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 2024

Index:

B.Tech. 1st Year Course Structure: 2024 – Odd Semester									
Semester 1 (Group – A) CSE, AI, IOT, IOTCSBT, CSBS, IT, CSIT									
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	BSCM103	Mathematics – I	3	1	0	0	4	4
3	Basic Science Course	BSCBE104	Biology for Engineers	2	1	0	0	3	3
4	Engineering Science Course	ESCEE101	Basic Electrical Engineering	3	1	0	0	4	4
5	Engineering Science Course	ESCME102	Engineering Mechanics I	1	1	0	0	2	2
6	Humanities and social sciences including Management	ESP101	Essential Studies for Professionals – I	2	0	0	0	2	0.5
PRACTICAL									
7	Basic Science Course	BSCPH191	Physics Laboratory	0	0	3	0	3	1.5
8	Engineering Science Course	ESCEE191	Basic Electrical Engineering Laboratory	0	0	2	0	2	1
9	Engineering Science Course	ESCME192	Engineering Graphics & Design	1	0	4	0	5	3

SESSIONAL									
10	Humanities and social sciences including Management	SDP181	Skill Development for Professionals – I	0	0	0	2	2	0.5
Mandatory Industry and Value-Added Courses (IVC)									
11	Mandatory Industry and Value-Added Courses (IVC)	IVC181	Design Thinking & Innovation- Basic	0	0	0	1	1	0
12	Mandatory Industry and Value-Added Courses (IVC)	IVC182	Economics, Finance and Entrepreneurship Skills - Foundation	0	0	0	1	1	0
13	Mandatory Industry and Value-Added Courses (IVC)	IVC183	Introduction to AI and Data Science using Python	0	0	0	1	1	0
14	Mandatory Co-curricular Courses	MCC181A	Co-Curricular Subjects	0	0	0	1	1	0
Total Credit Points of Semester				**15**	**5**	**9**	**6**	**35**	**23.5**

Co-curricular Subjects:
1.Foreign Language
2.Physical Education
3.Soft Skill

B.Tech. 1st Year Course Structure: 2024 – Odd Semester									
Semester 1 (Group – B) AIML, EE, ME, ECE, Civil, EEE, CST, Biotech									
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	BSCM103	Mathematics – I	3	1	0	0	4	4
3	Engineering Science Course	ESCEE101	Basic Electrical Engineering	3	1	0	0	4	4
4	Engineering Science Course	ESCME102	Engineering Mechanics I	1	1	0	0	2	2
5	Humanities and social sciences including Management	HSMC101	English	2	0	0	0	2	2
6	Humanities and social sciences including Management	ESP101	Essential Studies for Professionals – I	2	0	0	0	2	0.5
PRACTICAL									
7	Basic Science Course	BSCCH192	Chemistry Laboratory	0	0	3	0	3	1.5
8	Engineering Science Course	ESCEE191	Basic Electrical Engineering Laboratory	0	0	2	0	2	1
9	Engineering Science Course	ESCME193	Workshop/ Manufacturing Practices	1	0	4	0	5	3

10	Humanities and social sciences including Management	HSMC191	Language Laboratory	0	0	2	0	2	1
SESSIONAL									
11	Humanities and social sciences including Management	SDP181	Skill Development for Professionals – I	0	0	0	2	2	0.5
Mandatory Industry and Value-Added Courses (IVC)									
12	Mandatory Industry and Value-Added Courses (IVC)	IVC181	Design Thinking & Innovation- Basic	0	0	0	1	1	0
13	Mandatory Industry and Value-Added Courses (IVC)	IVC182	Economics, Finance and Entrepreneurship Skills - Foundation	0	0	0	1	1	0
14	Mandatory Industry and Value-Added Courses (IVC)	IVC183	Introduction to AI and Data Science using Python	0	0	0	1	1	0
15	Mandatory Co-curricular Courses	MCC181B	Co-Curricular Subjects	0	0	0	0	0	0
Total Credit Points of Semester				**15**	**4**	**11**	**5**	**35**	**23.5**

Co-curricular Subjects:
1. Foreign Language
2. Physical Education

Syllabus for B.Tech. Admission Batch 2024

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 IEM Learning Linkedin

COURSE OBJECTIVES :

1. To train the students to grasp the concepts of different areas of physics, appropriate for applications indifferent 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, Product of Two Vectors, Triple Product, 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 **Part B: Classical Mechanics** Inertial and Non-Inertial Frame of references, Friction, Problems including constraints and Friction, conservation Laws, Rigid Body,	***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 1	***International Academia:*** **https://catalog.mit.edu/subjects/8/** ***AICTE-prescribedsyllabus:*** 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

		Angular Velocity Vector, Moment of Inertia, Acceleration of a Rigid Body Rolling Down an Inclined plane				
2	**Oscillations**	**Oscillations:** Introduction, Relation of Simple Harmonic Motion with Circular Motion, Differential Equation of Simple Harmonic Motion, Various Characteristics of SHM, Energy of a Particle Executing SHM and Law of Conservation of Energy, Differential Equation of Free or Undamped Vibrations, Damped vibrations, Solution of the Equation of a Damped Oscillator and its Analysis, Electrical Analogy of SHM and DV, Analysis of Forced Vibration, Resonance, Energy of a Forced Vibrator, Sharpness of Resonance, Quality Factor, Forced Vibration in an LCR Circuit	***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 2.	***International Academia:*** **https://catalog.mit.edu/subjects/8/** ***AICTE-prescribedsyllabus:*** 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 :** Interference of light, Young's experiment, Resultant intensity due to superposition of two interfering waves, Interference and conservation of energy, Determination of fringe width in Young's experiment, Shape of interference fringes, conditions for interference of light, coherent sources, production of coherent	***Physics,*** B.K.Pandey, Monoj K Harbola et. al., Cengage, Chapter 2.	***International Academia:*** https://catalog.mit.edu/subjects/8/ ***AICTE-prescribedsyllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	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.

		sources, Fresnel's biprism, displacement of fringes, phase change on reflection, interference due to thin films, interference due to wedge shaped thin films, formation of Newton's ring. **Diffraction:** 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:** Characteristics of laser, Absorption and emission of radiations by matter, 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 3. ***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 5.	***Industry Mapping: Matlab software***		

4	**Introduction to Electromagnetic Theory**	**Maxwell's equations:** 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	***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 7 .	***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	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, Quantum harmonic oscillator, The Hydrogen atom	***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 10.	***International Standards:*** ***https://catalog.mit.edu/subjects/8/*** ***AICTE-prescribedsyllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf ***IndustryMapping: 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 plank's	***Engineering Physics***, Sujay Kumar Bhattacharya, Mc Graw Hill Education, Chapter 11.	***International Standards:*** ***https://catalog.mit.edu/subjects/8/*** ***AICTE-prescribedsyllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf	6	

		law of Radiation from BE Statistics, Comparative study of three Statistical Distribution functions				

MATLAB Project :

1. **Probability distribution of 1D quantum harmonic oscillator**

   Link : https://in.mathworks.com/matlabcentral/fileexchange/83163-probability-distribution-of-1d-quantum-harmonic-oscillator?s_tid=srchtitle

2. **Schrodinger's equation in the 1-dimensional potential well**

   Link : https://in.mathworks.com/matlabcentral/fileexchange/75495-schrodinger-s-equation-in-the-1-dimensional-potential-well?s_tid=srchtitle_site_search_1_schrodinger%20equation

COURSERA Courses :

1. Electrodynamics: Electric and Magnetic Fields

   Link : https://www.coursera.org/learn/electrodynamics-electric-magnetic-fields

2. Electrodynamics: In-depth Solutions for Maxwell's Equations

   Link : https://www.coursera.org/learn/electrodynamics-solutions-maxwells-equations

3. Quantum Mechanics for Engineers Specialization

   Link : https://www.coursera.org/specializations/quantum-mechanics-for-engineers

4. Mechanics: Motion, Forces, Energy and Gravity, from Particles to Planets

   Link : https://www.coursera.org/learn/mechanics-particles-planets

5. Quantum Mechanics

   Link : https://www.coursera.org/learn/quantum-mechanics

6. Vector Calculus for Engineers

   Link : https://www.coursera.org/learn/vector-calculus-engineers

7. Physics of Oscillators and Waves

   Link : https://www.coursera.org/learn/oscillators-waves

Nptel Courses:

1. Newtonian Mechanics : https://onlinecourses.nptel.ac.in/noc24_ph47/preview
2. Radiation Physics : https://onlinecourses.swayam2.ac.in/ini24_ph03/preview

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 book stall, Revised Ninth Edition, 2009
3. A textbook on Optics, B.Ghosh and K.G.Majumder, Sreedhar Publishers, fifth edition
4. Introduction to Electrodynamics by David J.Griffiths 3rd Edition
5. Concepts of Modern Physics (Sixth Edition) by Arthur Beiser (PublishedbyMcGraw-Hill)

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

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

			les/Untitled_1-min.pdf ***Industry Mapping:*** A Python Program for Solving Schrödinger's Equation in Undergraduate Physical Chemistry | Journal of Chemical Education (acs.org) https://in.mathworks.com/matlabcentral/fileexchange/125425-matlab-support-package-for-quantum-computing			
2	**Spectroscopic techniques and applications**	Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.	***International Academia:*** ***https://ocw.mit.edu/courses/5-80-small-molecule-spectroscopy-and-dynamics-fall-2008/*** ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf	6	1. Food dyes and Beers law using UV-vis spectroscopy. 2. Estimation of metal ions using UV-vis spectroscopy.	Chemistry- I, Second Edition, Gourkrishna Dasmohapatra, chapter- 2

			Industry Mapping: HORIBA Scientific's Lab Spec 6 Spectroscopy Suite provides an intuitive, powerful software platform for imaging and spectroscopy by Raman, photoluminescence (PL), cathodoluminescence (CL) and AFM-Raman. ***https://www.horiba.com/int/scientific/products/detail/action/show/Product/labspec-6-spectroscopy-suite-software-1843/***		3. Studies on the synthesis of Nanoparticles using UV-vis spectroscopy.	
3	**Intermolecular forces and potential energy surfaces**	Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.	***International Academia:*** *MIT*- Unit III: Thermodynamics & Chemical Equilibrium | Principles of Chemical Science | Chemistry | MIT Open Course Ware *Stanford University*- Stanford University Explore Courses ***AICTE Syllabus*:** Final_ECE.pdf (aicte-india.org)	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

			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.			
4	**Use of free energy in chemical equilibria**	Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.	***International Academia:*** *MIT*- ***https://ocw.mit.edu/courses/5-60-thermodynamics-kinetics-spring-2008/resources/lecture-13-gibbs-free-energy/*** ***https://ocw.mit.edu/courses/5-111sc-principles-of-chemical-science-fall-2014/pages/unit-iii-thermodynamics-chemical-equilibrium/lecture-16/*** ***https://ocw.mit.edu/courses/5-60-thermodynamics-***	9	1. Acid base titration (Colorimetric) 2. Acid base titration (Conductometric) 3. Acid base titration (pH metric) 4. Potentiometric Titration 5. Determination of the partition coefficient of a substance between two immiscible liquids (Heterogeneous Equilibrium). 6. Determination of hardness of water sample	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 5, 6, 7, 18

			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 Industries: **Potentiometer, Conductivity meter, pH-meter** **Gibbs Energy Minimization Software for Geochemical Modeling:** https://www.bing.com/ck/a?!&&p=c92d076e6c36cf3aJmltdHM9MTcwMTEyOTYwMCZpZ3VpZD0xNjY1NGQ4Yy03NDMzLTYyMDAtMDE0Yi01YzcwNzU5ZTYzNWUmaW		7. Determination of alkalinity of water sample	

			5zaWQ9NTIxMQ&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 https://github.com/MathWorks-Teaching-Resources/Thermodynamics			
5	**Periodic properties**	Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and	***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf ***International Standards***: https://ocw.mit.edu/cours	3	**Periodic table and Graph** *Part-1*: study the structure of the Periodic Table of Elements and use it to find information about	Chemistry- I, Second Edition, Gourkrishna Das mohapatra, chapter- 5

		electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	es/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/		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	
6	**Stereochemistry**	Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	**International Standards** :(https://ocw.mit.edu/courses/5-12-organic-chemistry-i-spring-2003/resources/5_12_outline_1st_half/) ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf) **Industry Mapping:** Chem Draw software	3	1. Determination of specific rotation of sugar solution by polarimeter	Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.17th edition, chapter 27

7	**Organic reactions and synthesis of a drug molecule**	Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	***International Academia:*** https://ocw.mit.edu/courses/5-12-organic-chemistry-i-spring-2003/resources/5_12_outline_1st_half/ https://explorecourses.stanford.edu/m_search?page=0&q=CHEM&filter-coursestatus-Active=on&filter-catalognumber-CHEM=on https://catalog.mit.edu/subjects/5/ ***AICTE-prescribed syllabus:*** (https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf) **Industry Mapping:** Chem Draw software, Chem3D software Drug Design and Lead Molecule Discovery using	7	Determination of the rate constant of an organic reaction 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

			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

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1st Semester Syllabus for B.Tech Admission Batch 2024

Subject Name: Biology for Engineers **Credit: 3**
Subject Code: BSCBE104 **Lecture Hours: 36**

Prerequisites: Basic knowledge of Physics, Chemistry and Mathematics

Relevant Links:

Study material Coursera NPTEL INFOSYS SPRINGBOARD

Course Objective:

1.Bring out the fundamental differences between science and engineering
2.Discuss how biological observations of the 18th Century led to major discoveries

Course Outcomes:

The concepts developed in this course will help the students in their higher studies. Thecoursewill 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:Analyse biological processes at the reductionistic 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

Module number	Topic	Sub-topics	Text Book	Mapping with Industry and International Academia	LectureHours	Corresponding Lab Assignment
1	**Introduction**	Fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why do we need to study biology? Discuss how biological observations of the 18th Century lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics refer to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	Biology for Engineers **Chapter:1**	**No corresponding material**	**2**	**There are no corresponding labs.**
2	**Classification**	Hierarchy of life forms at the phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular	Biology for Engineers **Chapter:1**	**International standard** https://ocw.mit.edu/courses/7-014-introductory-biology-spring-2005/resources/17	**3**	**There are no corresponding labs.**

		(b)ultrastructure- prokaryotes or eukaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitat- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S. cerevisiae, D. elanogaster, C. elegance, A. thaliana, M. musculus		-carbon-and-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	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***	**4**	**There are no corresponding labs.**

		recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.		***prescribedsyllabus:***(***https://www.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**)**		
.4	**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. Two carbon units and lipids	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/sy2y033o***	**4**	**There are no corresponding labs**

				p) ***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 catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis	Biochemistry:Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co **Chapter: 8**	***International Standards:*** (https://ocw.mit.edu/search/?q=Enzymes&type=resourcefile) ***(https://harvard.simplesyllabus.com/en-US/doc/sy2y033op)*** - ***AICTE prescribedsyllabus*** **:(*https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf)*** ***IndustryMapping:*** *(https://kintekcorp.com/software)* ***(https://bio.tools/icekat)***	**4**	**There are no corresponding labs.**
6.	**Information Transfer**	The molecular basis coding and decoding genetic information is the universal Molecular basis of information	Campbell Biology:Campbell,N.A.;Reece,J.B.	***International Standards:*** ***(****https://ocw.mit.edu/courses/7-01sc-*	**4**	**There are no corresponding**

		transfer. DNA as a genetic material. Hierarchy of DNA structure- from single-strandedto double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. Mutation, The DNA Technology (Use and Application)	;Urry,Lisa;Cain, M,L.;Wasserman, S.A.;Minorsky,P. V.;Jackson. 12th Edition **Chapter 16,17**	*fundamentals-of-biology-fall-2011/pages/molecular-biology/dna-structure-classic-experiments/)* *(https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/molecular-biology/dna-replication/)* (https://ocw.mit.edu/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:***		**labs.**

				(**https://web.expasy.org/translate/**) ***(**https://blast.ncbi.nlm.nih.gov/Blast.cgi**)***		
7.	**Macromolecular analysis**	Examining biological processes at the reductionist level involves a comprehensive analysis of proteins, with a particular focus on their structure and function. This investigation encompasses the hierarchical organization of protein structures, spanning primary, secondary, tertiary, and quaternary levels. Additionally, proteins are explored in various roles, serving as enzymes, transporters, receptors, and essential structural elements within biological systems.	Biochemistry:Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto, 5th Edition. WH Freeman & Co. **Chapter:3,13**	***International Standards:****(https://ocw.mit.edu/courses/7-01sc-fundamentals-of-biology-fall-2011/pages/biochemistry/proteins-levels-of-structure-non-covalent-forces/)* ***AICTE 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.aa	**4**	**There are no corresponding labs.**

				u.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-*	4	**There are no corresponding labs.**

				01sc-fundamentals-of-biology-fall-2011/pages/biochemistry/chemiosmotic-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*		**There are no corresponding labs.**

Learning resources:

Text Book:

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

References:

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.HarleyandC.A.Klein1995.2ndeditionWmC.BrownPublishers
3. Principlesof Biochemistry(VEdition),ByNelson,D. L.; andCox,M.M.W.H.Freemanand 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

University of Engineering & Management, Jaipur

Syllabus for B.Tech Admission Batch 2024

Subject Name: English **Credit: 2** **Lecture Hours: 32 Subject Code: HSMC101**

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 Linkedin Learning Infosys Springboard

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	Topic	Sub Topic	Mapping with Textbook	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments
1.	**Vocabulary Building**	1.1 The concept of vocabulary and word formation. 1.2 Root Words from foreign languages. 1.3 Acquaintance with Prefixes and Suffixes 1.4 Synonyms, antonyms, and Standard abbreviations	Textbook- **Universal English in the Twenty-First Century**, P. Prasad Chapter- 1,2,3	*International Academia:* https://ocw.mit.edu/courses/21g-232-advanced-speaking-and-critical-listening-skills-els-spring-2007/ https://ocw.mit.edu/courses/24-901-language-and-its-structure-i-phonology-fall-2010/ *AICTE Prescribed Syllabus:* https://www.aicte-india.org/sites/default/files/ Untitled_1-min.pdf *Industry Mapping:* Business writing and corporate documents.	**4**	Activities on vocabulary building and Lexigraphy games. Exercises involving creating and using industry-specific vocabulary and understanding jargon.

2.	**Basic Writing Skills**	2.1 Sentence Structures 2.2 Use of phrases. 2.3 Importance of proper punctuation. 2.4 Creating coherence. 2.5 Organizing principles of paragraphs in documents. 2.6 Techniques for writing precisely.	Textbook- **Universal English in the Twenty-First Century**, P. Prasad Chapter- 1, 4, 5, 8	*International Academia* https://ocw.mit.edu/courses/21w-011-writing-and-rhetoric-rhetoric-and-contemporary-issues-fall-2015/ *AICTE Prescribed Syllabus:* https://www.aicte-india.org/sites/default/files/ Untitled_1-min.pdf *Industry Mapping:* Formal business Correspondence, project, and business writing.	**6**	Presentation activities and interactive activities with punctuation.

3.	**Identifying Common Errors in Writing**	3.1-Subject – Verb agreement 3.2- Noun-Pronoun Agreement 3.3- Misplaced modifiers 3.4- Articles and Prepositions 3.5-Redundancies and Clichés	Textbook- **Functional English**, Gajendra Singh Chauhan, Smita Kashiramka, L. Thimmesha Chapter- 4, 5, 10	*International Academia:* https://ocw.mit.edu/courses/24-900-introduction-to-linguistics-spring-2022/ *AICTE Prescribed Syllabus:* https://www.aicte-india.org/sites/default/files/ Untitled_1-min.pdf *Industry Mapping:* Formal business Correspondence.	**5**	Presentation skills on grammar and related topics on modifiers and redundancies.

4.	**Nature and Style of Sensible Writing**	4.1- Describing, Defining and Classifying 4.2- Providing examples or evidence 4.3- Writing introduction and conclusion	Textbook- **Universal English in the Twenty-First Century**, P. Prasad Chapter- 7	*International Academia*: https://ocw.mit.edu/courses/21w-794-graduate-technical-writing-workshop-january-iap-2019/ *AICTE Prescribed Syllabus:* https://www.aicte-india.org/sites/default/files/ Untitled_1-min.pdf *Industry Mapping:* Email writing and writing other relevant corporate documents.	**3**	Creative writing skills on descriptive essay, expository writing, persuasive writing, and Narrative writing.

5.	**Writing Practices**	5.1- Comprehension 5.2- Precis Writing 5.3- Essay Writing 5.4 Business Correspondence (Letter Writing, Business Letter, Cover Letter, Memos, Email) 5.5- CV Writing	Textbook- **Functional English**, Gajendra Singh Chauhan, Smita Kashiramka, L. Thimmesha Chapter- 11, 13, 17, 19	*International Academia:* https://ocw.mit.edu/courses/21g-225-advanced-workshop-in-writing-for-science-and-engineering-els-spring-2016/	**8**	Activities on reading comprehension and creative writing skills and assignments on concise writing.

				AICTE Prescribed Syllabus: https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf *Industry Mapping*: Project writing and documentation.		

6.	**Listening and Speaking Practices**	6.1- Listening Comprehension 6.2- Pronunciation, intonation, Stress, and rhythm. 6.3- Common everyday situation: Conversations and dialogues 6.4- Communication at Workplace 6.5- Interviews & Group Discussions 6.6- Formal Presentations	Textbook- **Functional English**, Gajendra Singh Chauhan, Smita Kashiramka, L. Thimmesha Chapter- 12, 14, 15, 16	*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.	**6**	Interactive Practice sessions in language lab.

Tools Used:

Generative AI: Chatgpt, Gemini, Meta AI

Image generator: Dall-E, Nvidia, Canva

Plagiarism checker: GptZero, Ithenticate

TEXT BOOKS:

1. Raman, Meenakshi. *Technical Communication Principles*. Oxford University Press.
2. Chauhan, Gajendra Singh, Smita Kashiramka & L. Thimmesha. *Functional English*. Cengage. AICTE Approved.
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. Chaturvedi, P.D. & Mukesh Chaturvedi. *The Art and Science of Business Communication*, 4th Edition by Released June 2017 Publisher(s): Pearson India.
3. Kumar, Sanjay & Pushp Lata. *Communication Skills*. Oxford University Press.

Syllabus for B.Tech Admission Batch 2024

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

Subject Code: BSCM103

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, matrices and determinants, sequence and series and also lay the concept of multivariable differentiation to the students enrolled in the first semester 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: 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 4: Use the tools of power series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

Module number	Topic	Sub-topics	Mapping with Textbooks	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	**Calculus (Differentiation)**	Rolle's Theorem, Mean Value Theorems, Taylor's and Maclaurin's Theorems with Remainders; Taylor's Series, Series for Exponential, Trigonometric and Logarithm Functions; Indeterminate forms and L' Hospital's Rule; Maxima and Minima; Evolutes and Involutes.	**T1: Chapter 4,** Secs. 4.3 - 4.5, 4.10 – 4.12, 4.14, 4.15	***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/	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^{3x} on **R** • Draw [x], the greatest integer function in the interval [0, 5]. 2. Draw the graph of the evolute of a parabola.

				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		

2	**Calculus (Integration)**	Evaluation of Definite and Improper Integrals; Beta and Gamma Functions and their properties; Applications of Definite Integrals to evaluate surface areas and volumes of revolutions.	**T1: Chapter 6,** Secs. 6.8 – 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	8	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	**Matrices and Determinants**	Matrices, Addition and Scalar Multiplication, Matrix Multiplication; Symmetric and Skew-symmetric Matrices; Hermitian and Skew-Hermitian Matrices; Determinants, Cramer's Rule; Inverse of a Matrix; Orthogonal Matrices; Gauss-Jordan Method to find the inverse of a matrix; Linear Systems of Equations, Rank of a Matrix. Eigenvalues and Eigenvectors; Eigenvalues of some special matrices; Cayley-Hamilton Theorem; Similarity Matrix, Diagonalization of matrices.	**T1: Chapter 2** Secs. 2.1 – 2.7(6), 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, & 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	10	1. Write a function that takes a matrix, a row number and a column number. Beginning with the row number passed to the function, scroll down the column passed to the function and return the row number that contains the largest absolute value in the column. 2. Using MATLAB, find the determinant and rank of a matrix. 3. Compute eigenvalues and eigenvectors of a matrix A $\in \mathbf{R}^{n\times n}$. 4. Solve a linear system of equations.

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 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.	**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 https://in.mathworks.com/ https://www.wolfram.com/mathematica/	10	1. To evaluate the sum of an infinite series. 2. To check the convergence or divergence of an infinite series.

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/

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.

Syllabus for B.Tech Admission Batch 2024

Subject Name: Basic Electrical Engineering **Credit: 4** **Lecture Hours: 42**

Subject Code: ESCEE101

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

Relevant Links:

COURSE OBJECTIVES:

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 and converter circuits. 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.

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 and converter circuits. 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.

Module number	Topic	Text Book, Chapter	Sub-topics (Yellow highlighted portion: AICTE syllabus; Red highlighted portion: MIT Syllabus)	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment
1	DC Circuits	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 1,2,21	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-india.org/sites/default/files/Untitled 1-min.pdf	8	Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2	AC Circuits	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 11,12,13,14	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-india.org/sites/default/files/Model Curriculum/AICTE%20-%20UG%20CSE.pdf	8	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	Transformers	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 6, 7, 32, 33	Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. Analysis and design of modern energy conversion and delivery systems.	***International Academia:*** *https://catalog.mit.edu/subjects/6/* ***AICTE Syllabus*:** https://www.aicte-india.org/sites/default/files/Model Curriculum/AICTE%20-%20UG%20CSE.pdf .	6	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	Basic Electrical Engineering By B.L.Theraja S.Chand Publication Chapter 26, 27, 28, 29, 30, 34, 35	Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf	8	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	Power Electronics By P.S. Bhimbra New Age Publication Chapter 7	DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf	6	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	Electrical Installations	Power Electronics By P.S. Bhimbra New Age Publication Chapter 11	Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup. critical challenges associated with global energy systems	***International Academia:*** https://catalog.mit.edu/subjects/6/ ***AICTE-prescribed syllabus:*** https://www.aicte-india.org/sites/default/files/Untitled_1-min.pdf	6	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.

TEXT BOOK:

1. Basic Electrical Engineering (Vol. 1 & 2) - B.L.Theraja; S.Chand Publication
2. Power Electronics - P.S. Bhimbra; New Age Publication

REFERENCE BOOKS:

1. Basic Electrical Engineering -Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda
2. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition

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)

Syllabus for B.Tech Admission Batch 2023

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

STUDY MATERIALS

Subject Code: ESCME102

Course Outcomes	
CO1	Remember laws of vector algebra and friction, and represent practical situations through free-body diagrams.
CO2	Understand concepts of equilibrium of system of forces, shear force and bending moment, centre of gravity, and moment of inertia.
CO3	Understand and apply the methods of virtual work and energy applicable to force systems.
CO4	Apply the concepts of equilibrium to solve practical problems involving friction, trusses, structures and beams.

Module number	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignment	Mapping with Text Books
1	**Vectors**	Introduction to Vectors and their applications.	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaSubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *MATLAB*	3	Solving vector mechanics problems in MATLAB	Engineering Mechanics, Ghosh, Chakrabarti, Ghosh – Chapter 2
2	**Force & Equilibrium Systems**	Basic concepts, ; Rigid Body equilibrium (2-D & 3-D); System of	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaS	4	Solving force equilibrium problems in MATLAB and validating with analytical solutions.	Engineering Mechanics, Ghosh, Chakrabarti, Ghosh – Chapter 3

		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.	ubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *MATLAB*			
3	**Friction**	Laws of Friction, Static and Dynamic Friction;, wedge friction and screw jack	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaSubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/	3	Solving numerical problems involving friction in MATLAB and validating the analytical solutions.	Engineering Mechanics, Ghosh, Chakrabarti, Ghosh – Chapter 4

			Industry Mapping: *MATLAB*			
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.	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaSubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *ANSYS Mechanical*	3	Solving numerical problems on Trusses in ANSYS Mechanical and verifying with analytical calculations	Engineering Mechanics (Statics & Dynamics), D.S. Kumar – Chapter 5
5	**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,	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaSubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:***	5	Solving numerical problems on CG & MI in MATLAB and validating with analytical solutions	Engineering Mechanics, Ghosh, Chakrabarti, Ghosh – Chapter 5, 6

		Moment of inertia of standard sections and composite sections; Concept of Mass moment inertia.	https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *MATLAB*			
6	**Basic Concept of Bending Moment**	Transverse loading on beams, Concept of shear force and bending moment, Different type of beams and loading., relationships between shear force and bending moment, shear force and bending moment diagrams of point loading on cantilevers and simply supported beams	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaSubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *ANSYS Mechanical*	3	Determining the shear force, bending moment and bending stress distribution of beams under transverse loading using ANSYS Mechanical.	Engineering Mechanics-Statics, Meriam & Craige – Chapter 5
7	**Virtual Work and Energy Method**	Virtual displacements, principle of virtual work for rigid bodies, degrees of freedom.	***IIT Kharagpur Syllabus:*** https://erp.iitkgp.ac.in/ERPWebServices/curricula/CurriculaS	3	Solving numerical problems on virtual work in MATLAB and validating with analytical solutions	Engineering Mechanics, Ghosh, Chakrabarti, Ghosh – Chapter 7

		Mechanical efficiency, energy equation for equilibrium. Applications of energy method for equilibrium.	ubjectsList.jsp?stuType=UG&splCode=ME ***International Standard:*** https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/ ***Industry Mapping:*** *MATLAB*			

Learning Resources (Books):

Text Books

1. Engineering Mechanics, B.B. Ghosh, S. Chakrabarti, S. Ghosh, Vikas Publishing House
2. Engineering Mechanics (Statics & Dynamics), D.S. Kumar, S K Kataria and Sons
3. Engineering Mechanics: Statics, Meriam & Craige, Wiley

Reference Books

1. Engineering Mechanics, Chanda & Nag, Wiley
2. Engineering Mechanics, Timoshenko, Young, Rao, Pati, McGraw Hill

Online Learning Materials:

1. Coursera: https://www.coursera.org/learn/engineering-mechanics-statics
   https://www.coursera.org/learn/engineering-mechanics-statics-2
   https://www.coursera.org/learn/mastering-statics

2. NPTEL: https://archive.nptel.ac.in/courses/112/106/112106286/
   https://archive.nptel.ac.in/courses/112/106/112106180/

MATLAB Tool for Practice:

'CADApps mechanics'
https://in.mathworks.com/matlabcentral/fileexchange/54504-cadapps-mechanics

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

Subject Code: IVC181

Relevant Links:

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

Study Materials: Design Thinking and Innovation-Basic

Mod ul e Nu m be r	Topics	Subtopics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Hands-on Assignment
1	**Introducti on 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	**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	**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.

		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.	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.		
		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	**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:**		**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.

2	**Introduction to Creative Process, Biomimicking and Prototyping.**	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.	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-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	**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.

		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.			

TextBook: **Design Thinking for Beginners: Innovation as a factor for entrepreneurial success**

Subject Name: Economics, Finance and Entrepreneurship Skills – Foundation **Credit: 0**

Lecture Hours: 12

Subject Code: IVC182

COURSE OUTCOMES:

The course will enable the student to:

CO1: Develop an entrepreneurial mind set which will be useful in all future endeavours including intrapreneurship.

CO2: Build a strong knowledge and skills foundation for students to start, build and grow a viable and sustainable venture.

CO3: Acquire the knowledge in basic Economics and Financial skills to develop a business, marketing strategy and revenue streams.

CO4: Learn critical skills like leadership, presentation, decision making and communication.

Module number	Topic	Sub-topics	Mapping with Industryand International Academia	Lecture Hours	Corresponding Lab Assignment
1	**An Overview of Engineering Economics**	Subject matter of Economics, Basic Economic Problems, Difference between Microeconomics and Macroeconomics, Definition, Scope and Principles of Engineering Economics, Engineering Economy, Engineering Design Process Activities	***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:*** *Syllabus has been designed after consulting with* ***Wadhwani Global Foundation***	2	1. Create one practice venture from your own new business idea. 2. Pitch your idea.
2	**Market Analysis**	Utility analysis, Demand, Supply, Market, Production, Cost, Revenue, Profit, Market Equilibrium under Perfect Competition, Target Customer, Segmentation and Targeting, Niche Marketing, Identify Jobs, Pain and Gains of the customers, Early Adopters, Value Proposition Design	***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:*** *Syllabus has been designed after consulting with* ***Wadhwani Global Foundation***	4	1. Design Value Proposition Canvas of your own business. 2. Design Lean Business model of your own business.

3	**Finance**	Money and Banking, Structure of a Financial System, Different Financial Instruments, Meaning of Risk, Concept of Return, Risk- Return Trade-off, Currency and Money Supply, Functions of Commercial Banks, Functions of Central Bank, Indian Money Market, Indian Financial Systems	***International Academia:*** ***https://ocw.mit.edu/courses/15-414-financial-management-summer-2003/resources/lec9_risk_return/ , https://ocw.mit.edu/courses/15-s12-blockchain-and-money-fall-2018/resources/session-16-central-banks-commercial-banking-part-2/*** ***AICTE-prescribed syllabus: NA*** ***Industry Mapping:*** *Syllabus has been designed after consulting with* ***Wadhwani Global Foundation***	3	1. Perform the financial and sales planning of your own business.
4	**Entrepreneurship Skill Development**	Different types of Business Organisation, Business Cycles, Entrepreneurship as a domain of expertise, Elements of Entrepreneurial Expertise, Principles of Entrepreneurial Expertise, Effectuation: The logic of Entrepreneurial Expertise, Quantitative Analysis of Data, Qualitative Analysis of Data, Importance of Team, Problem Identification, Brainstorming, Bootstrapping	***International Academia:*** ***https://ocw.mit.edu/courses/15-390-new-enterprises-spring-2013/resources/mit15_390s13_lec14/*** ***AICTE-prescribed syllabus: NA*** ***Industry Mapping:*** *Syllabus has been designed after consulting with* ***Wadhwani Global Foundation***	3	1. Give a PowerPoint Presentation using your prepared pitch deck to showcase your entrepreneurial mind set.

Reference Books:

1. Entrepreneurship (Second Edition) by Rajeev Roy, Oxford University Press
2. Engineering Economics and Costing by Sasmita Mishra, PHI Learning Private Limited
3. Economics for Engineers by Partha Chatterjee, Vrinda Publication (P) Ltd.

Subject Name: Introduction to AI and Data Science using Python **Credit:0** **Lecture Hours:36**

Subject Code: IVC183

StudyMaterial **Coursera** **NPTEL** **Linkedin** **Infosys Springboard**

COURSE OBJECTIVES:

Through this course the students will be introduced the paradigm of programming.
They will learn basic concepts such as data handling, control flow, and relevant command structure for procedural and object-oriented programming.
Additionally, these fundamental concepts of programming will lay the foundation for students and enable them to design solutions for real problems in the field ofAI and Data Science data analysis.

COURSE OUTCOMES:

After completion of this course students would be able to

CO1: Understand fundamental components of programming in python
CO2: Implement solutions using object orient programming concepts using python classes andobjects
CO3: Develop databases, perform numerical computation and visualize data using pythonpackages
CO4: Apply concepts of python to solve challenges in AI and Data Science.

Module	Topic	Sub-Topic	Mapping with Industry and International Academia	Lecture Hours	Corresponding Assignment
1	**Python Basics,**	The Python Interpreter, Console I/O, Conditions, Control Flow, Functions, Datatypes, List, Tuple, Set, Dictionaries, File I/O	**InternationalAcademia**: https://ocw.mit.edu/courses/6-189-a- gentle-introduction-to-programming- using-python- january-iap-2008/pages/syllabus/ https://ocw.mit.edu/c ourses/6-0001- introduction-to-computer-science- and-programming-in-python-fall-2016/pages/syllabus/	6	1) Write a program in python to print allprime numbers inside a range of numbers provided by the user 2) Create one Fibonacci sequence till a specific no. of terms and count the number of variablesused without any functions. Write onePython Program. 3) Print the series upto N terms: 1, 3,7, 13, 21, 31 and count thenumber of mathematical

	chapter 1,2,3,4,6,7, Python Computing Fundamentals and Applications, Abhijit Kar Gupta, Techno World.		**Industry Mapping** *GitHub platform* **IDEs-**PyCharm, IDLE,Visual Studio Code **Competitive Coding Platform** HackerRank, TCS Codevita projects **web-based interactive computing platform**jupyter notebook, google colab **LinkedIn Learning** **Artificial Intelligence** https://www.linkedin .com/learning/introd uction-to-artificial-intelligence?u=229219690 **Prompt Engineering** https://www.linkedin .com/learning/tech- trends/welcome-to- tech-trends?u=229219690 https://www.linkedin .com/learning/introd uction-to-prompt- engineering-for-generative-ai/joining-the-nlp- revolution?u=229219690 https://www.linkedin .com/learning/prompt-engineering-how- to-talk-to-the-ais/what-is-a- prompt?u=229219690 **Data Science** https://www.linkedin .com/learning/learning-data-science- understanding-the-basics/welcome?u=2 29219690		operators used without any functions. Write onePython Program. 4) Input a number andcheck whether it is Krishnamurthy or notusing functions and count the number of iterationsused without any functions. Write onePython Program. 5) Create one list of 20 values and find out Mean, Median andMode of a list of numbers. Count the number of separators used. Write one Python Program. 6) Given a list of numbers return theindices in which a specific number occurs. 7) Take input from onefile and place it to another file. Use Asciivalue for comparison Rotate the content in the copied file Design one hash function to

					check theintegrity of the two files Write a Python program. 8) Write a Python program to demonstrate the use of Local and Globalvariables 9) Implement the following

			Python https://www.linkedin .com/learning/python -functions-for-data- science/python- functions-you-should- know?u=229219690 **Beginner:** https://www.linkedin .com/learning/paths/getting-started-with-python **Intermediate:** https://www.linkedin .com/learning/paths/advance-your-skills- in-python-8969631 **Expert:** https://www.linkedin .com/learning/paths/advance-your-python-skills-for-data-science		functions/methodswhich operates on lists in Python with suitableexamples: **i) list( )** **ii) len( )** **iii) count( )** **iv) index ( )** **v) append( )** **vi) insert( )** **vii) extend()** **viii) remove( )** **ix) pop( )** **x) reverse( )** **xi) sort( )** **xii) copy( )** **xiii) clear( )** 10) Implements the following functions/methodswhich operates ontuples in Python with suitable examples: **i) len( )** **ii) count( )** **iii) index( )** **iv) sorted( )** **v) min ( )vi)max( )** **vii) cmp( )** **reversed( )**

2	**Object Oriented Programming with Python** **chapter 8 , Python Computing Fundament als and Applications , Abhijit Kar Gupta,Techno World.**	Classes, Objects, Special Methods: __init__, __call__, __iter__, __getitem_, __len	InternationalAcademia: https://ocw.mit.edu/courses/6-189-a- gentle-introduction-to-programming- using-python- january-iap-2008/pages/syllabus/ https://ocw.mit.edu/c ourses/6-0001- introduction-to-computer-science- and-programming-in-python-fall-2016/pages/syllabus/ **Industry Mapping** *GitHub platform* **IDEs**-PyCharm, IDLE,Visual Studio Code **Competitive Coding Platform** HackerRank, TCS Codevita projects **web-based interactive computing platform**jupyter notebook, google colab **LinkedIn Learning** **Artificial Intelligence** https://www.linkedin .com/learning/introd uction-to-artificial-intelligence?u=229219690 **Prompt Engineering** https://www.linkedin .com/learning/tech- trends/welcome-to-tech-trends?u=229219690 https://www.linkedin .com/learning/introd uction-to-prompt- engineering-for-		

			generative-ai/joining-the-nlp- revolution?u=229219690 https://www.linkedin .com/learning/prompt-engineering-how- to-talk-to-the-ais/what-is-a- prompt?u=229219690 **Data Science** https://www.linkedin .com/learning/learning-data-science- understanding-the-basics/welcome?u=2 29219690		

3	**Numerical Data Analysis with Python,** **chapter 11 ,Python Computing Fundame ntals and Applications, AbhijitKar Gupta, Techno World.**	NumPy N-Darrays, Indexing, Slicing, Reshaping, ND-Array Arithmetic	**InternationalAcademia:** https://ocw.mit.edu/courses/6-189-a- gentle-introduction-to-programming- using-python- january-iap-2008/pages/syllabus/ https://ocw.mit.edu/c ourses/6-0001- introduction-to-computer-science- and-programming-in-python-fall-2016/pages/syllabus/ **Industry Mapping** *GitHub platform* **IDEs-**PyCharm, IDLE,Visual Studio Code **Competitive Coding**	6	1) Write a Python program to take inputand display the valuesof 2 dimensional NumPy array 2) Write a Python program to transposea 2-dimensional NumPy array 3) Write a Python program to reshape a 2-dimensional NumPyarray. 4) Write a Python program to find thedeterminant of NumPy matrix 5) Write a Python program to find the inverse of a NumPy matrix
			Platform HackerRank, TCSCodevita projects **web-based interactive computing platform**jupyter notebook, google colab		

4	**Database Handling with Python** **chapter 14 , Python Computing Fundamentals andApplications, Abhijit Kar Gupta, Techno World.**	Introduction to Pandas, Series, Dataframes, read CSV,	InternationalAcademia: https://ocw.mit.edu/courses/6-189-a- gentle-introduction-to-programming- using-python- january-iap-2008/pages/syllabus/ https://ocw.mit.edu/c ourses/6-0001- introduction-to-computer-science- and-programming-in-python-fall-2016/pages/syllabus/ **Industry Mapping** *GitHub platform* **IDEs-**PyCharm, IDLE,Visual Studio Code **Competitive Coding Platform** HackerRank, TCS Codevita projects **web-based interactive computing platform**jupyter notebook, google colab **LinkedIn Learning** **Artificial Intelligence** https://www.linkedin .com/learning/introd uction-to-artificial-intelligence?u=229219690 **Prompt Engineering** https://www.linkedin .com/learning/tech- trends/welcome-to- tech-trends?u=229219690 https://www.linkedin .com/learning/introd uction-to-prompt- engineering-for-generative-ai/joining-the-nlp- revolution?u=229219690	6	1) Read a CSV file asa pandas dataframe 2) Fetch rows from the dataframe based on a specific attribute 3) Display the value of specific columns ofa pandas dataframe 4) Find the mean and standard deviation ofa specific column containing numeric data.

			https://www.linkedin .com/learning/prompt-engineering-how- to-talk-to-the- ais/what-is-a- prompt?u=229219690 **Data Science** https://www.linkedin .com/learning/learning-data-science- understanding-the- basics/welcome?u=2 29219690 **Python** https://www.linkedin .com/learning/python -functions-for-data- science/python- functions-you- should- know?u=229219690 **Beginner:** https://www.linkedin .com/learning/paths/getting-started-with-python **Intermediate:** https://www.linkedin .com/learning/paths/advance-your-skills- in-python- 8969631 **Expert:** https://www.linkedin.com/learning/paths/advance-your- python-skills-for-data- science		

5	**Data Visualization** **chapter 13 ,Python Computin g Fundamentals and Applications, AbhijitKar Gupta, Techno World.**	Introduction to Matplotlib: Pyplot, markers, lines,labels, grid, subplot, scatter, bars, histograms, pie-chart	InternationalAcademia: https://ocw.mit.edu/courses/6-189-a- gentle-introduction- to-programming- using-python- january-iap- 2008/pages/syllabus/ https://ocw.mit.edu/c ourses/6-0001- introduction-to-computer-science- and-programming-in-python-fall-2016/pages/syllabus/ **Industry Mapping** *GitHub platform* **IDEs-**PyCharm, IDLE,Visual Studio Code **Competitive Coding Platform** HackerRank, TCS Codevita projects **web-based interactive computing platform**jupyter notebook, google colab **LinkedIn Learning** **Artificial Intelligence** https://www.linkedin .com/learning/introd uction-to-artificial-intelligence?u=229219690 **Prompt Engineering** https://www.linkedin .com/learning/tech-trends/welcome-to-tech-trends?u=229219690 https://www.linkedin	6	1) Write a program using matplotlib todisplay a line plot 2) Write a program using matplotlib to use different types ofMatplotlib Markers 3) Write a program using matplotlib to use Matplotlib Labelsand Title 4) Write a program using matplotlib to display a scatter plot 5)Write a programusing matplotlib todisplay Matplotlib Histograms

			.com/learning/introd uction-to-prompt- engineering-for-generative-ai/joining-the-nlp- revolution?u=229219690 https://www.linkedin .com/learning/prompt-engineering-how- to-talk-to-the-ais/what-is-a- prompt?u=229219690 **Data Science** https://www.linkedin .com/learning/learning-data-science- understanding-the-basics/welcome?u=2 29219690 **Python** https://www.linkedin .com/learning/python -functions-for-data- science/python- functions-you-should- know?u=229219690 **Beginner:** https://www.linkedin .com/learning/paths/getting-started-with-python **Intermediate:** https://www.linkedin .com/learning/paths/advance-your-skills- in-python-8969631 **Expert:** https://www.linkedin .com/learning/paths/advance-your-python-skills-for-data- science		

6	**Introductionto AI and Prompt Engineering** **Chapter1 Prompt Engineeringfor Generative AI Future- Proof Inputsfor Reliable AI Outputs By James Phoenix, Mike Taylor** **· 2024,**	Introduction toAI, Application Areas, Definition & Types of Machine Learning, Prompt Engineering – Ethical Policies, Ideal Programming Practices with AI, AI based Coding Platforms : ChatGPT, Blackbox.AI , Gemini, ColabAI. Python Programming Platforms: Spyder, Jupyter Notebook, Google Colab.	**InternationalAcademia:** https://ocw.mit.edu/courses/6-189-a- gentle-introduction- to-programming- using-python- january-iap- 2008/pages/syllabus/ **Industry Mapping:** *GitHub platform* **IDEs-**PyCharm, IDLE,Visual Studio Code **Competitive Coding Platform** HackerRank, TCS Codevita projects **web-based interactive computing platform**jupyter notebook, google colab **LinkedIn Learning** **Artificial Intelligence** https://www.linkedin .com/learning/introd uction-to-artificial-intelligence?u=229219690 **Prompt Engineering** https://www.linkedin .com/learning/tech- trends/welcome-to- tech-trends?u=229219690 https://www.linkedin .com/learning/introd uction-to-prompt- engineering-for-generative-ai/joining-the-nlp- revolution?u=229219690 https://www.linkedin .com/learning/prompt-engineering-how- to-talk-to-the-	6	1) Introduction to Generative AI tools 2) Introduction to Prompt Engineering 3) Writing Prompts in different Gen AI tools 4) Question and Answering using GenAI Tools 5)Content Summarization using Gen AI Tools 6) Analyzing designs 7) Synthesis of design

			ais/what-is-a- prompt?u=229219690 **Data Science** https://www.linkedin .com/learning/learning-data-science- understanding-the-basics/welcome?u=2 29219690 **Python** https://www.linkedin .com/learning/python -functions-for-data- science/python- functions-you-should- know?u=229219690 **Beginner:** https://www.linkedin .com/learning/paths/getting-started-with-python **Intermediate:** https://www.linkedin .com/learning/paths/advance-your-skills- in-python-8969631 **Expert:** https://www.linkedin .com/learning/paths/advance-your-python-skills-for-data-science		

Text Books:

1) Python for Everybody: Exploring Data in Python 3, Charles Severance, SPD
2) Python Computing Fundamentals and Applications, Abhijit Kar Gupta, Techno World.
3) Prompt Engineering for Generative AI by James Phoenix, Mike Taylor, O'Reilly Media, Inc.
4) An Introduction to Python Paperback – 1 March 2011 by Guido Van Rossum (Author), Fred L Drake Jr (Author)

Reference Books:

1) Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, WesMcKinney, O'Reilly
2) Python: The Complete Reference Paperback – 20 March 2018 by Martin C. Brown
3) Python Programming and Numerical Methods - A Guide for Engineers and Scientists Book by Alexandre Bayen, Qingkai Kong, and Timmy Siauw.

Lab Simulator:

https://python-iitk.vlabs.ac.in/

Digital Twin:

Pyansys - https://twin.docs.pyansys.com/