4**	**4**
2	**Basic Science Course**	**BSCM103A**	**Mathematics - Calculus**	**3**	**1**	**0**	**0**	**4**	**4**
3	**Basic Science Course**	**BSCBE104**	**Biology for Engineers**	**2**	**0**	**0**	**0**	**2**	**2**
4	**Engineering Science Course**	**ESCEE101**	**Basic Electrical Engineering**	**3**	**1**	**0**	**0**	**4**	**4**
5	**Engineering Science Course**	**ESME102A**	**Engineering Mechanics - Principles**	**1**	**1**	**0**	**0**	**2**	**2**
6	**Engineering Science Course**	**ESCCS101**	**Programming for Problem Solving using C**	**2**	**1**	**0**	**0**	**3**	**3**
7	**General Studies Course**	**ESP101**	**Essential Studies for Professionals - I**	**1**	**0**	**0**	**0**	**1**	**1**
PRACTICAL									
8	**Basic Science Course**	**BSCPH191**	**Physics Laboratory**	**0**	**0**	**3**	**0**	**3**	**1.5**
9	**Basic Science Course**	**BSCBE194**	**Biology for Engineers Laboratory**	**0**	**0**	**2**	**0**	**2**	**1**

10	Engineering Science Course	ESCEE191	Basic Electrical Engineering Laboratory	0	0	2	0	2	1
11	Engineering Science Course	ESCME192	Engineering Graphics & Design	1	0	4	0	5	3
12	Engineering Science Course	ESCCS191	Programming for Problem Solving Laboratory using C	0	0	4	0	4	2
SESSIONAL									
13	Mandatory Courses	IKS171	Indian Knowledge System for Engineers	0	0	0	2	2	2
Mandatory Industry and Value Added Courses (IVC)									
14	Mandatory Industry and Value Added Courses (IVC)	IVC181	Design Thinking & Innovation- Basic	0	0	0	1	1	0
15	Mandatory Industry and Value Added Courses (IVC)	IVC182	Economics, Finance and Entrepreneurship Skills - Basic	0	0	0	1	1	0
Total Credit Points of Semester				16	5	15	4	40	30.5
16	Mandatory Courses	MAR	Mandatory Additional Requirements	0	0	0	0	0	0
17	Mandatory Online Courses	MOOCs	Massive Open Online Courses	0	0	0	0	0	0
18	Mandatory Online Courses	IFC	Industry and Foreign Certification	0	0	0	0	0	0
19	Mandatory Courses	SAR	Skill Additional Requirements	0	0	0	0	0	0
Skill Addition Requirements (SAR) 1. Foreign Language, 2. Physical Education, 3. Soft Skill									

B.Tech. 1st Year Course Structure : 2026-2027 – Odd Semester									
Semester 1 (Group – B)									
Sl. No.	**Type of Course**	**Subject code**	**Subject name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
THEORY									
1	**Basic Science Course**	**BSCCH102**	**Chemistry**	**3**	**1**	**0**	**0**	**4**	**4**
2	**Basic Science Course**	**BSCM103B**	**Mathematics and Basic Statistics**	**3**	**1**	**0**	**0**	**4**	**4**
3	**Humanities and social sciences including Management**	**HSMC101**	**English**	**2**	**0**	**0**	**0**	**2**	**2**
4	**Engineering Science Course**	**ESCEC101**	**Basic Electronics Engineering**	**3**	**1**	**0**	**0**	**4**	**4**
5	**Engineering Science Course**	**ESME102B**	**Engineering Mechanics - Essentials**	**1**	**1**	**0**	**0**	**2**	**2**
6	**Engineering Science Course**	**ESCCS101**	**Programming for Problem Solving using C**	**2**	**1**	**0**	**0**	**3**	**3**
7	**General Studies Course**	**ESP101**	**Essential Studies for Professionals - I**	**1**	**0**	**0**	**0**	**1**	**1**
PRACTICAL									
8	**Basic Science Course**	**BSCCH192**	**Chenistry Laboratory**	**0**	**0**	**3**	**0**	**3**	**1.5**
9	**Humanities and social sciences including Management**	**HSMC191**	**Language laboratory**	**0**	**0**	**2**	**0**	**2**	**1**
10	**Engineering Science Course**	**ESCEC191**	**Basic Electronics Engineering Laboratory**	**0**	**0**	**2**	**0**	**2**	**1**

11	Engineering Science Course	ESCME193	Workshop/ Manufacturing Practices	1	0	4	0	5	3
12	Engineering Science Course	ESCCS191	Programming for Problem Solving Laboratory using C	0	0	4	0	4	2
SESSIONAL									
13	Mandatory Courses	IKS171	Indian Knowledge System for Engineers	0	0	0	2	2	2
Mandatory Industry and Value Added Courses (IVC)									
14	Mandatory Industry and Value Added Courses (IVC)	IVC181	Design Thinking & Innovation- Basic	0	0	0	1	1	0
15	Mandatory Industry and Value Added Courses (IVC)	IVC182	Economics, Finance and Entrepreneurship Skills - Basic	0	0	0	1	1	0
Total Credit Points of Semester				16	5	15	4	40	30.5
16	Mandatory Courses	MAR	Mandatory Additional Requirements	0	0	0	0	0	0
17	Mandatory Online Courses	MOOCs	Massive Open Online Courses	0	0	0	0	0	0
18	Mandatory Online Courses	IFC	Industry and Foreign Certification	0	0	0	0	0	0
19	Mandatory Courses	SAR	Skill Additional Requirements	0	0	0	0	0	0
Skill Addition Requirements (SAR) 1. Foreign Language, 2. Physical Education, 3. Soft Skill									

B.Tech. 1st Year Course Structure : 2026-2027 – Even Semester									
Semester 2 (Group – A)									
Sl. No.	**Type of Course**	**Subject code**	**Subject name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
THEORY									
1	**Basic Science Course**	**BSCCH202**	**Chemistry**	**3**	**1**	**0**	**0**	**4**	**4**
2	**Basic Science Course**	**BSCM203B**	**Mathematics and Basic Statistics**	**3**	**1**	**0**	**0**	**4**	**4**
3	**Humanities and social sciences including Management**	**HSMC201**	**English**	**2**	**0**	**0**	**0**	**2**	**2**
4	**Engineering Science Course**	**ESCEC201**	**Basic Electronics Engineering**	**3**	**1**	**0**	**0**	**4**	**4**
5	**Engineering Science Course**	**ESME202B**	**Engineering Mechanics - Essentials**	**1**	**1**	**0**	**0**	**2**	**2**
6	**Engineering Science Course**	**ESCCS202**	**Introduction to AI and Data Science using Python**	**2**	**1**	**0**	**0**	**3**	**3**
7	**General Studies Course**	**ESP201**	**Essential Studies for Professionals - II**	**1**	**0**	**0**	**0**	**1**	**1**
PRACTICAL									
8	**Basic Science Course**	**BSCCH292**	**Chemistry Laboratory**	**0**	**0**	**3**	**0**	**3**	**1.5**
9	**Humanities and social sciences including Management**	**HSMC291**	**Language laboratory**	**0**	**0**	**2**	**0**	**2**	**1**
10	**Engineering Science Course**	**ESCEC291**	**Basic Electronics Engineering Laboratory**	**0**	**0**	**2**	**0**	**2**	**1**
11	**Engineering Science Course**	**ESCME293**	**Workshop/ Manufacturing Practices**	**1**	**0**	**4**	**0**	**5**	**3**

12	Engineering Science Course	ESCCS292	Introduction to AI and Data Science Laboratory using Python	0	0	4	0	4	2
SESSIONAL									
13	Humanities and social sciences	UHV272	Universal Human Values- II	0	0	0	2	2	3
Mandatory Industry and Value Added Courses (IVC)									
14	Mandatory Industry and Value Added Courses (IVC)	IVC281	Design Thinking & Innovation- Imtermediate	0	0	0	1	1	0
15	Mandatory Industry and Value Added Courses (IVC)	IVC282	Economics, Finance and Entrepreneurship Skills – Intermediate	0	0	0	1	1	0
Total Credit Points of Semester				16	5	15	4	40	31.5
16	Mandatory Courses	MAR	Mandatory Additional Requirements	0	0	0	0	0	0
17	Mandatory Online Courses	MOOCs	Massive Open Online Courses	0	0	0	0	0	0
18	Mandatory Online Courses	IFC	Industry and Foreign Certification	0	0	0	0	0	0
19	Mandatory Courses	SAR	Skill Additional Requirements	0	0	0	0	0	0
Skill Addition Requirements (SAR) 1. Foreign Language, 2. Physical Education, 3. Soft Skill									

B.Tech. 1st Year Course Structure : 2026-2027 – Even Semester									
Semester 2 (Group – B)									
Sl. No.	**Type of Course**	**Subject code**	**Subject name**	**L**	**T**	**P**	**S**	**Total Contact Hours**	**Credit Points**
THEORY									
1	Basic Science Course	BSCPH201	Physics	3	1	0	0	4	4
2	Basic Science Course	BSCM203A	Mathematics - Calculus	3	1	0	0	4	4
3	Basic Science Course	BSCBE204	Biology for Engineers	2	0	0	0	2	2
4	Engineering Science Course	ESCEE201	Basic Electrical Engineering	3	1	0	0	4	4
5	Engineering Science Course	ESME202A	Engineering Mechanics - Principles	1	1	0	0	2	2
6	Engineering Science Course	ESCCS202	Introduction to AI and Data Science using Python	2	1	0	0	3	3
7	General Studies Course	ESP201	Essential Studies for Professionals - II	1	0	0	0	1	1
PRACTICAL									
8	Basic Science Course	BSCPH291	Physics Laboratory	0	0	3	0	3	1.5
9	Basic Science Course	BSCBE294	Biology for Engineers Laboratory	0	0	2	0	2	1
10	Engineering Science Course	ESCEE291	Basic Electrical Engineering Laboratory	0	0	2	0	2	1
11	Engineering Science Course	ESCME292	Engineering Graphics & Design	1	0	4	0	5	3

12	Engineering Science Course	ESCCS292	Introduction to AI and Data Science Laboratory using Python	0	0	4	0	4	2
SESSIONAL									
13	Humanities and social sciences	UHV272	Universal Human Values- II	0	0	0	2	2	3
Mandatory Industry and Value Added Courses (IVC)									
14	Mandatory Industry and Value Added Courses (IVC)	IVC281	Design Thinking & Innovation- Intermediate	0	0	0	1	1	0
15	Mandatory Industry and Value Added Courses (IVC)	IVC282	Economics, Finance and Entrepreneurship Skills - Intermediate	0	0	0	1	1	0
Total Credit Points of Semester				16	5	15	4	40	31.5
16	Mandatory Courses	MAR	Mandatory Additional Requirements	0	0	0	0	0	0
17	Mandatory Online Courses	MOOCs	Massive Open Online Courses	0	0	0	0	0	0
18	Mandatory Online Courses	IFC	Industry and Foreign Certification	0	0	0	0	0	0
19	Mandatory Courses	SAR	Skill Additional Requirements	0	0	0	0	0	0
Skill Addition Requirements (SAR) 1. Foreign Language, 2. Physical Education, 3. Soft Skill									

University of Engineering and Management

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

Syllabus for B.Tech Admission Batch 2026

Subject Name: Mathematics-Calculus **Credit: 4** **Lecture Hours: 48**

Subject Code: BSCM103A

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)**	Function, Limit and Continuity with graphical concepts. 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; Evolutes and Involutes.	**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 **R** • Draw the greatest integer and least functions in the interval [0, 5]. 2. Draw the graph of the evolute of a parabola.

				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		

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.

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	1. Find partial differentiation of any function of two or three variables. 2. Find gradient, divergence and curl of any vector valued function. 3. Find the directional derivative of any vector. 4. 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, Integral Test, D'Alembert's Ratio Test, Raabe's Test and Cauchy's Root test. Alternating Series - Leibnitz's test [Statement only], Absolute and Conditional Convergence.		https://in.mathworks.com/ https://www.wolfram.com/mathematica/		

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 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	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

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

Syllabus for B.Tech. Admission Batch 2026

Subject Name: Physics **Credit: 4** **Lecture Hours: 42**

Subject Code: BSCPH101 / BSCPH201

Pre-requisite: Physics of Higher Secondary Standard

Relevant Links:

Study Material **Coursera** **NPTEL** **IEMLearning**

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 - Characteristic 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 Bhattachary a, 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, Shape of Interference Fringes, Coherence, Change of Phase Due to Reflection: Stokes' Law, Interference in a Thin film (Reflected Light), Interference in a Wedge-Shaped film, Newton's Ring. **Diffraction:** Introduction, Different types of diffraction phenomena, difference between interference and diffraction, Fraunhofer diffraction due to a single slit, Fraunhofer diffraction due to a double slit, Difference between Single slit and a double slit diffraction pattern, Diffraction due to Plane Diffraction Grating, Rayleigh's Criteria on Resolution, Resolving Power of a Grating, Application of Diffraction Grating. **Laser:** Introduction, Characteristics of laser,	***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.

		Absorption and emission of radiations by matter, Einstein's A and B Coefficients, working principle of 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, Potentials of Electromagnetic Field, Electromagnetic Waves in a Charge-Free Conducting Media and Skin Depth, Skin Depth or Depth of Penetration (δ), Electromagnetic Energy Flow and Poynting Vector, Average Power Calculation Using Poynting Vector	***Engineerin g Physics***, Sujay Kumar Bhattachar ya, 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 and Extension in Quantum well and Dots, Quantum Harmonic Oscillator, The Hydrogen Atom	***Engineering Physics***, Sujay Kumar Bhattachary a, 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

6	**Statistical Mechanics**	**Statistical Mechanics** : Introduction, Concept of Phase Space, Concept of Energy levels and Energy states, Macrostate and Microstate, Thermodynamic Probability and Entropy, Equilibrium Macrostate, MB, BE and FD statistics, Maxwell-Boltzmann (MB) Statistics, Bose-Einstein (BE) Statistics, Fermi-Dirac (FD) Statistics, Classical Statistics as a special case of Quantum Statistics, Density of states or Quantum states in energy range between ε and ε+dε, Fermi distribution at zero and non-zero temperature, Derivation of Planck's Law of Radiation, Density of States Function Concept, Comparative study of three Statistical Distribution functions.	***Engineering Physics***, Sujay Kumar Bhattachary a, Mc Graw Hill Education, Chapter 11.	***International Standards:*** ***https://catalog.mit.edu/ subjects/8/*** ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	6	

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)

University of Engineering and Management

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

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

Index:

Syllabus Structure:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Theory	BSCBE104	Biology For Engineers	3	0	2	5	4

University of Engineering and Management

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

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

Subject Name: Biology for Engineers **Credit: 3** **Lecture Hours: 36**

Subject Code: BSCBE104

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**	**1**	**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	Biology for Engineers **Chapter:1**	**International standard** https://ocw.mit.edu/courses/7-014-introductory-biology-spring-2005/resources/17-carbon-and-	**2**	1. Phylogenetic tree construction (Bioinformatics)

		eukaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitat- acquatic or terrestrial (f) Molecular taxonomy and phylogentics: 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. elanogaster, C. elegance, A. thaliana, M. musculus.		energy-metabolism/ ***AICTE prescribedsyllabus:***(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf***) ***IndustryMapping: 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 give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders	Campbell Biology: Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman,S.A.;Minorsky,P.V.;Jackson. 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 prescribedsyllabus:***(***https://ww***	**3**	1.Study of Genetic Variation (Alien Genetics | Biology | CK-12 PLIX Series https://www.labxchange.org/)

		in humans. Discuss the concept of complementation using human genetics.		***w.aicte-india.org/sites/default/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****)***	**3**	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

				AICTE prescribedsyllabus:(***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf***) ***IndustryMapping:*** *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	Biochemistry:Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto,	***International Standards:*** (https://ocw.mit.edu/search/?q=Enzymes&type=resourcefile)	**3**	1.Enzyme kinetics using UV-Vis spectrophotometer

		two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis	5th Edition. WH Freeman & Co **Chapter: 8**	***(***https://harvard.simplesyllabus.com/en-US/doc/sy2y033op***)*** - ***AICTE prescribedsyllabus:*****(*****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	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-*	**3**	1.Sequence alignment-Pairwise (Global and Local) and BLAST 2.Identification of DNA using Agarose gel electropho-resis

		and Application), Sequence alignment- Pairwise and BLAST.		*01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/dna-replication/)* (https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/transcription-translation/) *-**AICTE prescribedsyllabus:**(**https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf**)* ***IndustryMapping:** (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.	Biochemistry:Jeremy M. Berg, Lubert Stryer, John L.	***International Standards:**(https://ocw.mit.edu/courses/7-01sc-*	**3**	Membrane Channels (Membrane Channels - LabXchange)

		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.	Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co. **Chapter:3,13**	*fundamentals-of-biology-fall-2011/pages/biochemistry/proteins-levels-of-structure-non-covalent-forces/)* ***AICTE prescribed syllabus:(https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf*** ***IndustryMapping:*** ***(****https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3090454/)* ***(https://nmr.science.oregonstate.edu/macromolecular-analysis)*** ***(****https://moduler.aau.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 CO_2 + H_2O (Glycolysis and Gluconeogenesis and Krebs cycle). Electron transport chain and Oxidative phosphorylation **Photosynthesis:** Synthesis of glucose from $CO_2$and H_2O. Cyclic and non-cyclic photophosphorylation. Calvin cycle. CAM cycle.	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-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-*	**3**	Bioenergetics (https://www.labxchange.org/)

				principle-photosynthesis/) *(https://harvard.simplesyllabus.com/en-US/doc/sy2y033op)* ***AICTE prescribedsyllabus:*** (***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf***) ***IndustryMapping:*** (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* ***IndustryMapping:*** *https://pages.primuslabs.com/primuslabs-new-client-usa.html?gclid=CjwKCAiA9ourBhAVEiwA3L5RFieYQ2c6mskEkqLg0_vaDlTGFqq7Ah5YAt_vHdeawcqIhQ3ItsjM3BoChLIQAvD_BwE*	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 *E.coli.*

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.MJ.P.Harley and C.A.Klein1995.2nd editionWmC. Brown Publishers
3. Principles of Biochemistry (VEdition),By Nelson,D. L.;and Cox,M.M.W.H.Freeman nd Company
4. Outlines of Biochemistry,Conn,E.E;Stumpf,P.K;Bruening,G;Doi,R.H.JohnWileyand 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

Syllabus Structure

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Engineering Science Course	ESCEE101	Basic Electrical Engineering	3	1	0	4	4
2	Engineering Science Course	ESCEE191	Basic Electrical Engineering Laboratory	0	0	2	2	1
				Total Credit points				5

- **Subject Name:** Basic Electrical Engineering
- **Subject Code:** ESCEE101/ESCEE191
- **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. Time-domain analysis of first-order RL and RC circuits.	***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	Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	***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	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

						verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
3	Transformer	Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer Introduction to three-phase transformer.	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** 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:** 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 different starters, Introduction to synchronous motor **DC machine:** Construction, working, torque-speed characteristic and speed control of separately excited dc motor	***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 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 winging -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.

5	Power Converters	DC-DC buck and boost converters, Single phase bridge rectifier with R load, Introduction to different types of inverter and its application.	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	6	Power Electronics By P.S. Bhimbra New Age Publication, Chapter 7	Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc- ac converter for speed control of an induction motor and (d) Components of LT switchgear.
6	Miscellaneous	Basics of electrical installation components: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Introduction to other energy sources e.g. Wind, Solar, Fuel cell, BESS, Critical challenges associated with global energy systems	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** https://www.aicte.gov.in/downloads/msyllabus/UG/ELECTRICAL%20Engg%20Final.pdf	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) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an Induction motor and (d) Components of LT switchgear. Demonstration of (a) PV module, (b) Battery energy storage system

- **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)

University of Engineering and Management

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

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

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

Subject Code: ESME102A
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/courses/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/courses/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/courses/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 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	**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/courses/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
5	**Kinematics of Particles**	Definitions and basic concepts of particle motion, Rectilinear motion: equations of motion for constant and variable acceleration, Projectile motion, Introduction to	***International Academia:*** ***https://ocw.mit.edu/courses/2-003sc-engineering-dynamics-fall-2011/*** ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/***	5	Use Mujoco or PyBullet to simulate a particle's trajectory under different initial velocities and accelerations.	B.B. Ghosh, S. Chakrabarti, S. Ghosh "Engineering Mechanics" - Part II – Chapters 1,2

		relative motion.	***Model_Curriculum/Final_Mechanical%20Engg.pdf*** ***Industry Mapping:*** *Mujoco, PyBullet*		Analyze how changes in parameters affect the path	
6	**Kinetics of Particles**	Application of Newton's laws and D' Alembert's principles to solve motion problems	***International Academia:*** ***https://ocw.mit.edu/courses/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

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

University of Engineering and Management

Institute of Engineering & Management, Salt Lake CampusInstitute of Engineering & Management, New Town CampusUniversity of Engineering & Management, Jaipur

Subject Name: Programming for Problem Solving using C **Credit: 3** **Lecture Hours: 36**

Subject Code: ESCCS102/ESCCS192

Lecture Notes | Coursera | NPTEL | LinkedIn Learning | Infosys Springboard

Course Objectives:

Upon successful completion of this course, students will be able to:

- Understand core programming principles and the C programming language.
- Develop C programs to solve computational problems.
- Utilize C libraries for common programming tasks.
- Employ effective programming practices.
- Gain a foundation for further computer science studies.
- Appreciate C programming's industry relevance.

Course Outcomes:

CO1: Impart the fundamental concepts of problem-solving approaches and algorithmic thinking

CO2: Provide comprehensive knowledge of the C programming language, including character sets, expressions, and operators

CO3: Demonstrate control over program flow and logic using input/output operations, control structures, and program organization

CO4: Enable students to solve real-world challenges by applying advanced concepts such as functions, arrays, pointers, data structures and file handling in building end-to-end applications

Module	Topic	Sub-topics	Mapping with Industryand International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Introduction to C**	**Introduction:** • The Von-Neuman Architecture, • Hardware and Software, • Phases of a program execution, • Compiler vs Interpreter, • Phases of a C Program Compilation • Execution of a C Program **Structure of C Program:** • The first C Program: Hello World • Preprocessor Directives • Header Files • The MAIN function • Keywords &Identifiers • Statements • Punctuations and Various Brackets	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** – Understanding File systems, command line interfaces and programming practices **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a C program that prints "Hello, World!" and your name on separate lines. Add comments explaining each part. • Write a simple C program and conceptually explain the preprocessor, compiler, assembler, and linker phases. Compile and execute it. Introduce an error and observe the compiler message. • List five C keywords with their purposes. Provide five valid and five invalid identifiers with explanations. Write a short program using at least three keywords and three valid identifiers.
2	**Data Representation, I/O and Operators**	**Datatypes** – • Binary Representation, Allocation Size, Range. • Console I/O - printf() & scanf() • Formatted Strings • Format Specifiers • Escape Sequences. **Operators -** • Operands and Expressions • Unary, Binary, Ternary	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** – Understanding the concept of memory representation of data **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a C program to print the size and range of int, char, float, double, short int, long int, and long double using sizeof(). Experiment with out-of-range values. • Write a program to get user input for name and age and print it back using printf() with appropriate format specifiers. Format the output neatly. Explore different format specifiers. • Write a program that takes two integers and performs addition, subtraction, multiplication, integer division, and modulus, printing the results. • Write a program demonstrating prefix and postfix increment and decrement operators, explaining

		Operators • Arithmetic, Logical, Assignment, Relational, Bitwise, Increment, Decrement, Conditional Operators • Operator Precedence			their difference. • Write a program using logical operators (&&, ||, !) to evaluate a simple condition based on user input. • Write a program using bitwise operators (&, |, ^, ~, <<, >>) on two integers and print the binary results (helper function might be needed). • Write a program with an expression involving multiple operators of different precedence levels. Predict and verify the output.
3	**Control Flow**	**Conditions**: • If, Else, Else if • Nested Conditions • Switch-case • Goto. **Iterations:** • While loop, • Do-while loop, • For loop, • Break and continue, • Nested loops	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** Learning to build Flowcharts **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	6	• Write a program to check if an input integer is positive, negative, or zero. • Write a program to find the largest of three input integers using nested if-else. • Write a program that takes a character and uses switch-case to identify it as a vowel or consonant (case-insensitive), including a default case. • (Optional) Demonstrate a simple use of goto and explain why it should be used cautiously. • Write a program using a while loop to print the first n natural numbers (n is user input). • Write a program using a do-while loop to repeatedly ask for a positive number until one is entered. • Write a program using a for loop to calculate the sum of even numbers from 1 to 100. • Write a program with a nested loop to print a simple pattern of asterisks. • Write a program with a for loop from 1 to 10. Use break to exit when the number is 5, printing preceding numbers. • Write a program with a for loop from 1 to 10. Use continue to skip even numbers and print only odd numbers.
4	**Arrays and Strings**	**Arrays:** • Declaration and Initialization, • Indexing	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Exploring the	5	• Declare and initialize an integer array of size 5. Print all elements with their indices. • Write a program to find the sum and average of elements in an integer array. • Write a program to find the largest and smallest

		• Memory Layout • Multidimensional Arrays **Strings:** • Character arrays vs strings • Declaring and initializing strings, • String Input and Output • String library functions	foundations of structured data representation and manipulation. **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita		element in an integer array. • Declare and initialize a 2x3 integer matrix. Print all elements in row-major order. • Write a program to add two 2x2 matrices and print the resulting matrix. • Declare a character array and initialize it with a string literal. Print the string by iterating until the null terminator. • Declare a string using a string literal directly and print it using printf() with %s. • Write a program to get a string input from the user and print it back using scanf() (be aware of buffer overflow) and printf(). • Repeat the above using fgets() for safer string input. • Write a program that takes two strings and uses strlen(), strcpy(), strcat(), and strcmp() from <string.h> to demonstrate their functionalities. •
5	**Function and Recursion**	• Declaration, Definition, & Calling • Formal vs Actual parameters • Return type • Recursion • Scope: local vs global variables • Storage classes: auto, static, extern, register	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Understanding the foundation of procedural programming, code reusability **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a function add (int a, int b) that returns the sum. Call it from main with sample values and print the result. • Write a function is Even(int num) that returns 1 if even, 0 otherwise. Call it from main and print a message based on the return value. • Write a function square (int x). In main, pass a variable to square (call by value) and show the original variable remains unchanged. Explain formal vs. actual parameters. • Write a recursive function factorial (int n). Call it from main and print the result. • Write an iterative function factorial_iterative (int n). Compare it with the recursive version. • Write a program demonstrating local and global variables with the same name, showing which is accessed within a function. • Write a program using a static local variable in a function to show its value persists across calls.

6	**Pointers**	• Concept of memory address, • Declaring and using pointers, • & and * operators. • Call by value vs Call by Reference, • Pointers and arrays, • Pointers with strings, • Pointers to pointers, • Dynamic memory allocation • Command-line arguments.	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Explore direct memory manipulation capabilities of C. **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	6	• Declare an integer and a pointer to an integer. Assign the integer's address to the pointer. Print the integer's value directly and indirectly, and print the address and pointer value. • Demonstrate the use of & (address-of) and * (dereference) operators. • Write swap_value(int a, int b) that doesn't swap original values in main (call by value). Explain why. • Write swap_reference(int *a, int *b) that swaps original values using pointers (call by reference). • Declare an integer array and a pointer to its first element. Iterate using pointer arithmetic and print each element. Show the array name acts as a pointer. • Declare a string literal and assign its address to a character pointer. Iterate and print each character until the null terminator. • Declare an integer, a pointer to an integer, and a pointer to a pointer. Demonstrate accessing the original value using the double pointer. • Write a program to get the size of an integer array from the user and use malloc() to allocate memory. Read values, print them, and then free() the memory. • Repeat the dynamic allocation using calloc() and observe the initialization difference. • Write a program to dynamically resize an array using realloc() after initial allocation. • Write a program that takes two command-line arguments (numbers) and prints their sum.
7	**Structures & Unions**	**Structures**: • Defining and declaring structures, • Accessing members • User-defined data types - typedef • Passing structures to	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Learning to construct user-defined datatypes. **Platforms & IDEs:** GitHub, VSCode,	4	• Define a Student structure (name, roll_no, marks). Declare and initialize a Student variable. Print its information using the dot operator. • Use typedef to create an alias for the Student structure. Declare and initialize a variable of the new type. • Write a function displayStudent(struct Student s) to print student info (pass by value). Call it from

		functions, • Arrays of structures, • Nested structures **Unions**: • Syntax & memory layout of unions • Struct vs. union • Enum definition and use in switch-case • Enum vs #define constants	GCC **Competitive Coding:** HackerRank, Leetcode, Codevita		main. • Write a function updateMarks(struct Student *s, float new_marks) to update marks (pass by reference). Call it from main. • Declare an array of three Student structures, initialize them, and print the information of all students. • Define an Address structure (street, city, zipcode). Modify Student to include an Address member. Declare, initialize, and print a Student with address details. • Define a Data union (int or float). Declare a variable, assign an int and print, then assign a float and print. Observe the output. • Write a short explanation comparing and contrasting structures and unions. • Define an enum DayOfWeek. Write a program that takes an integer input and uses a switch-case with the enum to print the day name. • Explain the advantages of using enums over #define constants for related integer constants.
8	**File Handling**	• The file pointer • Opening & closing a file • Reading and Writing Files • Formatted: fprintf and fscanf • Character: fputc and fgetc • String: fputs and fgets • File Modes • ftell,fseek,rewind,feof	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** Learning to build advanced project with database integration **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	3	• Write a program to open "my_file.txt" in write mode, write a few lines, and close it. Then, open it in read mode and print each line until EOF. • Create a Product structure (name, price). Write a program to write info for three products into a file using fprintf(). Write another program to read this data back using fscanf() and print it. • Write a program to open a file in write mode and use fputc() to write a string character by character. Write another program to read it back using fgetc() until EOF. • Write a program to open a file in write mode and use fputs() to write a few strings (one per line). Write another program to read them back using fgets() until NULL. • Experiment with different file modes ("r", "w", "a", "r+", "w+", "a+") with small programs to understand their behavior.

					• Write a program to open a file, write data, use ftell() to get the position, fseek() to go to the beginning and read, and rewind() to go to the beginning and read again. • Write a program that reads a file character by character using fgetc() and uses feof() to detect the end and stop reading.

Text Books:

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2. Reema Thareja, Computer Fundamentals and programming in C, Oxford University Press
3. Yashavant Kanetkar, Let Us C, BPB Publications,13th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

Alternate Courses:

NPTEL – Introduction to programming in C, Satyadev Nandakumar, IIT Kanpur - https://nptel.ac.in/courses/106104128
COURSERA – Introductory C Programming Specialization- Andrew D. Hilton- https://www.coursera.org/specializations/c-programming

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

Syllabus for B.Tech. Admission Batch 2026

Course Name: Physics Laboratory	
Course Code: BSCPH191/291	
Course Code: BSCPH191/291	**Category:** Basic Science Courses
Course Title: Physics Laboratory	**Semester:** First/Second
L-T-P: 0-0-3	Credit: 1.5
Pre-Requisites: Basic Knowledge of Algebraic Calculation and graph plot, Basic knowledge about measurement techniques by vernier calipers and screw gauge, Basic concepts of 12^{th} standard physics	
Course Outcomes CO1. Apply the working principles, learn to handle instruments, analyze data and comparison of results with theoretical calculations. CO2. Develop familiarity with range of experiments related to elastic, electric and electronic properties of materials. CO3. Verify theories of different optical and quantum phenomenon by conducting relevant experiments. CO4. Develop an ability to work in team to design innovative projects with engineering knowledge in solving real time problems in societal and environmental contexts.	

List of Hands on experiment to be conducted in the laboratory			
Sl No.	**Name of Experiments**	**Digital Twin link**	**Mapping with MIT & Stanford**
1	Determination of Planck's constant by photoelectric emission process.	http://vlab.amrita.edu/?sub=1&brch=195&sim=547&cnt=1	https://applets.kcvs.ca/photoelectricEffect/PhotoElectric.html
2	To determine the radius of curvature of a Plano convex lens by formation of Newton's ring method	https://lo-au.vlabs.ac.in/laser-optics/Newtons_Rings_Wavelength_of_light/experiment.html	NA
3	To determine the wavelengths of a given light source by diffraction grating method	https://ov-au.vlabs.ac.in/optics/Diffraction_Grating/	NA
4	Determination of the excitation potential of a given gas by Franck-Hertz experiment	https://www.laboratoriovirtual.fisica.ufc.br/experimento-de-frank-hertz?lang=en	https://www.laboratoriovirtual.fisica.ufc.br/experimento-de-frank-hertz?lang=en
5	To determine the Young's Modulus of material of a bar by Flexure method	https://amv-au.vlabs.ac.in/advanced-mechanics/Youngs_Modulus_Uniform_Bending/	NA
6	Determination of the band-gap of a semiconductor by measuring the resistivity at different Temperatures by four-probe method	https://bop-iitk.vlabs.ac.in/exp/energy-band-gap/index.html	NA
7	To determine the resistance per unit length of a given bridge wire and hence to determine the very low unknown resistance	https://bop-iitk.vlabs.ac.in/exp/carey-foster-bridge/index.html	NA

	by using Carey Foster's bridge		
8	To determine the Modulus of rigidity of a material of a rod by static method	https://amv-au.vlabs.ac.in/advanced-mechanics/Rigidity_Modulus/experiment.html	NA
9	To determine the Modulus of rigidity of a material of a wire by dynamic method	https://amv-au.vlabs.ac.in/advanced-mechanics/Rigidity_Modulus_Torsion_Pendulum/	NA
10	Determination of Planck's Constant using LED	http://vlab.amrita.edu/?sub=1&brch=195&sim=547&cnt=1	NA
11	To study the different characteristics of a solar cell	https://vlab.amrita.edu/?sub=1&brch=195&sim=360&cnt=1	NA
12	Determination of Hall coefficient.	https://mpv-au.vlabs.ac.in/modern-physics/Hall_Effect_Experiment/experiment.html	NA
13	To generate parametric oscillations in a string Melde's Experimental setup	NA	NA
14	Deflection of charged particle under electric field and magnetic field	NA	NA
15	Laser based free space communication.	NA	NA
16	To study the characteristics and morphology of a material by digital microscope.	NA	NA

18	Conversion of vibration to voltage using piezoelectric materials.	NA	NA
19	Conversion of thermal energy into voltage using thermoelectric modules.	NA	NA
21	Determining electronic charge by its mass (e/m) by JJ Thomson method.	NA	NA
22	Optical Emission Spectra of Hydrogenic Atoms	https://javalab.org/en/spectrum_of_hydrogen_en/	https://ocw.mit.edu/courses/8-13-14-experimental-physics-i-ii-junior-lab-fall-2016-spring-2017/pages/experiments/optical-emission-spectra-of-hydrogenic-atoms/
23	Doppler-Free Laser Spectroscopy	NA	https://ocw.mit.edu/courses/8-13-14-experimental-physics-i-ii-junior-lab-fall-2016-spring-2017/pages/experiments/doppler-free-laser-spectroscopy/
24	Michelson Interferometer	https://lo-au.vlabs.ac.in/laser-optics/Michelsons_Interferometer_Wavelength_of_Laser_Beam/	https://ocw.mit.edu/courses/8-13-14-experimental-physics-i-ii-junior-lab-fall-2016-spring-2017/pages/experiments/michelson-interferometer/
25	Determination of earth's magnetic field using Stewart & Gee's method	NA	NA

26	Determination of resonance using LCR circuit and DSO (Bread Board type)	https://bop2-iitk.vlabs.ac.in/exp/series-lcr-circuit/simulation.html	NA

Innovative Experiment	
1	Synthesis and Characterisation of nanomaterials using Chemical Bath and Pellet Press method.

List of virtual lab experiments			
Sl No	**Name of the experiment**	**Simulation software link**	**Mapping link with MIT/Standford**
1	Poisson Statistics	Using Matlab	https://ocw.mit.edu/courses/8-13-14-experimental-physics-i-ii-junior-lab-fall-2016-spring-2017/pages/experiments/poisson-statistics/
2	Compton Scattering	https://www.geogebra.org/m/dgx8uSXJ	https://ocw.mit.edu/courses/8-13-14-experimental-physics-i-ii-junior-lab-fall-2016-spring-2017/pages/experiments/compton-scattering/
3	Millikan's oil drop experiment	https://vlab.amrita.edu/?sub=1&brch=195&sim=357&cnt=2	

4	Numerical Aperture of Optical Fiber	https://vlab.amrita.edu/?sub=1&brch=189&sim=343&cnt=4	
5	Black Body Radiation	https://htv-au.vlabs.ac.in/heat-thermodynamics/Black_Body_Radiation/experiment.html	
6	Thermo Couple-Seebeck Effect	https://htv-au.vlabs.ac.in/Thermo_Couple_Seebeck_Effect/experiment.html	
List of Experiment/project using Generative AI			
1	Solve Schrodinger equation for quantum harmonic oscillator by using Elvet, a neural-network based differential equation solver. Compare analytical solution and Elvet's prediction by plotting. (Programming	gitlab.com/elvet/elvet https://arxiv.org/abs/2103.14575	NA

	language: Python 3)		
2	Consider a uniform gyroelectric medium. a plane electric wave linearly polarized along x axis is launched. The polarization vector will precess around the gyrotropy axis (z axis) as the wave propagates. This is called Faraday rotation. Using MEEP simulation software, gyroelectric material. Set Up and run MEEP simulation. Plot variation of Ex and Ey versus z.	https://meep.readthedocs.io/en/latest/Scheme_Tutorials/Gyrotropic_Media/	Meep (MIT Electromagnetic Equation Propagation) software package for electromagnetic simulations

LASER BASED PROJECTS:

1. **Build a LASER interferometer**
2. **Make LASER light at the laboratory**
3. **Engrave a QR code with LASER**

University of Engineering and Management,
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Institute of Engineering & Management, New Town Campus
University of Engineering & Management, Jaipur

Syllabus for B.Tech. Admission Batch 2026

Course Name: Biology for Engineers Laboratory

Course Code: BSCBE194

Course Code:	Category: Basic Science Courses
Course Title: Biology for Engineers Laboratory	Semester: First/ Second
L-T-P: 0-0-2	Credit:1
Pre-Requisites: Basic knowledge of Physics, Chemistry and Biology. Basic knowledge of Mathematics and graph plotting.	

Course Outcomes

CO1: Apply the working principles, learn to handle instruments, analyze data and comparison of results with theoretical knowledge.

CO2: Develop familiarity with the range of experiments related to microscopy, both protein and DNA gel assays, UV Visible Spectroscopy and microbial cell culture

CO3: Gain knowledge of Bioinformatics tools and apply them to relevant experiments

CO4: Develop an ability to work in a team to design innovative projects with engineering knowledge in solving real-time problems in societal and environmental contexts.

Expt. No.	List of Regular Experiments to be conducted in the laboratory
1	Microscopic analysis of a living cell.

2	Enzyme kinetics using UV-Visible Spectrophotometer.
3	Identification of bacteria through Gram Staining.
4	Identification of DNA through DNA gel electrophoresis.
5	Estimation of protein using Bradford Assay (UV-Visible Spectrophotometer)
6	Identification of proteins through SDS-PAGE
7	Sequence analysis with Bioinformatics tools
8	Protein's 3D structure prediction with the help of Alpha Fold (AI system developed by Google DeepMind)
9	Digital Twin Experiment: Digital Twin of Bacterial Growth (Microbiology Focus) Create a virtual model of Bacterial population growth to stimulate and predict how factors like nutrients or temperature affect proliferation, mirroring real cultures like E.coli.
10	Digital Twin Experiment: Simulation of growth and proliferation of eukaryotic species

List of Virtual experiments to be conducted in the laboratory		
Sl No	**Name of the experiment**	**Simulation software link**
10	Isoelectric Precipitation of Proteins: Casein from Milk	https://vlab.amrita.edu/?sub=3&brch=63&sim=158&cnt=1
11	Separation of Amino Acids by Thin Layer Chromatography	https://vlab.amrita.edu/?sub=3&brch=63&sim=154&cnt=1
12	Qualitative Analysis of Amino Acid	https://vlab.amrita.edu/?sub=3&brch=63&sim=1094&cnt=1
13	Bacterial Growth Curve	https://vlab.amrita.edu/?sub=3&brch=73&sim=1105&cnt=1
14	Plasmid Isolation (Mini prep)	https://vlab.amrita.edu/?sub=3&brch=77&sim=314&cnt=1
15	Polymerase Chain Reaction (PCR)	https://vlab.amrita.edu/?sub=3&brch=186&sim=321&cnt=1
16	Cell Organization and Sub Cellular Structure Studies (Prokaryotic and Eukaryotic)	https://vlab.amrita.edu/?sub=3&brch=187&sim=324&cnt=1
17	Introduction to Biological Image Analysis	https://vlab.amrita.edu/?sub=3&brch=278&sim=1482&cnt=1

Open book experiment:

1. **Human chromosome analysis using machine learning**

Innovative experiments:

1. **Making of portable microscope**
2. **Cell counter using with Arduino kit**
3. **Computational drug designing**

Detailed Syllabus:

	Experiment Description	Matching University/Course	Details/Link
1	Microscopic analysis of a living cell	MIT OpenCourseWare - 7.012 Introduction to Biology	Labs include hands-on experience with organisms and microscopy techniques for analyzing cells. https://ocw.mit.edu/courses/7-012-introduction-to-biology-fall-2004/pages/labs/
2	Enzyme kinetics using UV-Visible Spectrophotometer	MIT OpenCourseWare - 20.109 Laboratory Fundamentals in Biological Engineering	Module 2: Protein Engineering includes assaying protein behavior, which covers enzyme kinetics using spectrophotometry. https://ocw.mit.edu/courses/20-109-laboratory-fundamentals-in-biological-engineering-spring-2010/pages/labs/
3	Microscopic analysis of the chromosome	Harvard University - BIOS E-1bxl Introduction to Organismic and Evolutionary Biology (Lab)	Lab techniques include analysis of cell division, chromosome structure, and karyotypes. https://coursebrowser.dce.harvard.edu/course/introduction-to-organismic-and-evolutionary-biology-lab-2/
4	Identification of bacteria through Gram Staining	Colorado State University - LIFE 212 Introductory Cell Biology Laboratory	Microbiology techniques module includes Gram staining for bacterial identification. https://www.bmb.colostate.edu/wp-content/uploads/sites/22/2020/09/syllabus_212_2020.pdf
5	Identification of DNA through DNA gel electrophoresis	MIT OpenCourseWare - 7.15 Experimental Molecular Genetics	Protocols include agarose gel electrophoresis for DNA analysis. https://ocw.mit.edu/courses/7-15-experimental-molecular-genetics-spring-2015/pages/labs/
6	Estimation of protein using Bradford Assay (UV-Visible Spectrophotometer)	MIT OpenCourseWare - 20.109 Laboratory Fundamentals in Biological Engineering	Protein engineering module includes protein assays like Bradford for estimation using spectrophotometry. https://ocw.mit.edu/courses/20-109-laboratory-fundamentals-in-biological-engineering-spring-2010/pages/labs/
7	Identification of protein through SDS-PAGE	MIT OpenCourseWare - 7.003 Applied Molecular Biology Lab	Labs cover molecular techniques including SDS-PAGE for protein identification. https://ocw.mit.edu/courses/7-003-applied-molecular-biology-lab-spring-2022/pages/labs/

8	Microscopic analysis of blood cells and ABO typing	Harvard University - Integrated Biology Laboratory: Anatomy, Physiology, Microbiology, and Genetics	Case-based labs integrate microscopy of blood cells and typing techniques. https://coursebrowser.dce.harvard.edu/course/integrated-biology-laboratory-anatomy-physiology-microbiology-and-genetics/
9	Sequence analysis with Bioinformatics tools	MIT OpenCourseWare - 6.047 Computational Biology	Syllabus includes biological sequence analysis, hidden Markov models, gene finding, and bioinformatics tools. https://ocw.mit.edu/courses/6-047-computational-biology-fall-2015/pages/syllabus/
10	Proteinâ€™s 3 D structure prediction with the help of Alpha Fold (AI system developed by Google DeepMind)	University of Virginia - CS 4501 Computational Biology / Biological Computing	Class 24 covers protein folding and AlphaFold for 3D structure prediction. https://computingbiology.github.io/s22/class24/
11	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 E.coli.	Wellcome Connecting Science - Computational Systems Biology for Digital Medicine	Course covers large-scale digital twins and models for bacterial growth factors like nutrients and temperature. https://coursesandconferences.wellcomeconnectingscience.org/event/computational-systems-biology-for-digital-medicine-20251207/
12	Microscopic image analysis and enzyme kinetics simulation using MATLAB	University of Pennsylvania - Introduction to Computational Biology and Biological Modeling	Course includes programming for biological simulations, including image analysis and enzyme kinetics models. https://www.med.upenn.edu/gcb/assets/user-content/documents/gcb-536-syllabus-fall-2018.pdf

University of Engineering and Management

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

1s Semester Syllabus for B.Tech Admission Batch 2026

Subject Name: Engineering Graphics & Design **Credit: 3**
Lecture Hours: 70

Subject Code: ESCME192

Total of 10 Lecture Hours & 60 Hours of Lab. Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory (as per AICTE).

Course Objective:

1. Introduction to engineering design and its place in society,
2. Exposure to the visual aspects of engineering design,
3. Exposure to engineering graphics standards,
4. Exposure to creating working drawings,
5. Exposure to computer-aided geometric design,
6. Exposure to engineering communication.

Course Content:

Module No.	Module Name with details	Mapping with Industry and International Academia	Lecture (L)	Practical (P)
1.	**INTRODUCTION TO ENGINEERING DRAWING:** Principles of Engineering Graphics and their significance, usage of Drawing instruments,	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-	1	4

	lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales	resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo ***Linkedin Learning Course:*** https://www.linkedin.com/learning/autocad-2024-essential-training?trk=learning-serp_learning-search-card_search-card&upsellOrderOrigin=default_guest_learning		
2.	**ORTHOGRAPHIC PROJECTIONS:** Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes -Auxiliary Planes;	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo	1	8
3.	**PROJECTIONS OF REGULAR SOLIDS:** Solids inclined to both the Planes-Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo, Tinkercad	1	8

4.	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo	1	8
5.	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo, Tinkercad ***Linkedin Learning Course:*** https://www.linkedin.com/learning/cert-prep-certified-solidworks-professional-2/welcome?u=229219690	2	8

6.	**OVERVIEW OF COMPUTER GRAPHICS** The computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo	1	8
7.	**CUSTOMISATION & CAD DRAWING** Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/	1	8

	coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;	***Industry Mapping:*** AutoCAD, Solidworks, Creo		
8.	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** Applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/length en); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface;	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** AutoCAD, Solidworks, Creo	1	2

9	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids in 3D printed model; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling	***AICTE prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_Mechanical%20Engg.pdf ***International Standards*** : https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/ ***Industry Mapping:*** Solidworks, Creo, Staad Pro, Cura, Aurdino, Raspberry pi ***Linkedin Learning Course:*** https://www.linkedin.com/learning/product-design-from-cad-to-3d-model/welcome?u=229219690 ***Linkedin Learning Course:*** ***https://www.linkedin.com/learning/solidworks-simulationxpress/welcome?u=229219690*** ***Coursera Learning Course:*** ***https://www.coursera.org/learn/modelling-analysis-and-design-of-steel-buildings*** ***Linkedin Learning Course:*** ***https://www.linkedin.com/learning/learning-arduino-foundations-2/getting-started-with-arduino-22858971?u=229219690***	1	6

Course Outcomes

- Prepare students to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Prepare students to communicate effectively.
- Prepare students to use the techniques, skills, and modern engineering tools necessary for engineering practice
- Helping students to increase their visualization power

Learning Resources

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
3. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMHPublication
4. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, PearsonEducation
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, ScitechPublishers
6. Corresponding set of Software Theory and User Manual

University of Engineering and Management

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University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 6

Subject Name: Mathematics and Basic Statistics **Credit: 4** **Lecture Hours: 48**

Subject Code: BSCM103B

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, Diagonalization of matrices.	**T2: Chapter 15** **T1: Chapter 2** Secs. 2.7, 2.9, 2.10, 2.13 – 2.16	***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 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 colum

				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 $A \in \mathbf{R}^{n\times n}$.

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	1. Find the inner product of any two vectors of $\mathbf{R}^3$. 2. Using Gram-Schmidt Orthogonalization, find the orthonormal vectors for any three vectors in $\mathbf{R}^3$.

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; Cauchy-Euler Equation.	**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 ***AICTE prescribed syllabus:*** Untitled_1-min.pdf (aicte-india.org) ***Industry Mapping:*** MATLAB	14	1. Solve any initial valued ordinary differential equation. 2. Solve any boundary valued ordinary differential equation

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**	***International Academia:*** **Theory of Probability Course I Stanford Online** Statistical Methods in Engineering & Physical Sciences I Stanford Online) ***AICTE prescribed syllabus:*** Untitled_1-min.pdf (aicte-india.org) ***Industry Mapping:*** 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.

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:

- **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

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

Syllabus for B.Tech. Admission Batch 2026

Subject Name: Chemistry **Credit: 4** **Lecture Hours: 42**

Subject Code: BSCCH102/ BSCCH202

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

Relevant Links:

Study Material | Coursera | NPTEL | IEM Learning | Infosys Springboard

COURSE OBJECTIVES:

- 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.
- The student with the knowledge of the basic chemistry will understand and explain scientifically the various chemistry related problems in the industry/engineering field.
- The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology.
- 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:

● 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.

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

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

● 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**	
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	***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-	7	1. Estimation of Hardness of water sample byComplexometric titration. 2. Synthesis of Nanoparticles	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra , chapter- 1

		multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. 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.	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:*** 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)			
2	**Spectroscopic techniques**	Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and	***International Academia: https://ocw.mit.edu/co***	6	1. Beers law using UV-vis spectroscopy.	Chemistry- I, Second Edition,

	and applications	its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.	***urses/5-80-small-molecule-spectroscopy-and-dynamics-fall-2008/*** ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model Curriculum/AICTE%20-%20UG%20CSE.pdf ***Industry Mapping:*** HORIBA Scientific's LabSpec 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/***		2. Studies on the synthesis of Nanoparticles using UV-vis spectroscopy.	Gourkrishna Dasmohapatra, chapter- 2

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_2F and HCN and trajectories on these surfaces.	***International Academia:*** *MIT*- Unit III: Thermodynamics & Chemical Equilibrium | Principles of Chemical Science | Chemistry | MIT OpenCourseWare *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.	3	1. Determination of surface tension of liquids using Stalagmometer Instrument 2. Determination of viscosity of liquids using Ostwald Viscometer.	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 3
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	***International Academia:*** *MIT*- ***https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/resources/lecture-13-gibbs-free-energy/***	9	1. Acid base titration (Colorimetric) 2. Acid base titration (Conductometric) 3. Acid base titration (pH metric) 4. Potentiometric Titration	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 5, 6, 7, 18

		solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	***https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-iii-thermodynamics-chemical-equilibrium/lecture-16/*** ***https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/pages/lecture-notes/*** ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf ***Industry Mapping:*** Energy, entropy and free energy concepts come from thermodynamics and are applicable to all fields of science and engineering. Instruments Used in		5. Determination of the partition coefficient of a substance between two immiscible liquids (Heterogeneous Equilibrium). 6. Determination of hardness of water sample 7. Determination of alkalinity of water sample 8. Making Battery: The Generation of Electrical Energy from Chemical Energy 9. Making Sodium Ion Battery (Solid State Battery)	

			Industries: **Potentiometer, Conductivity meter, pH-meter** **Gibbs Energy Minimization Software for Geochemical Modeling:** https://www.bing.com/ck/a?!&&p=c92d076e6c36cf3aJmltdHM9MTcwMTEyOTYwMCZpZ3VpZD0xNjY1NGQ4Yy03NDMzLTYyMDAtMDE0Yi01YzcwNzU5ZTYzNWUmaW5zaWQ9NTIxMQ&ptn=3&ver=2&hsh=3&fclid=16654d8c-7433-6200-014b-5c70759e635e&psq=gibbs+free+energy+software&u=a1aHR0cDovL2dlbXMud2ViLnBzaS5jaC8&ntb=1 Materials analysis applying thermodynamic (MAAT) software: A friendly and free tool to analyze the formation of solid solutions, amorphous phases and intermetallic compounds - ScienceDirect			

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-prescribedsyllabus:*** 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 stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute	**International Standards** :(https://ocw.mit.edu/courses/5-12-organic-chemistry-i-spring-2003/resources/5_12_outline_1st_half/)	3		Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 27

		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			
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/ ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf)	7	1. Determination of the rate constant of an organic reaction 2. Thin layer chromatography https://vlab.amrita.edu/?sub=3&brch=63&sim=154&cnt=2	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 26

			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. ***Industry Tool:*** Screening of drug molecules using Popular Industrial Software using **AutoDock, AutoDock Vina, Open Babel, Biovia Discovery Studio**			

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

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

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

Subject Name: English **Credit: 2** **Lecture Hours: 24**

Subject Code: HSMC101/HSMC191

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**

Syllabus Structure

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
	Humanities and social	HSMC101	English	2	0	0	2	2
	sciences including Management	HSMC191	Language Laboratory	0	0	2	2	1
				Total Credit points				3

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)	***International Academia:*** https://ocw.mit.edu/courses/21g-232-advanced- speaking-and-critical- listening-skills-els-spring- 2007/	**3**	Das Biswas, Samapika & Riya Barui. *Mastering the Art of English*.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/co urses/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. *Mastering the Art of English*.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 Prescribe d Syllabus:*** https://www.aicte-india.org/sites/default/files/ Untitled_1-min.pdf ***Industry Mapping:*** Formal business Correspondence.	**4**	Das Biswas, Samapika & Riya Barui. *Mastering the Art of English*.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 Prescribe d 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. *Mastering the Art of English*.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/courses/21g-225-	**5**	Das Biswas, Samapika & Riya Barui. *Mastering the Art of English*.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/defau lt /files/ Untitled_1-min.pdf ***Industry Mapping*:** Project writing and documentation			

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. *Mastering the Art of English*.2024. Publisher(s): Aryan Publishing House	Interactive Practice sessions in language lab.

7.	**Teaching Language through Literature**	7.1 – *Tiger, Tiger, Burning Bright* 7.2 - *There Will Come Soft Rains* 7.3 – *Harrison Bergeron*	***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.

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

University of Engineering and Management

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University of Engineering & Management, Jaipur

1st Semester Syllabus of Basic Electronics Engineering for Batch 2026-2030

Index:

Syllabus Structure

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Engineering Science Course	ESCEC101	Basic Electronics Engineering	3	1	0	4	4
2	Engineering Science Course	ESCEC191	Basic Electronics Engineering Laboratory	0	0	2	2	1
				Total Credit points				5

1st Semester Syllabus of Basic Electronics Engineering for Batch 2026-2030

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

Subject Code: ESCEC101 /ESCEC191

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

OURSE 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, density of state function and dimensional problem quantization	***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			clamper 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, 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	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, **frequency dependent negative resistance and solution of differential equations**.	***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.

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.

University of Engineering and Management

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University of Engineering & Management, Jaipur

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

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

Subject Code: ESME102B

Pre-requisite: High School Mathematics

Relevant Links:

Study Material Coursera NPTEL

COURSE OBJECTIVES:

1. To build foundational understanding of vector representation and computation 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'Alembertian frameworks.
4. To apply energy principles for analyzing particle motion, and understand the relationship between work, energy, and power in mechanical systems.

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	**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/courses/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/courses/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	

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/courses/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:*** *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	**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 D'Alembert's principle for dynamic equilibrium; equations of motion for translation, rotation, and combined motion.	***International Academia:*** ***https://ocw.mit.edu/courses/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
5	**Work, Energy & Power**	Work-energy principle for particles, Kinetic energy, potential energy, and conservation of energy	***International Academia:*** ***https://ocw.mit.edu/courses/2-003sc-engineering-dynamics-fall-2011/*** ***AICTE-prescribed syllabus:*** ***https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_***	4	Use Mujoco or PyBullet to simulate a particle's trajectory under different initial velocities and accelerations. Analyze how	B.B. Ghosh, S. Chakrabarti, S. Ghosh "Engineering Mechanics" - Part II – Chapter 4

			Mechanical%20Engg.pdf ***Industry Mapping:*** *MATLAB, Blender*		changes in parameters affect the path	

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 CampusInstitute of Engineering & Management, New Town CampusUniversity of Engineering & Management, Jaipur

Subject Name: Programming for Problem Solving using C **Credit: 3** **Lecture Hours: 36**

Subject Code: ESCCS102/ESCCS192

Lecture Notes | Coursera | NPTEL | LinkedIn Learning | Infosys Springboard

Course Objectives:

Upon successful completion of this course, students will be able to:

- Understand core programming principles and the C programming language.
- Develop C programs to solve computational problems.
- Utilize C libraries for common programming tasks.
- Employ effective programming practices.
- Gain a foundation for further computer science studies.
- Appreciate C programming's industry relevance.

Course Outcomes:

CO1: Impart the fundamental concepts of problem-solving approaches and algorithmic thinking

CO2: Provide comprehensive knowledge of the C programming language, including character sets, expressions, and operators

CO3: Demonstrate control over program flow and logic using input/output operations, control structures, and program organization

CO4: Enable students to solve real-world challenges by applying advanced concepts such as functions, arrays, pointers, data structures and file handling in building end-to-end applications

Module	Topic	Sub-topics	Mapping with Industryand International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Introduction to C**	**Introduction:** • The Von-Neuman Architecture, • Hardware and Software, • Phases of a program execution, • Compiler vs Interpreter, • Phases of a C Program Compilation • Execution of a C Program **Structure of C Program:** • The first C Program: Hello World • Preprocessor Directives • Header Files • The MAIN function • Keywords &Identifiers • Statements • Punctuations and Various Brackets	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** – Understanding File systems, command line interfaces and programming practices **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a C program that prints "Hello, World!" and your name on separate lines. Add comments explaining each part. • Write a simple C program and conceptually explain the preprocessor, compiler, assembler, and linker phases. Compile and execute it. Introduce an error and observe the compiler message. • List five C keywords with their purposes. Provide five valid and five invalid identifiers with explanations. Write a short program using at least three keywords and three valid identifiers.
2	**Data Representation, I/O and Operators**	**Datatypes** – • Binary Representation, Allocation Size, Range. • Console I/O - printf() & scanf() • Formatted Strings • Format Specifiers • Escape Sequences. **Operators -** • Operands and Expressions • Unary, Binary, Ternary	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** – Understanding the concept of memory representation of data **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a C program to print the size and range of int, char, float, double, short int, long int, and long double using sizeof(). Experiment with out-of-range values. • Write a program to get user input for name and age and print it back using printf() with appropriate format specifiers. Format the output neatly. Explore different format specifiers. • Write a program that takes two integers and performs addition, subtraction, multiplication, integer division, and modulus, printing the results. • Write a program demonstrating prefix and postfix increment and decrement operators, explaining

		Operators • Arithmetic, Logical, Assignment, Relational, Bitwise, Increment, Decrement, Conditional Operators • Operator Precedence			their difference. • Write a program using logical operators (&&, ||, !) to evaluate a simple condition based on user input. • Write a program using bitwise operators (&, |, ^, ~, <<, >>) on two integers and print the binary results (helper function might be needed). • Write a program with an expression involving multiple operators of different precedence levels. Predict and verify the output.
3	**Control Flow**	**Conditions**: • If, Else, Else if • Nested Conditions • Switch-case • Goto. **Iterations:** • While loop, • Do-while loop, • For loop, • Break and continue, • Nested loops	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** Learning to build Flowcharts **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	6	• Write a program to check if an input integer is positive, negative, or zero. • Write a program to find the largest of three input integers using nested if-else. • Write a program that takes a character and uses switch-case to identify it as a vowel or consonant (case-insensitive), including a default case. • (Optional) Demonstrate a simple use of goto and explain why it should be used cautiously. • Write a program using a while loop to print the first n natural numbers (n is user input). • Write a program using a do-while loop to repeatedly ask for a positive number until one is entered. • Write a program using a for loop to calculate the sum of even numbers from 1 to 100. • Write a program with a nested loop to print a simple pattern of asterisks. • Write a program with a for loop from 1 to 10. Use break to exit when the number is 5, printing preceding numbers. • Write a program with a for loop from 1 to 10. Use continue to skip even numbers and print only odd numbers.
4	**Arrays and Strings**	**Arrays:** • Declaration and Initialization, • Indexing	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Exploring the	5	• Declare and initialize an integer array of size 5. Print all elements with their indices. • Write a program to find the sum and average of elements in an integer array. • Write a program to find the largest and smallest

		• Memory Layout • Multidimensional Arrays **Strings:** • Character arrays vs strings • Declaring and initializing strings, • String Input and Output • String library functions	foundations of structured data representation and manipulation. **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita		element in an integer array. • Declare and initialize a 2x3 integer matrix. Print all elements in row-major order. • Write a program to add two 2x2 matrices and print the resulting matrix. • Declare a character array and initialize it with a string literal. Print the string by iterating until the null terminator. • Declare a string using a string literal directly and print it using printf() with %s. • Write a program to get a string input from the user and print it back using scanf() (be aware of buffer overflow) and printf(). • Repeat the above using fgets() for safer string input. • Write a program that takes two strings and uses strlen(), strcpy(), strcat(), and strcmp() from <string.h> to demonstrate their functionalities. •
5	**Function and Recursion**	• Declaration, Definition, & Calling • Formal vs Actual parameters • Return type • Recursion • Scope: local vs global variables • Storage classes: auto, static, extern, register	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Understanding the foundation of procedural programming, code reusability **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	4	• Write a function add (int a, int b) that returns the sum. Call it from main with sample values and print the result. • Write a function is Even(int num) that returns 1 if even, 0 otherwise. Call it from main and print a message based on the return value. • Write a function square (int x). In main, pass a variable to square (call by value) and show the original variable remains unchanged. Explain formal vs. actual parameters. • Write a recursive function factorial (int n). Call it from main and print the result. • Write an iterative function factorial_iterative (int n). Compare it with the recursive version. • Write a program demonstrating local and global variables with the same name, showing which is accessed within a function. • Write a program using a static local variable in a function to show its value persists across calls.

6	**Pointers**	• Concept of memory address, • Declaring and using pointers, • & and * operators. • Call by value vs Call by Reference, • Pointers and arrays, • Pointers with strings, • Pointers to pointers, • Dynamic memory allocation • Command-line arguments.	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Explore direct memory manipulation capabilities of C. **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	6	• Declare an integer and a pointer to an integer. Assign the integer's address to the pointer. Print the integer's value directly and indirectly, and print the address and pointer value. • Demonstrate the use of & (address-of) and * (dereference) operators. • Write swap_value(int a, int b) that doesn't swap original values in main (call by value). Explain why. • Write swap_reference(int *a, int *b) that swaps original values using pointers (call by reference). • Declare an integer array and a pointer to its first element. Iterate using pointer arithmetic and print each element. Show the array name acts as a pointer. • Declare a string literal and assign its address to a character pointer. Iterate and print each character until the null terminator. • Declare an integer, a pointer to an integer, and a pointer to a pointer. Demonstrate accessing the original value using the double pointer. • Write a program to get the size of an integer array from the user and use malloc() to allocate memory. Read values, print them, and then free() the memory. • Repeat the dynamic allocation using calloc() and observe the initialization difference. • Write a program to dynamically resize an array using realloc() after initial allocation. • Write a program that takes two command-line arguments (numbers) and prints their sum.
7	**Structures & Unions**	**Structures**: • Defining and declaring structures, • Accessing members • User-defined data types - typedef • Passing structures to	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping:** Learning to construct user-defined datatypes. **Platforms & IDEs:** GitHub, VSCode,	4	• Define a Student structure (name, roll_no, marks). Declare and initialize a Student variable. Print its information using the dot operator. • Use typedef to create an alias for the Student structure. Declare and initialize a variable of the new type. • Write a function displayStudent(struct Student s) to print student info (pass by value). Call it from

		functions, • Arrays of structures, • Nested structures **Unions**: • Syntax & memory layout of unions • Struct vs. union • Enum definition and use in switch-case • Enum vs #define constants	GCC **Competitive Coding:** HackerRank, Leetcode, Codevita		main. • Write a function updateMarks(struct Student *s, float new_marks) to update marks (pass by reference). Call it from main. • Declare an array of three Student structures, initialize them, and print the information of all students. • Define an Address structure (street, city, zipcode). Modify Student to include an Address member. Declare, initialize, and print a Student with address details. • Define a Data union (int or float). Declare a variable, assign an int and print, then assign a float and print. Observe the output. • Write a short explanation comparing and contrasting structures and unions. • Define an enum DayOfWeek. Write a program that takes an integer input and uses a switch-case with the enum to print the day name. • Explain the advantages of using enums over #define constants for related integer constants.
8	**File Handling**	• The file pointer • Opening & closing a file • Reading and Writing Files • Formatted: fprintf and fscanf • Character: fputc and fgetc • String: fputs and fgets • File Modes • ftell,fseek,rewind,feof	**MIT OCW** – LINK **AICTE** – LINK **Industry Mapping** Learning to build advanced project with database integration **Platforms & IDEs:** GitHub, VSCode, GCC **Competitive Coding:** HackerRank, Leetcode, Codevita	3	• Write a program to open "my_file.txt" in write mode, write a few lines, and close it. Then, open it in read mode and print each line until EOF. • Create a Product structure (name, price). Write a program to write info for three products into a file using fprintf(). Write another program to read this data back using fscanf() and print it. • Write a program to open a file in write mode and use fputc() to write a string character by character. Write another program to read it back using fgetc() until EOF. • Write a program to open a file in write mode and use fputs() to write a few strings (one per line). Write another program to read them back using fgets() until NULL. • Experiment with different file modes ("r", "w", "a", "r+", "w+", "a+") with small programs to understand their behavior.

					• Write a program to open a file, write data, use ftell() to get the position, fseek() to go to the beginning and read, and rewind() to go to the beginning and read again. • Write a program that reads a file character by character using fgetc() and uses feof() to detect the end and stop reading.

Text Books:

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
2. Reema Thareja, Computer Fundamentals and programming in C, Oxford University Press
3. Yashavant Kanetkar, Let Us C, BPB Publications,13th Edition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

Alternate Courses:

NPTEL – Introduction to programming in C, Satyadev Nandakumar, IIT Kanpur - https://nptel.ac.in/courses/106104128
COURSERA – Introductory C Programming Specialization- Andrew D. Hilton- https://www.coursera.org/specializations/c-programming

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Syllabus for B.Tech. Admission Batch 2026

Course Name: Chemistry Laboratory	
Course Code: BSCCH192/292	
Course Code: BSCCH192/292	**Category:** Basic Science Courses
Course Title: Chemistry Laboratory	**Semester:** First/Second
L-T-P: 0-0-3	Credit: 1.5
Pre-Requisites: Basic knowledge of Chemistry in Class- XI and XII level. Basic concepts of qualitative and quantitative analysis. Basic knowledge of algebraic calculation and graph plot	

Course Outcomes

CO1: Apply knowledge in quantitative estimation, Electroplating, Electric Power generation and synthesis of Nanomaterials and Quantum dots.

CO2: Operate the instruments properly, record and interpret data.

CO3: Estimate rate constants of reactions from concentration of reactants/products as a function of time.

CO4: Work effectively in teams to accomplish the assigned responsibilities.

List of Experiments

Expt. No.	List of Regular Experiments
1	Determination of the alkalinity present in water (Acid – Base Titration)
2	Determination of the pH of sample solutions by digital pH meter: pH metric titration (using **MATLAB**)
3	Determination of cell constant and conductance of solutions: Conductometric titration (using **MATLAB**)
4	Determination of surface tension of liquids using Stalagmometer Instrument.
5	Determination of viscosity of liquids using Ostwald Viscometer.
6	Determination of the partition coefficient of a substance between two immiscible liquids
7	Determination of the rate constant of a reaction (using **MATLAB**)
8	Potentiometry - determination of redox potentials and emfs
9	Determination of the hardness of water.

Innovative Experiments

Sl No	Name of Experiment	Corresponding Equipments/Links
10	Synthesis and characterization of Nanoparticles	Magnetic Stirrer, UV-visible Spectrophotometer
11	Synthesis and characterization of Carbon Dots	Magnetic Stirrer, UV-visible Spectrophotometer
12	Electroplating	
13	Making Battery: The Generation of Electric Power/Energy from Chemical Energy	
14	Digital Twin of a Water Purification System using MATLAB	
15	Beer's Law Lab Study/Verification	Using UV-visible Spectrophotometer and also using PHET simulator (https://phet.colorado.edu/en/simulations/beers-law-lab)

List of Virtual experiments to be conducted in the laboratory		
Sl No	**Name of the experiment**	**Simulation software link**
16	Saponification/acid value of an oil	https://vlab.amrita.edu/index.php?sub=3&brch=63&sim=688&cnt=4
17	Determination of the Chemical Oxygen Demand.	https://ee2-nitk.vlabs.ac.in/exp/chemical-oxygen/simulation.html
18	Adsorption of acetic acid by charcoal	https://vlab.amrita.edu/?sub=3&brch=190&sim=606&cnt=1
19	Thin layer chromatography	https://vlab.amrita.edu/index.php?brch=63&cnt=1&sim=154&sub=3
20	Colligative properties using freezing point depression	https://vlab.amrita.edu/index.php?sub=2&brch=190&sim=337&cnt=1
21	Rutherford Scattering Experiment	https://phet.colorado.edu/en/simulations/ruth erford-scattering
22	Fluorescence Spectroscopy	https://mfs-iiith.vlabs.ac.in/exp/fluorescence- instrumentation/simulation.html
23	Infrared Spectroscopy	https://ccnsb06-iiith.vlabs.ac.in/exp/solutions-infra-red- spectroscopy/simulation.html

Mandatory Project

Sl No	Name/Title of the Project
1	Making Sodium Ion Battery (Solid State Battery)

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1st Semester Syllabus for B.Tech. Admission Batch 2026

Subject Name: Workshop/Manufacturing Practices **Credit: 3**
Subject Code: ESCME193 **L-T-P: 1-0-4**

Category: Engineering Science Courses

Pre-Requisites: Knowledge in dimensions and units.

Usage of geometrical instruments and analytical ability.

Course Outcomes

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

CO4: Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

List of Hands on experiment to be conducted in the laboratory				
Sl No.	**Name of Experiments**	**Digital Twin link**	**Mapping with MIT & Stanford**	**Use of Software**
1	**Fitting shop :** Typical jobs that may be made in this practice module: To prepare a simple type fitting job **Fitting shop:** Typical jobs that may be made in this practice module: To make a Gauge from MS plate.	• http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpMM/exp2/index.html • http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpMM/exp1/index.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .
2	**Casting :** Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated.	• https://fab-coep.vlabs.ac.in/exp/molding-casting-polyurethane-parts/	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .
3	**Welding shop:** Typical jobs that may be made in this practice module: ARC WELDING (4 hours): To join two thick (approx	• https://mm-coep.vlabs.ac.in/exp/welding-ndyag-laser/procedure.html • https://mm-coep.vlabs.ac.in/exp/welding-ndyag-laser/procedure.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .

	6mm) MS plates by manual metal arc welding. **Welding shop:** Typical jobs that may be made in this practice module: To join two thin mild steel plates or sheets by gas welding.		• https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	
4	**Smithy :**Typical jobs that may be made in this practice module: Prepare a simple type job by upsetting process **Smithy:** Typical jobs that may be made in this practice module: Prepare a simple type job by drawing down process		• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .
5	**Carpentry:** Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.	• https://fab-coep.vlabs.ac.in/exp/computer-controlled-cutting/	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bu	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .

			lletin0809/current/pdf/MechEng.pdf	
6	**Machine shop:** Typical jobs that may be made in this practice module: To make a pin from a mild steel rod in a lathe. **Machine shop:** Typical jobs that may be made in this practice module: To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.	• https://fab-coep.vlabs.ac.in/exp/3d-machining/	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .
7	**Plastic moulding & Glass cutting:** Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made. **Plastic moulding & Glass cutting :** Typical jobs that may be made in this practice module: For glass cutting, three rectangular glass pieces may be cut to make a	• https://fab-coep.vlabs.ac.in/exp/molding-casting-polyurethane-parts/ • https://fab-coep.vlabs.ac.in/exp/pcb-design-fabrication/theory.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .

	kaleidoscope using a black colour diamond cutter, or similar other components may be made.			
8	**Electrical & Electronics:** Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable. Electrical & Electronics: Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point. Electrical & Electronics: Simple wiring exercise to be executed to understand the basic electrical	• https://be-iitkgp.vlabs.ac.in/ • https://be-iitkgp.vlabs.ac.in/	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .

	circuit. Electrical & Electronics: Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication. Electrical & Electronics: Simple soldering exercises to be executed to understand the basic process of soldering.			
9	Advance Machining by using Advance Laser Cut machine.	• http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpMM/exp2/index.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .
10	Advance Welding by usng Adavnce Robotic Arm	• https://www.weldsimulator.com/?gad_source=1&gclid=CjwKCAjwk8e1BhALEi	• https://catalog.mit.edu/schools/engin	**Auto CAD, Solidworks, Creo, Fusion 360,**

	welding .	wAc8MHiJyE9E0aVgudFeA93Gr_LBCtWysh33JuVvCIeEjOibSPP4H9attARRoCeyQQAvD_BwE	eering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Catia** .
11	Automated Metarial cutting by Smart Cutting machine like Circuit Maker3.	• https://guides.library.illinois.edu/Cricut	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .
12	Adavced maching by using CNC Lathe and CNC Milling.	• http://vlabs.iitkgp.ernet.in/vlabs/rtvlab1/cncbase%20software.html • https://fab-coep.vlabs.ac.in/exp/computer-controlled-cutting/theory.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks , Creo, Fusion 360, Catia** .

List of Innovative Experiments in Laboratory				
1	Advance Machining by using Advance Laser Cut machine.	• http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpMM/exp2/index.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .
2	Advance Welding by using Adavnce Robotic Arm welding .	• https://www.weldsimulator.com/?gad_source=1&gclid=CjwKCAjwk8e1BhALEiwAc8MHiJyE9E0aVgudFeA93Gr_LBCtWysh33JuVvCIeEjOibSPP4H9attARRoCeyQQAvD_BwE	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .

3	Automated Metarial cutting by Smart Cutting machine like Cricut Maker3.	• https://guides.library.illinois.edu/Cricut	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .
4	Adavced maching by using CNC Lathe and CNC Milling.	• http://vlabs.iitkgp.ernet.in/vlabs/rtvlab1/cncbase%20software.html • https://fab-coep.vlabs.ac.in/exp/computer-controlled-cutting/theory.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .
5	**Plastic moulding & Glass cutting:** Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made. **Plastic moulding & Glass cutting :** Typical jobs that	• https://fab-coep.vlabs.ac.in/exp/molding-casting-polyurethane-parts/ • https://fab-coep.vlabs.ac.in/exp/pcb-design-fabrication/theory.html	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/Mec	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .

	may be made in this practice module: For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.		hEng.pdf	

List of virtual lab experiments			
Sl No	**Name of the experiment**	**Simulation software link**	**Mapping link with MIT/Standford**
1	Advance Machining by using Advance Laser Cut machine.	**Auto CAD, Solidworks, Creo, Fusion 360, Catia .**	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf
2	Advance Welding by using Adavnce Robotic Arm welding .	**Auto CAD, Solidworks, Creo, Fusion 360, Catia .**	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf

3	Automated Metarial cutting by Smart Cutting machine like Cricut Maker3.	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf
4	Adavced maching by using CNC Lathe and CNC Milling.	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf
5	**Plastic moulding & Glass cutting:** Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made.	**Auto CAD, Solidworks, Creo, Fusion 360, Catia** .	• https://catalog.mit.edu/schools/engineering/mechanical-engineering/ • https://stanford.edu/dept/registrar/bulletin0809/current/pdf/MechEng.pdf

List of Experiments using MATLAB

1	Model-Based Design Series: Basic Component Modeling	https://in.mathworks.com/academia/courseware/basic-component-modeling.html	NA
2	Heat Transfer with MATLAB	https://in.mathworks.com/academia/courseware/heat-transfer.html	NA

List of Experiment/project using Generative AI			
1	AI for Computational Design and Manufacturing	https://professional.mit.edu/course-catalog/ai-computational-design-and-manufacturing	NA
2	Robotic Welding	https://www.canadianmetalworking.com/canadianfabricatingandwelding/article/automationsoftware/ai-and-robotics-in-assembly-and-finishing	NA

University of Engineering and Management

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

University of Engineering & Management, Jaipur

1st Semester Syllabus for B.Tech Batch 2025-2029

Index:

Syllabus Structure:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1	Sessional	IKS281	Indian Knowledge Systems for Engineers	0	0	4	4	2
				Total Credit points				2

University of Engineering and Management

Institute of Engineering & Management,

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

University of Engineering & Management, Jaipur

1st Semester Syllabus for B.Tech Batch 2025-2029

Subject Name: Indian Knowledge Systems for Engineers **Credit:** 2 **Lecture Hours:** 40

Subject Code: IKS281

Pre-requisite: Passed 10+2 or equivalent examination

Relevant Links:

NPTEL
https://nptel.ac.in/courses/111101080
https://nptel.ac.in/courses/121104006
https://nptel.ac.in/courses/101104065
https://nptel.ac.in/courses/109106195

COURSE OBJECTIVES:

The course "IKS and its Application for Engineers" aims to introduce undergraduate engineering students to the foundational concepts and practical relevance of Indian Knowledge Systems (IKS).

1. This course aims to introduce students to the depth and diversity of Indian Knowledge Systems, cultivated over millennia across various domains of life, learning, and innovation. Students will:

    - Grasp the definition, scope, and organization of IKS.
    - Understand its historicity, cultural foundations, and relevance in the contemporary world.
    - Appreciate IKS as a holistic and interdisciplinary framework integrating science, philosophy, and social values.

2. The course seeks to impart interdisciplinary knowledge by exploring key domains of traditional Indian wisdom and their scientific relevance, enabling students to:
    - Understand the structure and content of the Vedic corpus, Vedāṅgas, and systems of logic and epistemology.
    - Explore traditional Indian contributions to mathematics, astronomy, linguistics, architecture, and technology.
    - Analyze indigenous number systems, units of measurement, and algorithmic thinking rooted in Sanskrit and Chandaḥ Śāstra.
    - Discover ethical frameworks (like Karma Yoga) and moral reasoning applicable to engineering practice.
    - Examine town planning, temple architecture, and scientific advancements in ancient India through the lens of sustainability and design thinking.
    - Reflect on the potential of IKS in modern technological applications including computation, natural language processing, and water management.

COURSE OUTCOMES:

CO1. Demonstrate a foundational understanding of the Indian Knowledge System (IKS) — including its historical development, philosophical basis, and relevance to contemporary contexts.
(Mapped to Week 1: Introduction to IKS)

CO2. Explain key components of the Vedic corpus and Vedāṅgas, and articulate their significance in knowledge organization and cultural life.
(Mapped to Week 2: The Vedic Corpus)

CO3. Identify and interpret traditional Indian number systems and units of measurement, including Kaṭapayādi, Bhūta Saṃkhyā, and their applications in early science and technology.
(Mapped to Weeks 3–4: Number Systems & Indian Mathematics)

CO4. Analyze ancient Indian contributions to mathematics and astronomy, and connect these to modern scientific concepts in algebra, geometry, trigonometry, and celestial navigation.
(Mapped to Weeks 4–5)

CO5. Apply ethical frameworks derived from Indian philosophy (e.g., Karma Yoga) to engineering practice, decision-making, and personal integrity.
(Mapped to Week 6: Moral Science for Engineers)

CO6. Explore indigenous technological advancements in irrigation, surgery, shipbuilding, and art, recognizing their innovation and sustainability principles.
(Mapped to Week 7: Engineering and Technology in Ancient India)

CO7. Discuss principles of Vāstu-śāstra and ancient town planning, including Indian temple architecture and iconography, in the context of design thinking and spatial aesthetics.
(Mapped to Week 8)

CO8. Understand Indian epistemological frameworks (Nyāya-Vaiśeṣika) and their relevance in scientific reasoning, classification, and

logic systems.
(Mapped to Week 9: Knowledge Framework and Classifications)

CO9. Interpret the Aṣṭādhyāyī and principles of Sanskrit linguistics, and appreciate their role in computational logic and natural language processing.
(Mapped to Week 10: Linguistics and NLP Applications)

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	**Indian Knowledge System (IKS) – An Introduction**	• What is Indian Knowledge System (IKS) • Why do we need IKS? • Organization of IKS • Historicity of IKS • Salient aspects of IKS	***International Academia:*** South Asian Studies, Comparative Philosophy (Harvard, SOAS, Leiden) ***AICTE-prescribed syllabus:*** Unit 1: Definition, scope, salient features of IKS ***Industry Mapping:*** Education, Cultural Policy, Heritage Tech	4	1. *Kapil Kapoor – Indian Knowledge Systems* https://iks.iitgn.ac.in/wp-content/uploads/2020/06/Indian_Knowledge_Systems-Kapil-Kapoor.pdf?utm_source=chatgpt.com 2. *Charles A. Moore – The Indian Mind* https://ia801402.us.archive.org/13/items/in.ernet.dli.2015.533775/2015.533775.indian-mind_text.pdf	❖

2	**The Vedic Corpus**	• Introduction to Vedas • A synopsis of the four Vedas • Sub-classification of Vedas • Messages in Vedas • Introduction to Vedāṅgas • Prologue on Śikṣā and Vyākaraṇa • Basics of Nirukta and Chandas • Introduction to Kalpa and Jyotiṣa • Vedic Life: A Distinctive Features	***International Academia:*** Indology, Vedic Studies (Oxford, Chicago, EFEO) ***AICTE-prescribed syllabus:*** Unit 2: Vedic corpus and Vedāṅgas ***Industry Mapping:*** Yoga, Ayurveda, Vedic research publishing	4	1. *Roshen Dalal – The Vedas* https://tarapurbengali.in/books/The%20Vedas_%20An%20Introduction%20to%20Hinduism%E2%80%99s%20Sacred%20Texts.pdf?utm_source=chatgpt.com 2. *F. Max Müller – The Six Systems* https://ia802302.us.archive.org/24/items/sixsystemsofindi005498mbp/sixsystemsofindi005498mbp.pdf	❖
3	**Number Systems and Units of Measurement:**	• Number systems in India - Historical evidence • Salient aspects of Indian Mathematics • Bhūta-Saṃkhyā system • Kaṭapayādi system • Measurements for time, distance, and weight Piṅgala and the Binary system	***International Academia:*** History of Mathematics (Cambridge, ETH Zurich)	4	1. Datta & Singh – A History of Hindu Mathematics https://archive.org/details/history-of-hindu-mathematics-1-bibhutibhusan-datta-avadesh-narayan-	❖

			AICTE-prescribed syllabus: Unit 3: Ancient Indian number systems & Bhūta Saṃkhyā ***Industry Mapping:*** Fintech, Data encoding, NLP models		singh?utm_source=chatgpt.com	
4	**Mathematics:**	• Introduction to Indian Mathematics • Unique aspects of Indian Mathematics • Indian Mathematicians and their Contributions • Algebra • Geometry • Trigonometry • Binary mathematics and combinatorial problems in Chandaḥ Śāstra Magic squares in India	***International Academia:*** Non-European Mathematics (University of Manchester, Rutgers) ***AICTE-prescribed syllabus:*** Unit 4: Contributions to algebra, geometry, combinatorics ***Industry Mapping:*** STEM Education, EdTech, Logic Design		*1. G. G. Joseph*, *The Crest of the Peacock* https://ia800600.us.archive.org/27/items/crest-of-the-peacock-joseph-george-gheverghese/Crest%20of%20the%20peacock%2C%20non-European%20roots%20of%20mathematics%20Joseph%20George%20Gheverghese%20Third%20Edition.pdf NPTL Course: https://nptel.ac.in/courses/111101080	❖

5	**Astronomy:**	• Introduction to Indian astronomy • Indian contributions in astronomy • The celestial coordinate system • Elements of the Indian calendar • Notion of years and months • Pañcāṅga – The Indian calendar system • Astronomical Instruments (Yantras) - Jantar Mantar of Rājā Jai Singh Sawai	***International Academia:*** Archaeoastronomy, Ancient Sciences (University of Arizona, Bonn) ***AICTE-prescribed syllabus:*** Unit 5: Indian calendar, celestial models ***Industry Mapping:*** Panchāṅga apps, Aerospace heritage, ISRO heritage outreach	4	1. *Astronomy*, Author - Amitabha Ghosh, Published by The National Academy of Sciences, India and R K Mission Institute of Culture, Gol Park Kolkata 2. Subhash Kak – Indian Astronomy: A Sourcebook https://archive.org/details/indian-astronomy-a-sourcebook-b.-v.-subbarayappa-k.-v.-sarma?utm_source=chatgpt.com 3. NPTL Course https://nptel.ac.in/courses/121104006	❖

6	**Moral Science for Engineers:**	• Foundations of Moral Philosophy- Morality, Utilitarianism • Moral relativism vs. moral universalism • Role of conscience and character • Moral leadership and ethical decision-making • Group thinking, peer pressure, and ethical fading • Karma Yoga – Work as worship • Cultivating moral courage and resilience in professional life	***International Academia:*** Applied Ethics (Stanford, TU Delft, Oxford Uehiro Centre) ***AICTE-prescribed syllabus:*** Unit 6: Karma Yoga, moral reasoning ***Industry Mapping:*** Corporate Ethics, Leadership Training		1. *Mike Martin & Roland Schinzinger – Ethics in Engineering* https://archive.org/details/ethicsinengineer0000mart_x0l7/page/n3/mode/2up?view=theater	❖
7	**Engineering and Technology: Other applications:**	• Irrigation systems and practices in South India • Literary sources for science and technology • Physical structures in India • Irrigation and water management • Dyes and painting technology • The art of making perfumes • Surgical techniques • Shipbuilding • Sixty-four art forms (64	***International Academia:*** Ancient Technology Studies (Max Planck Institute, UCLA) ***AICTE-prescribed syllabus:*** Unit 7: Water	4	1. *Debiprasad Chattopadhyaya – History of Science Philosophy and Culture (Vol. 2, Part 1)* *2. Needham, Joshep, istory of Science and*	❖

		Kalās) • Status of Indigenous S & T	management, shipbuilding, arts ***Industry Mapping:*** Rural Tech, Heritage Science, Wellness Industry		*Technology in Ancient India* https://ia802909.us.archive.org/16/items/historyofscienceandtechnologyinancientindiathebeginningsdebiprasadchattopadhyaya_57_k/History%20Of%20Science%20And%20Technology%20In%20Ancient%20India%20The%20Beginnings%20Debi%20Prasad%20Chattopadhyaya%20Firma%20K.L.%20Mukopadhyaya.pdf 3. NPTL Course: https://nptel.ac.in/courses/101104065	
08	**Town Planning and Architecture:**	• Perspective of Arthaśāstra on town planning • Vāstu-śāstra – The science of architecture • Eight limbs of Vāstu • Town planning • Temples in India: marvelous stone	***International Academia:*** Architectural Anthropology, Urban Studies (Columbia GSAPP, UCL) ***AICTE-prescribed syllabus:***		1. *B. B. Puri – Vāstu Śāstra* 2. *Percy Brown – Indian Architecture* https://ia903201.us.archive.org/34/items/IndianArchitecture/Indian	❖

		architecture for eternity • Temple architecture in India • Iconography	Unit 8: Vāstu-śāstra, temple planning ***Industry Mapping:*** *Sustainable Architecture, Urban Design*		Architecture.pdf	
09	**Knowledge Framework and classifications:**	• Indian scheme of knowledge • The knowledge triangle • Prameya – A vaiśeṣikan approach to physical reality • Dravyas – the constituents of the physical reality • Attributes – the properties of substances and Action – the driver of conjunction and disjunction • Sāmānya, viśēṣa, samavāya • Pramāṇa – the means of valid knowledge • Saṃśaya – ambiguities in existing knowledge • Framework for establishing valid knowledge • Deductive or inductive logic framework • Potential fallacies in the reasoning process • Siddhānta: established tenets in a field of study	***International Academia:*** Logic and Philosophy of Science (Carnegie Mellon, IITs) ***AICTE-prescribed syllabus:*** Unit 9: Nyāya-Vaiśeṣika, Pramāṇa, logic ***Industry Mapping:*** AI Ethics, Knowledge Systems, Decision Science	4	1. *Subhash Kak – Nyaya-Vaisheshika* 2. *Daya Krishna – Indian Epistemology and Metaphysics* 3. Prabhu, CSR, The Physics of *Vaiśeṣika* https://ia803209.us.archive.org/19/items/thephysicsofvaisheshika/The%20Physics%20of%20Vaisheshika_text.pdf	❖

10	**Linguistics**	• Introduction to Linguistics • Aṣṭādhyāyī • Phonetics • Word generation • Computational aspects • Mnemonics • Recursive operations • Rule based operations • Sentence formation • Verbs and prefixes • Role of Sanskrit in natural language processing	***International Academia:*** Sanskrit Computational Linguistics (Heidelberg, Kyoto, IIT-H) ***AICTE-prescribed syllabus:*** Unit 10: Aṣṭādhyāyī, NLP and computation ***Industry Mapping:*** NLP, AI Language Tools, EdTech content systems	4	*1. George Cardona, Panini: His Work and Its Traditions* 2. NPTL Course: https://nptel.ac.in/courses/109106195	❖

TEXT BOOKS:

1. Kapil Kapoor – *Indian Knowledge Systems*
2. Debiprasad Chattopadhyaya – *History of Science Philosophy and Culture (Vol. 2, Part 1)*
3. Roshen Dalal – *The Vedas*
4. Amitabha Ghosh – *Astronomy,* Published by The National Academy of Sciences, India and R K Mission Institute of Culture, Gol Park Kolkata
5. Amitabha Ghosh – *History of Science in India Vol 1 Part 2*

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2. Osmund Bopearachchi, The Greek God Helios and the Indian Deity Surya, The ink: beyond imagination, Kolkata, 2021.
3. Gupta, Kanika. The Cursed Land of Lustful Women and the Power of Storytelling: Performance Text with Notes, Kaveri Books, Delhi, 2023.
4. Kannal, Deepak H., and Kanika Gupta. *Lupadakhe: Unknown Master Sculptors of Ancient India*. Mandala, 2019.
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https://www.bbc.com/future/article/20210316-the-legendary-fabric-that-no-one-knows-how-to-make
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http://ijl.ilsl.br/detalhe_artigo.php?id=NTAwMQ%3D%3D&secao=ORIGINAL+ARTICLE
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https://ecologise.in/2016/08/25/flashback-arundhati-roys-landmark-essay-on-the-narmada-resistance/
13. Ramanujan, A. K. "2. Three Hundred Rāmāyaṇas: Five Examples and Three Thoughts on Translation". *Many Ramayanas: The Diversity of a Narrative Tradition in South Asia*, edited by Paula Richman, Berkeley: University of California Press, 2023, pp. 22-49. https://doi.org/10.1525/9780520911758-004
https://archive.org/details/three-hundred-Ramayanas-A-K-Ramanujan
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https://india.mongabay.com/2021/02/ecological-degradation-at-narmadas-origin-in-amarkantak-spells-more-trouble/
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https://india.mongabay.com/2022/05/fish-famine-livelihood-loss-because-of-upcoming-vizhinjam-port-say-fishers-of-south-kerala/
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https://www.academia.edu/2624271/Water_Management_System_at_Kanheri
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https://www.metmuseum.org/essays/red-sea-textile-trade
18. Indigenous Knowledge of using Medicinal Plants in Treating Skin deceases by Tribal's in Central Narmada Valley of Madhya Pradesh (India) By Dr Mahendra Singh choudhary
https://www.academia.edu/126472004/Indigenous_Knowledge_of_using_Medicinal_Plants_in_Treating_Skin_deceases_by_Tribals_in_Central_Narmada_Valley_of_Madhya_Pradesh_India_
19. Diversity of freshwater fish in Narmada River, Madhya Pradesh by Shivani Pathak
https://www.academia.edu/111778970/Diversity_of_freshwater_fish_in_Narmada_River_Madhya_Pradesh

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

Subject Name**: Design Thinking and Innovation- Basic** Credit**: 0** Lecture Hours**: 12**

Subject Code**: IVC281A**

Prerequisite: Basic Knowledge of Physics, Chemistry and Mathematics of 10+2 Level

Relevant Links:

Linkedin Learning **Coursera** **SWAYAM**

Study Materials: Design Thinking and Innovation-Basic

Course Outcomes

At the end of the course

CO1: The student will be able to Understand the concepts of design thinking approaches.

CO2: The student will be able to Create design thinking teams and conduct design thinking sessions.

CO3: The student will be able to Apply both critical thinking and design thinking in parallel to solve Problems

CO4: The student will be able to Understand how to conduct research and how to write a research paper.

Module Number	Topics	Subtopics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Hands on Assignment
1	**Introduction to Design Thinking**	Introduction to Design Thinking, Importance of Design Thinking and Innovation in Today's World, Stages of Design Thinking, Design Thinking: A Non-Linear Process, Understanding the User: Empathy and Empathy Mapping, Case Studies of Empathy Mapping, Customer Journey Mapping, Case Studies of Customer Journey Mapping, Techniques for generating ideas: Brainstorming and Its Importance, Techniques for generating ideas: Mind Mapping and Its Importance, Divergent Thinking and Convergent Thinking, Human Centered Design and Case Studies of Human Centered Design.	**International Academia:** ***MIT***- Design Thinking Certification at MIT Sloan | Online Program ***Stanford University***- Creativity and Design Thinking | Stanford Online ***AICTE Syllabus:*** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** Many companies across various sectors, such as technology, healthcare, and finance, are adopting design thinking methodologies to foster innovation and create user-centric products and services. For example, companies like Apple, Google, and IDEO are known for incorporating design thinking into their product development processes. Industries recognize that design thinking is not just a buzzword but a crucial approach for staying competitive in a rapidly changing market. Companies like Airbnb, IBM, and Nike have all embraced design thinking to drive innovation and enhance customer experiences. Various industries follow the stages of design thinking, including empathizing with users, defining problems, ideating solutions, prototyping, and testing. Companies like Samsung, Toyota, and Procter & Gamble utilize these stages to develop products and services that meet customer needs effectively. Companies leverage empathy mapping techniques to gain deeper insights into their target audience's needs, desires, and pain points. For instance, companies like Netflix and Spotify use empathy mapping to understand user preferences and tailor their content recommendations accordingly.	4	**Assignment-1:** Empathy Interview: Conduct an empathy interview with a potential user or customer to understand their needs, challenges, and experiences. Create an empathy map based on the insights gathered. **Assignment-2:** Customer Journey Mapping: Choose a product or service and create a customer journey map to visualize the user's experience from start to finish. Identify pain points and areas for improvement. **Assignment-3:** Brainstorming Session: Organize a brainstorming session with a group to generate ideas for solving a specific design challenge. Use techniques such as "How Might We" questions to guide brainstorming. **Assignment-4:** Mind Mapping Exercise: Use mind mapping to explore and visualize connections between different ideas related to a design problem. Share your mind map and explain the connections you've identified.

2	**Introduction to Creative Process, Biomimicking and Prototyping.**	Introduction to Creative Process, Introduction to Creative Process, Stages of Creative Process, Preparation Stage of Creative Process, Incubation Stage of Creative Process, Illumination Stage of Creative Process, Evaluation Stage of Creative Process, Implementation Stage of Creative Process, Creative Thinking Principles: New ideas are composed of old elements., Creative Thinking Principles: Not all new ideas are on a par, Creative Thinking Principles: Creativity is Enhanced by the Ability to Detect Connections between Ideas, Steps to Enhance Creative Thinking, Introduction to Biomimicking, Importance of Biomimicking, Examples of Product designed from Biomimicking, Biomimicking for Engineering, Case Studies of Biomimicry.	**International Academia:** *MIT*- Design Thinking Certification at MIT Sloan | Online Program *Stanford University*- Creativity and Design Thinking | Stanford Online **AICTE Syllabus:** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** Industries employ customer journey mapping to visualize and optimize the entire customer experience across different touchpoints. Companies like Starbucks, Amazon, and Disney use this technique to identify opportunities for improving customer satisfaction and loyalty. Brainstorming and mind mapping are widely used in industries to foster creativity and innovation during problem-solving sessions. Companies like Google, Facebook, and 3M regularly conduct brainstorming sessions to generate new product ideas and improve existing processes. Industries value both divergent and convergent thinking to explore a wide range of possibilities and then converge on the best solutions. Companies like Tesla, SpaceX, and IDEO encourage their teams to think divergently to explore innovative ideas before converging on feasible solutions. Human-centered design principles are applied across industries to create products and services that prioritize the user's needs and preferences. Companies like Airbnb, Uber, and Slack integrate human-centered design into their design processes to deliver seamless user experiences.	**4**	**Assignment-5:** Design Challenge: Present a design challenge to students and ask them to come up with innovative solutions using the principles of human-centered design. Prototype and test the most promising ideas. **Assignment-6:** Creative Process Analysis: Analyze a creative process from a real-world example (e.g., a product design, a marketing campaign) and identify the stages of preparation, incubation, illumination, evaluation, and implementation. **Assignment-7:** Biomimicry Case Study: Research and present a case study where biomimicry was used to design a product or solve a problem. Discuss the principles of biomimicry and how they were applied in the case.

3	**Introduction to Research and Research Ethics**	Meaning, Objectives and Motivation in Research, Types of Research and its Examples, Research Approaches, Significance of Research, Research Methods versus Methodology, Library Research, Field Research, Laboratory Research, Introduction to Review Article, Structure of a Review Articles, How to Write a Review Article, Advantages of Writing a Review Article, Importance of Google Scholar, Google Patent and Research-gate for Design Thinking and Innovation, Literature Survey, Reading a Review Articles and Research Articles to Generate Ideas [with reference to few latest research article], Databases of Library Research, Open-Source Databases, Introduction to Journal Indexing, H-Index and i-10 Index, Introduction to Journal Impact Factor, Impact Factor and 5-Year Impact Factor, Choosing the right Journal for Your Article, Research Ethics, Importance of Research Ethics.	**International Academia:** *MIT*- Design Thinking Certification at MIT Sloan | Online Program *Stanford University*- Creativity and Design Thinking | Stanford Online **AICTE Syllabus:** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** Biomimicry is increasingly being adopted by industries, such as architecture, automotive, and materials science, to design innovative products inspired by nature. Companies like Tesla, Airbus, and Nike draw inspiration from biological systems to create sustainable and efficient designs. Research methods and ethics are essential considerations for industries conducting product development, market research, and user testing. Companies like Microsoft, Pfizer, and Google adhere to ethical research practices and leverage various research methods to inform their decision-making processes.	**4**	**Assignment-8:** Literature Review: Conduct a literature review on a topic related to your domain of interest. Summarize key findings and identify gaps in the existing research. **Assignment-9:** Research Ethics Discussion: Lead a discussion on the importance of research ethics in design thinking and innovation. Discuss ethical considerations in research and how they can impact the design process. **Assignment-10:** Journal Selection Exercise: Explore different academic journals related to design thinking and innovation. Choose a journal and write a mock submission for an article on a relevant topic.

Course Textbook: Textbook of Design Thinking and Innovation by Chandan Adhikari, Prabir Kumar Das, and Tanay Pramanik. S. Chand Publishing, 2026. ISBN: 9789373598031.

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

Subject Name**: Design Thinking and Innovation- Intermediate** Credit**: 0** Subject Code**: IVC281B** Lecture Hours**: 12**

Prerequisite: Basic Knowledge of Physics, Chemistry and Mathematics of 10+2 Level

Relevant Links:

Linkedin Learning **Coursera** **SWAYAM**

Study Materials: Design Thinking and Innovation-Intermediate

Course Outcomes :

At the end of the course

CO1: The student will be able to Examine Design Thinking concepts and principles.

CO2: The student will be able to Practice the methods, processes, and tools of Design Thinking.

CO3: The student will be able to Apply the Design Thinking approach and model to real world situations.

CO4: The student will be able to Learn about Intellectual Property rights and how to file a Patent.

Module Number	Topics	Subtopics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Hands on Assignment
1	**Product Innovation**	Invention and Innovation, Importance of Innovation, Innovation and Modern-Day Civilization, Differences between Invention and Innovation with examples, How Innovations can help various Engineering disciplines, Types of Innovations and examples, Levels of Innovations, Incremental Innovation with Examples, Breakthrough innovation with Examples, Breakout Innovation with Examples, Characteristics of Innovation, Product Innovation, Various steps in Product Innovation by Design, Problem Identification, Analysis and Insights in Product Innovations, Design Brief, Concept Generation, Prototyping, Testing in Product Innovations, Various Types of Prototyping Methods, Introduction to New Product Development Process (NPD), Case studies of Product Innovation.	**International Academia:** ***MIT***- Design Thinking Certification at MIT Sloan | Online Program ***Stanford University***- Creativity and Design Thinking | Stanford Online ***AICTE Syllabus:*** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** *NPD is a systematic approach to bringing a new product to market.* Industries that heavily invest in research and development, such as pharmaceuticals and electronics, follow NPD processes to ensure the successful launch of new products. *Manufacturing, aerospace, and automotive industries use prototyping to test and validate designs before mass production.*	**4**	**Assignment 1:** Form small groups and select a problem related to any engineering discipline. Follow the steps of the product innovation process: problem identification, analysis, insights, design brief, concept generation, prototyping, and testing. Each group should present their final prototype along with the challenges faced and lessons learned during the process. **Assignment-2:** Researchand compile a comprehensive report on how innovation has impacted different engineering disciplines such as civil, mechanical, electrical, and computer engineering. Provide real-world examples of innovations in each discipline, discussing their significance and contributions to the respective fields. **Assignment-3:** Simulate a new product development process for a hypothetical product. Students will go through each stage of the process, from problem identification to the final
					case study of product innovation. The simulation should involve creating a design brief, generating concepts, developing prototypes, and testing the product. Each group should present their findings and reflections on the challenges faced.

2	**SCAMPER Technique**	Introduction SCAMPER Technique, Importance of SCAMPER Technique, How SCAMPER Technique can help in Innovation, Substitution Technique for Innovation with examples, Combine Technique for Innovation with examples, Adaptation Technique for Innovationwith examples, Minification Technique for Innovation with examples, Magnification Technique for Innovation with examples, Modification Technique for Innovation with examples, Put to Other Use Technique for Innovation withexamples, Elimination Technique for Innovation with examples, Rearrange/Replace/Reverse Techniques for Innovations, Case Studies of Scamper Techniques.	**International Academia:** *MIT*- Design Thinking Certification at MIT Sloan |Online Program *Stanford University*- Creativity and Design Thinking | Stanford Online **AICTE Syllabus:** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** Replacing traditional materials with advanced materials in electronic components for improved performance. Integrating different technologies (e.g., electric and autonomous) to create innovative automotive solutions. Modifying product features to meet changing consumer preferences or address emerging trends. Rearranging or reconfiguring manufacturing processes to improve efficiency and reduce costs.	**4**	**Assignment-4:** Select a product or service from a specific industry (e.g., technology, healthcare, automotive) and apply the SCAMPER techniques to generate innovative ideas for improvement. (Use at least three SCAMPER techniques (e.g., Combine, Adaptation, Minification) to brainstorm and propose modifications). **Assignment-5:** Choose a business process within a chosen industry and analyse how the SCAMPER techniques can be employed to optimize and innovate the workflow. (Identify specific steps in the chosen process and apply relevant SCAMPERtechniques). Explore how the SCAMPER techniques can be utilized to expand the market reach of an existing product or service. **Assignment-6:** Explore how the SCAMPER techniques can be utilized to expand the market reach of an existing product or service. (Select a product/service, and apply techniques like Put to Other Use, Modification, and Magnification to devise strategies for entering new markets or attracting new customer segments. Includea comprehensive market analysis and potential challenges). **Assignment-7:** Choose a commonly used product (e.g., a smartphone, a water bottle,a backpack). Apply each SCAMPER technique to brainstorm innovative ideas for

					improving the chosen product. Create a presentation or report showcasing your ideas and the impact each innovation could have on the product. Discuss potential challenges and benefits of implementing the suggested changes.

3	**Introduction to IPR and PatentFiling**	Introduction to IPR, Examples of IPR, Types of IPR, Patents, Copyrights, Trademarks, Industrial designs, Geographical indications, Trade secrets, Plant variety rights, Database rights, Integrated circuit topographies, Traditional knowledge, Importance ofIPR, The Patent Act 1970 and Patent System in India, Procedure of Patent Filling, Criteria for Patentability, Advantages of Patents, How to File a Patent in India, Sample Patent form ofIndia, Patent Databases for Patent Search, Patent System in USA, Importance of USA Patent, Difference between Indian Patent and USA Patent, Advantages of USA Patent, How to get Patent from USA, How to File Patent Application for USA Patent, Sample Patent Form of USA, CaseStudy of few interesting Patents.	**International Academia:** *MIT*- Design Thinking Certification at MIT Sloan |Online Program *Stanford University*- Creativity and Design Thinking | Stanford Online **AICTE Syllabus:** AICTE Model Curriculum for UG Degree Course in Computer Science and Engineering (Artificial Intelligence and Data Science (AI&DS)) (aicte-india.org) **Industry Mapping:** Technology, Pharmaceuticals, Biotechnology Companies in these sectors heavily rely on patent protection for their innovations. Understanding the patent system, criteria for patentability, and procedures is essential for research and development. Trademarks are crucial for companies to establish and protect their brand identity. Industries producing physical products often focus on industrial designs to protect the aesthetic and visual aspects of their products.	**4**	**Assignment-8:** (To develop practical skills in drafting a patent application) You are required to choose a simple invention (e.g., a household item, a gadget, or a process) and draft a provisional patent application. You should include detailed descriptions, drawings, and claims. Emphasis should be placed on meeting the criteria for patentability and clarity in expression. **Assignment-9:** (To understand the process of trademark registration and conduct a comprehensive search) Select a fictional business or product and perform a trademark search to ensure uniqueness. Then simulate the process of filing a trademark application, including completing the necessary forms and understanding the associated legal considerations. You should also discuss the importance of trademarks for businesses. **Assignment-10:** (To compare and contrast the patent systems of India and the USA) Do research and prepare a report on the differences between the Indian and USA patent systems. You should focus on the legal frameworks, criteria for patentability, and procedural aspects. Additionally, You should analyze the advantages and disadvantages of each system.

Course Textbook

Textbook of Design Thinking and Innovation by Chandan Adhikari, Prabir Kumar Das, and Tanay Pramanik. S. Chand Publishing, 2026. ISBN: 9789373598031.

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus

Institute of Engineering & Management, New Town Campus

University of Engineering & Management, Jaipur

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

Index:

Syllabus Structure:

Sl. No.	Type	Subject Code	Subject Name	L	T	P	Total	Credit
1								
2								
3								
4								
5								
6								
7								
8								
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12								
13								
14								
15								
16								
17								
				Total Credit points				

University of Engineering and Management

Institute of Engineering & Management, Salt Lake Campus
Institute of Engineering & Management, New Town
CampusUniversity of Engineering & Management,
Jaipur

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

Subject Name: Economics, Finance and Entrepreneurship

Credit: 0

Lecture Hours: 12

Subject Code: IVC182

Pre-requisite: Basic Mathematical Knowledge

Relevant Links:

Study Material

https://drive.google.com/drive/folders/1nG94FKCOI7kFTeAFPeYjdRwYv_2UpXpH?usp=drive_link

Coursera

https://www.coursera.org/programs/iem-uem-program-2024-2dvv9/learn/firm-level-economics?source=search&collectionId=skill~business-economics#modules https://www.coursera.org/programs/iem-uem-program-2024-2dvv9/learn/market-equilibrium-government-policies-and-elasticity?source=search&collectionId=skill~business-economics https://www.coursera.org/programs/iem-uem-program-2024-2dvv9/learn/introduction-to-tech-

entrepreneurship?fromClip=sfc_page_course_link~U91j2 https://www.coursera.org/specializations/business-entrepreneurship

NPTEL

https://nptel.ac.in/courses/110106141

COURSE OBJECTIVES:

1. To introduce the fundamentals of economics with a focus on engineering applications, including basic economic problems, micro and macroeconomic concepts, and the scope of engineering economics.

2. To impart knowledge on market structures, demand and supply analysis, production and cost behavior, and strategies for identifying target markets and customer segments using analytical tools.

3. To impart knowledge on consumer and producer behavior, utility concepts, elasticity, equilibrium conditions, and value proposition frameworks through real-world case studies.

4. To impart knowledge on entrepreneurship skill development, including self-discovery, effectuation principles, team building, leadership styles, hiring, bootstrapping, and creative problem-solving techniques.

COURSE OUTCOMES:

CO 1: Apply basic economic principles and distinguish between micro and macroeconomic concepts in the context of engineering decision-making.

CO 2: Analyze market dynamics, demand-supply behavior, and consumer segmentation to evaluate business opportunities and market potential.

CO 3: Interpret consumer and producer behavior using economic laws and value proposition models to design customer-centric products and services.

CO 4: Demonstrate entrepreneurial mindset by identifying problems, applying effectuation principles, and developing team-based, resource-efficient startup solutions.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Text Book Mapping	Corresponding Lab Assignment
1	**An Overview of Engineering Economics**	What is Economics, Basic Economic Problems, Micro vs Macro, Engineering Economics Overview	***International Academia:*** *https://ocw.mit.edu/courses/3-080-economic-environmental-issues-in-materials-selection-fall-2005/resources/lec_ee1/* ***AICTE-prescribed syllabus:*** *NA* ***Industry Mapping:*** *Wadhwani Global Foundation*	2	**Book: Engineering Economics and Costing by Sasmita Mishra** Chapter 1: Engineering Economics- An Overview and Chapter 2: Microeconomics and Macroeconomics (2.1 and 2.2)	❖ Plan your own new business idea.
2	**Market Analysis**	Utility Analysis, Demand and Supply, Market and Market Equilibrium under Perfect Competition, Production and Cost Analysis, Revenue and Profit, Target Customer Identification, Segmentation and Targeting (including Niche Marketing), Customer Jobs, Pains and Gains, Early Adopters	***International Academia:*** *https://ocw.mit.edu/courses/2-964-economics-of-marine-transportation-industries-fall-2006/resources/market_econ/* ***AICTE-prescribed syllabus:*** *NA* ***Industry Mapping:*** *Wadhwani Global Foundation*	4	**Book:** 1. **Engineering Economics and Costing by Sasmita Mishra** Chapter 2: Microeconomics and Macroeconomics (2.3-2.8) 2. **Economics, Finance and Entrepreneurship Skills by Ranabir**	❖ Plan your own new business idea. ❖ Pitch the same idea.

					Banik, Subhamoy Bamerjee, Jeet Sen and Prabir Kumar Das, McGraw Hill Chapter 4: Market Analysis (4.1-4.7)	
3	**Consumer and Producer Behaviour**	Law of Diminishing Marginal Utility, Elasticity of Demand, Consumer Equilibrium, Law of Variable Proportions, Stages of Production and Returns to Scale, Elasticity of Supply, Producer Equilibrium, Customer vs Consumer, Value Proposition Design, Case Studies	***International Academia:*** *https://ocw.mit.edu/courses/14-01sc-principles-of-microeconomics-fall-2011/pages/unit-3-producer-theory/productivity-and-costs/* , *https://ocw.mit.edu/courses/15-010-economic-analysis-for-business-decisions-fall-2004/resources/mkt_elstic_srpl/* , *https://ocw.mit.edu/courses/14-01sc-principles-of-microeconomics-fall-2011/pages/unit-3-producer-theory/introduction-to-producer-theory/* , *https://ocw.mit.edu/courses/11-203-microeconomics-fall-2010/resources/mit11_203f10_handout2/* ***AICTE-prescribed syllabus:***	4	**Books:** **1. Microeconomics | Ninth Edition | By Pearson [Paperback] Pindyck, Robert and Rubinfeld, Daniel by Robert Pindyck and Daniel Rubinfeld** Part 2: Producers, Consumers and Competitive Market **2.Economics, Finance and Entrepreneurship Skills by Ranabir Banik, Subhamoy Bamerjee, Jeet Sen and Prabir Kumar Das, McGraw Hill** Chapter 2: Consumer and Producer	❖ Design Value Proposition Canvas of your own business.

			NA ***Industry Mapping:*** *Wadhwani Global Foundation*		Behaviour (2.1-2.8)	
4	**Entrepreneurship Skill Development**	Entrepreneurship as a Domain of Expertise, Effectuation Principles, Self-Discovery and Flow, Team Building and Shared Leadership, Leadership Styles, Hiring Strategy, Bootstrapping, Problem Identification and Brainstorming	***International Academia:*** *https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/mit15_390s13_lec14/* ***AICTE-prescribed syllabus:*** *NA* ***Industry Mapping:*** *Wadhwani Global Foundation*	2	**Books:** **1.Economics, Finance and Entrepreneurship Skills by Ranabir Banik, Subhamoy Bamerjee, Jeet Sen and Prabir Kumar Das, McGraw Hill** Chapter 3 : Self-Discovery and Hiring Strategy (3.1 – 3.7) **2.Entrepreneurship (Second Edition) by Rajeev Roy, Oxford University Press** Chapter 1: Understanding Entrepreneurship and Chapter 2: Growth of a Business Idea	❖ Pitch Deck Presentation – Showcasing Your Entrepreneurial Mindset

TEXT BOOKS:

1. Engineering Economics and Costing by Sasmita Mishra, PHI Learning Private Limited
2. Microeconomics | Ninth Edition | By Pearson [Paperback] Pindyck, Robert and Rubinfeld, Daniel by Robert Pindyck and Daniel Rubinfeld
3. Entrepreneurship (Second Edition) by Rajeev Roy, Oxford University Press
4. Economics, Finance and Entrepreneurship Skills by Ranabir Banik, Subhamoy Bamerjee, Jeet Sen and Prabir Kumar Das, McGraw Hill

REFERENCE BOOKS:

1. Entrepreneurship Development & Project Management by Supriya Biswas and Dr. Shampa Chakraborty, Aryan Publishing House
2. Financial Economics: A Simple Introduction (Simple Introductions), by K.H. Erickson
3. Economics for Engineers by Partha Chatterjee, Vrinda Publication (P) Ltd.