

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	3	2	2	2	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-	
2	3	2	2	2	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-	
3	3	2	2	2	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-	
4	3	2	2	2	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-	
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS			
Module	Title	Topics	Hours
1	Linear Algebra	Linear systems of equations: Gauss elimination, Row echelon form, Linear Independence: rank of a matrix, Solutions of linear systems: Existence, Uniqueness (without proof), The matrix Eigen Value Problem, Determining Eigen values and Eigen vector, Diagonalization of matrices. (Text 1: Relevant topics from sections 7.3, 7.4, 7.5, 8.1, 8.4)	11
2	Ordinary Differential Equations	Homogeneous linear ODEs of second order, Superposition principle, General solution, Homogeneous linear ODEs of second order with constant coefficients (Method to find general solution, solution of linear Initial Value Problem). Non homogeneous ODEs (with constant coefficients) - General solution, Particular solution by the method of undetermined coefficients (Particular solutions for the functions ke^{yx} , kx^n , $k\cos\omega x$, $k\sin\omega x$, $ke^{\alpha x}\cos\omega x$, $ke^{\alpha x}\sin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE (with constant coefficients), Solution by variation of parameters (Second Order). (Text 1: Relevant topics from sections 2.1, 2.2, 2.7, 2.10)	12
3	Laplace Transforms	Laplace Transform and its inverse, linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives, solution of differential equations using Laplace transform, Unit step function, Second shifting theorems. Dirac delta function and its Laplace transform, Convolution theorem (without proof) and its application for finding inverse Laplace transform of products of functions. (Text 1: Relevant topics from sections 6.1, 6.2, 6.3, 6.4, 6.5)	12
4	Fourier series, Integrals And Transforms	Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions), Fourier series of 2π periodic functions, Fourier series of $2l$ periodic functions, Half range sine series expansion, Half range cosine series expansion. Fourier Integral, Fourier Cosine and Sine Transform, Fourier Transform and its inverse. (Text 1: Relevant topics from sections 11.1, 11.2, 11.7, 11.8, 11.9)	10

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOK				
SL. No.	Name of Book	Name of Author/s	Publisher	Edition and Year
1	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons	10th edition, 2016
REFERENCE				
SL. No.	Name of Book	Name of Author/s	Publisher	Edition and Year
1	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson	15th edition, 2023
2	Essential Calculus	J. Stewart	Cengage	2nd edition, 2017
3	Elementary Linear Algebra	Howard Anton, Chris Rorris	Wiley	11th edition, 2019

4	Bird’s Higher Engineering Mathematics	John Bird	Taylor & Francis	9th edition, 2021
5	Higher Engineering Mathematics	B. V. Ramona	McGraw-Hill Education	39th edition, 2023
6	Calculus	H. Anton, I .Biven ,S .Davis	Wiley	12th edition,2024
VIDEO LINKS				
1	https://archive.nptel.ac.in/courses/111/107/111107164/			
2	https://archive.nptel.ac.in/courses/111/104/111104031/			
3	https://archive.nptel.ac.in/courses/111/106/111106139/			
4	https://archive.nptel.ac.in/courses/111/101/111101164/			
VIRTUAL LAB/SIMULATION TOOLS				
1	Python			
2	MATLAB			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1. Linear Algebra (11 Hrs)	Part 1	Linear System of Equations	Systems of linear equations, Solution by Gauss elimination	3
	Part 2	Solutions of Linear Systems	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems.	2
	Part 3	The matrix Eigen Value Problem	Determining Eigen values and Eigen values	3
	Part 4	Diagonalization	Diagonalization	3
2. Ordinary Differential Equations (12 hours)	Part 1	Homogeneous linear ODEs of second order,	Homogeneous linear ODEs of second order, Superposition principle, General solution, Homogeneous linear ODEs of second order with constant coefficients (Method to find general solution, solution of linear Initial value problems).	3
	Part 2	Non homogenous ODEs (with constant coefficients)	General solution, Particular solution by the method of undetermined coefficients (Particular solutions for the functions $ke^{\gamma x}$)	3
	Part 3	Initial value Problem	Particular solution by the method of undetermined coefficients (Particular solutions for the functions $ke^{\gamma x}$, kx^n , $k\cos\omega x$, $k\sin\omega x$, $ke^{ax}\cos\omega x$, $ke^{ax}\sin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE (with constant coefficients),	3
	Part 4	Method of Variation of Parameters	Solution by variation of parameters (Second Order)	3

3.Laplace Transforms (12 hours)	Part 1	Laplace Transform, inverse Transform	Finding Laplace Transform and inverse Transform, Linearity, First shifting theorem	3
	Part 2	Solution of Differential equations	Solution of Differential equations, Initial value problems by Laplace transform method.	3
	Part 3	Unit step function and Dirac Delta function	Unit step function --- Second shifting theorem, Dirac Delta function	3
	Part 4	Convolution method	Finding Inverse Laplace Transform using Convolution method.	3
4. Fourier series, Integrals And Transforms (10 Hrs)	Part 1	Fourier series	Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions)	2
	Part 2	Half Range Cosine and Sine Series	Fourier Cosine and Sine Series	3
	Part 3	Fourier Integral	Fourier Integral representation including Sine and Cosine integral	3
	Part 4	Fourier Transform	Fourier Cosine and Sine Transform, Fourier Transform and its inverse	2

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Eigenvalue Computation.	Implement Gauss elimination and eigenvalue/eigenvector computation in Python; verify diagonalization on sample matrices and document observations.	7	1	CO1	WK2, WK3	PO1, PO2
2	ODE Solver Study	Solve a set of second-order ODEs using undetermined coefficients and variation of parameters; cross-check with a symbolic solver and prepare a comparative write-up.	7	2	CO2	WK1, WK2, WK3	PO1, PO2
3	Laplace Transform Worksheet	Use Laplace transforms to solve a set of linear ODEs, including problems involving the unit step and Dirac delta functions; verify with Python.	8	3	CO3	WK2, WK3, WK4	PO1, PO2, PO5, PO11
4	Fourier Series Approximation	Implement partial-sum Fourier series of standard periodic functions in Python; study convergence behaviour with plots	8	4	CO4	WK2, WK3	PO1, PO2, PO5, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Verification of Linear System Solutions using Determinant and Rank Conditions	Students will manually verify consistency of different linear systems using determinant and rank criteria. Compare the theoretical results with numerical verification using a calculator or Python (optional). Prepare a tabular summary showing consistent/inconsistent systems.	5 Hrs	1	CO1	WK2 , WK3	PO1, PO2, PO5
2	Differential Equations Assignment	Prepare a graded report solving non-homogeneous by hand, with engineering-context examples and verification of results.	5 Hrs	2	CO2	WK1 , WK2 , WK3	PO1, PO2, PO5, PO1 1
3	Laplace Transform Problem.	Submit a computational report by solving 5 problems on Laplace transforms, shifting theorems and convolution applied to differential equations.	5 Hrs	3,4	CO3, CO4	Wk1, WK2 , WK3 , WK4	PO1, PO2, PO5, PO1 1

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	40%
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	60%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Linear Algebra	11	-	3	12				15
2	Ordinary Differential Equations	12	-	3	12				15
3	Laplace Transforms	12	-	3	12				15
4	Fourier series, Integrals And Transforms	10	-	3	12				15
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					60

Course Code	Course Name				Credits
J1BSP132	ENGINEERING PHYSICS				4
Regulation	2026	L:T:P:H:S	3:0:2:0:5.5	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 60 Marks	ESE:40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Higher secondary level Physics-Basic knowledge of mathematics, wave concepts, electricity, and modern physics				

COURSE OBJECTIVE	
1	To provide students with a solid background in the fundamentals of Physics and impart this knowledge in Physical Science and Life Science disciplines.
2	To develop scientific attitudes and enable students to correlate Physics concepts with their core programs.
3	To equip students with practical knowledge that complements their theoretical studies and develop their ability to create practical applications and solutions in engineering based on their understanding of Physics.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the principles and properties of lasers and optical fibres in solving basic engineering problems.	K3
2	Apply the concepts of interference and diffraction of light to interpret and solve problems involving optical devices and measurements.	K3
3	Apply the principles of quantum mechanics to explain the behaviour of matter at the atomic and subatomic levels.	K3
4	Apply the knowledge of waves and acoustics in non-destructive testing and in acoustic design of buildings.	K3
5	Apply basic knowledge of principles and theories in physics to conduct experiments	K3

COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	2	2	-	1	-	-	-	3	2	1	-	1	-	-	-	-	-	2	-	-	-
2	3	2	2	-	-	-	-	-	-	3	2	-	-	1	-	-	-	-	-	2	-	-	-
3	3	2	2	-	-	-	-		-	3	2	-	-	-	-	-	-	-	-	2	-	-	-
4	3	2	3	2	-	3	2	1	-	3	2	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	2	2	-	2	-	1	2	3	2	-	-	2	-	1	2	2	-	2	-	-	-
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																							

SYLLABUS

Module	Title	Topics	Hours
1	Laser & Fibre Optics	Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing – Population inversion- Pumping- Metastable states, Basic components of laser - Active medium - Optical resonant cavity, Construction and working of Ruby laser and CO ₂ laser, Construction and working Semiconductor laser (qualitative), Properties of laser, Applications of laser. Optic fibre-Principle of propagation of light, Types of fibres-Step index and Graded index fibres - Multimode and single mode fibers, Acceptance angle, Numerical aperture –Derivation, Applications of optical fibres - Fibre optic communication system (block diagram)	9
2	Interference and Diffraction	Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference, Cosine law-reflected system- Condition for constructive and destructive interference, Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength, Air wedge- Measurement of thickness of thin sheets. Antireflection coating-Diffraction-Fresnel and Fraunhofer classes of diffraction, Diffraction grating – Construction - grating equation, Resolving and Dispersive power of a grating with expression (no derivation)	9
3	Quantum Mechanics	Introduction, Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Application of uncertainty principle-Absence of electron inside nucleus - Natural line broadening, Wave function – properties - physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function, Quantum Mechanical Tunnelling(qualitative)	9
4	Waves & Acoustics	Waves- transverse and longitudinal waves, Concept of frequency, wavelength and time period (no derivation), Transverse vibrations in a stretched string-derivation of velocity and frequency - laws of transverse vibration Acoustics- Reverberation and echo, Reverberation time and its significance - Sabine's Formula, Factors affecting acoustics of a building. Ultrasonics-Piezoelectric oscillator, Ultrasonic diffractometer, SONAR, NDT-Pulse echo method, medical application-Ultrasound scanning (qualitative)	9

LEADERS OF TOMORROW

LIST OF EXPERIMENTS (24 hours)

Instructions		
Minimum 10 Experiments		
Sl. No.	Experiment	CO
1	Optical fibre characteristics- Measurement of Numerical aperture.	1,5
2	Determination of wavelength of Laser using diffraction grating.	1,5
3	Measure the wavelength of Laser using a millimetre scale as a grating.	1,5
4	Determination of wavelength of a monochromatic light using Newton's Rings method.	2,5
5	Determination of diameter of wire or thickness of thin sheet using Air wedge method.	2,5

6	Determination of slit width (diffraction due to a single slit).	2,5
7	Measure wavelength of light source using diffraction grating.	2,5
8	Determination of resolving power and dispersive power of grating.	2,5
9	Characteristics of LED.	5
10	CRO basics-Measurement of frequency and amplitude of wave forms.	5
11	Solar Cell- I V and Intensity Characteristics.	4,5
12	Melde's experiment- Frequency calculation in Transverse and Longitudinal Mode	4,5
13	LCR circuit –forced and damped harmonic oscillations.	5
14	Determination of wavelength and velocity of ultrasonic waves using ultrasonic diffractometer	4.5
15	Determination of particle size of lycopodium powder	5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Textbook of Engineering Physics	M N Avadhanulu, P G Kshirsagar & TVS Arun Murthy	S Chand & Co.	11 th Edition, 2024
2	Engineering Physics	H K Malik, A.K. Singh,	McGraw Hill Education	2 nd Edition, 2017
3	Optics	Ajoy Ghatak	Mc Graw Hill Education	8 th Edition, 2024

REFERENCE

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Physics	G Vijayakumari	Vikas Publications	8 th Edition, 2014
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	7th Edition 2017
3	Engineering Physics	Aruldas G.	PHI Pvt. Ltd	2 nd Edition, 2015
4	Fiber Optic Communications	Gerd Keiser	Springer	5 th Edition 2021
5	A Text Book of Engineering physics	I. Dominic, A. Nahari	OWL Publications	2 nd Edition, 2016
6	Advanced Engineering Physics	Premlet B	Phasor Books	10 th Edition 2017
7	Engineering Physics	Rakesh Dogra	Katson Books	1 st Edition, 2019

VIDEO LINKS (NPTEL, SWAYAM...)	
1	https://nptel.ac.in/courses/115102124 https://nptel.ac.in/courses/104104085
2	https://nptel.ac.in/courses/115105537
3	https://nptel.ac.in/courses/115102023 https://nptel.ac.in/courses/115101107
4	https://nptel.ac.in/courses/112104212 https://nptel.ac.in/courses/124105004
VIRTUAL LAB/SIMULATION TOOLS	
1	https://vlab.amrita.edu
2	https://be-iitkgp.vlabs.ac.in

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1-Laser & Fibre Optics	Part 1	Optical Processes and Principle of Laser	Optical processes – Absorption-Spontaneous emission and stimulated emission, Principle of laser - conditions for sustained lasing Population inversion- Pumping- Metastable states, Basic components of laser - Active medium - Optical resonant cavity	2
	Part 2	Construction, Working, and Applications of Lasers	Construction and working of Ruby laser Construction and working of CO ₂ laser Construction and working Semiconductor laser (qualitative), Properties of laser, Applications of laser	3
	Part 3	Optical Fibre and Its Types	Optic fibre-Principle of propagation of light Types of fibres-Step index and Graded index fibres - Multimode and single mode fibers	2
	Part 4	Acceptance Angle, Numerical Aperture, and Applications of Optical Fibres	Acceptance angle, Numerical aperture –Derivation Applications of optical fibres - Fibre optic communication system (block diagram)	2
2- Interference and Diffraction	Part 1	Interference of Light – Principle, Conditions, and Cosine Law	Introduction, Principle of super position, Constructive and destructive interference, Optical path, Phase difference and path difference Cosine law- reflected system- Condition for constructive and destructive interference	2
	Part 2	Colours in Thin Films and Newton's Rings	Colours in thin films, Newton's Rings-Determination of refractive index of transparent liquids and wavelength	2
	Part 3	Air wedge	Air wedge- Measurement of thickness of thin sheets. Antireflection coating	2
	Part 4	"Diffraction Phenomena and Grating Applications in Optics	Diffraction-Fresnel and Fraunhofer classes of diffraction, Diffraction grating – Construction - grating equation, Resolving and Dispersive power of a grating with expression (no derivation)	3

3-Quantum Mechanics	Part 1	Concept of Uncertainty in Quantum Mechanics	Introduction, Concept of uncertainty and conjugate observables (qualitative) Uncertainty principle (statement only)	2
	Part 2	Application of uncertainty principle	Application of uncertainty principle- Absence of electron inside nucleus Natural line broadening	2
	Part 3	Time-Dependent and Time-Independent Schrödinger Equations	Wave function – properties - physical interpretation Formulation of time dependent and time independent Schrodinger equations	3
	Part 4	Particle in a One-Dimensional Box and Tunnelling Phenomenon	Particle in a one- dimensional box - Derivation of energy eigen values and normalized wave function Quantum Mechanical Tunnelling (qualitative)	2
4-Waves & Acoustics	Part 1	Wave Motion and Basic Concepts	Waves- transverse and longitudinal waves Concept of frequency, wavelength and time period (no derivation)	2
	Part 2	Transverse Vibrations in Strings: Derivations and Laws	Transverse vibrations in a stretched string- derivation of velocity and frequency laws of transverse vibration	2
	Part 3	Fundamentals of Acoustics and Reverberation in Buildings	Acoustics- Reverberation and echo, Reverberation time and its significance Sabine's Formula, Factors affecting acoustics of a building	2
	Part 4	Ultrasonics: Generation, Applications, and Non-Destructive Testing	Ultrasonics- Piezoelectric oscillator Ultrasonic diffractometer, SONAR NDT-Pulse echo method, medical application- Ultrasound scanning (qualitative)	3

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Comparative Study of Laser Systems	Study the working principles of Ruby, CO ₂ , and Semiconductor Lasers, and prepare a comparison chart based on the active medium, pumping method, wavelength, output, and application.	4Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2
2	Study the Applications of Optical Fibres	Investigate the applications of optical fibres in communication, medicine, sensing, and industry, and prepare a brief summary highlighting their significance.	4Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2
3	Study of Thin-Film Interference	Explore educational resources to understand colours in thin films and their formation due to interference	4Hrs	2	CO2	WK1 WK2 WK3	PO1 PO2
4	Diffraction Grating Simulation-Using an interactive simulator	Determine the number of lines per unit length of a diffraction grating and record the observations.	4Hrs	2	CO2	WK1 WK2 WK3	PO1 PO2

5	Analysis of Wave Function in a Potential Well	Draw a sketch of a typical wave function for a particle in a potential well. Label regions where ψ is positive, negative, or zero. Write short notes explaining: What ψ and $ \psi ^2$ represent physically.	3 Hrs	3	CO3	WK1 WK2 WK3	PO1 PO2
6	Study of Quantum Tunnelling and Wave Functions	Study quantum tunnelling through educational videos and prepare a brief report on its applications in alpha decay or tunnel diodes.	3 Hrs	3	CO3	WK1 WK2 WK3	PO1 PO2
7	Relate transverse vibration principles to musical instruments	Research and write a short note on: How guitars, violins, or piano strings follow the laws of transverse vibration.	4Hrs	4	CO4	WK1 WK2	PO1 PO2
8	Study of Medical Applications of Ultrasonic Waves	Explore educational resources on ultrasound scanning and prepare a report explaining its principle and role in medical imaging.	4Hrs	4	CO4	WK1 WK2 WK4	PO5 PO6

TERM WORK ACTIVITIES (30 Hrs)

Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Exploring the Working Principles and Real-World Applications of Laser and Optical Fibre Communication	Laser Application Case Study Study an industry/medical use of lasers (e.g., LASIK surgery, laser engraving). Research the working principles of lasers and optical fibres Collect data / observations, Present findings through a short report or presentation.	10 Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2 PO11
2	Thin Film & Anti-Reflection Coating	Research the materials used (e.g., MgF_2 , TiO_2 , SiO_2) and fabrication techniques (vacuum deposition, sputtering, CVD). Discuss energy efficiency, cost, and real-world impact. Prepare a technical PowerPoint (10–12 slides)	10 Hrs	2	CO2	WK1 WK2 WK3	PO1 PO2 PO11
3	Exploring Sound and Vibrations: Study of Waves, Acoustics, and Ultrasonic Applications	Factors Affecting Acoustics of Buildings. Identify and suggest corrections for poor acoustics in classrooms or halls.	10 Hrs	4	CO4	WK1 WK2 WK4 WK7	PO3 PO5 PO6 PO7 PO11

RUBRICS FOR TERM WORK EVALUATION

Sl.No.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS

Sl.No.	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Preparation & Pre-Lab Work	30	Comes fully prepared with pre-lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives /procedure.
2	Experimental Skills & Performance	40	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance; procedure mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure; requires constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30	Analyse, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	60%
Lab Evaluation	30 %
Learning Activity (Self Learning& Term Work)	10%
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	40%
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teachin g Hours	Distribution of Marks (Revised Bloom’s Level)						Total Marks
			R	U	A	An	E	C	
1	Laser & Fibre Optics	9	2	5	3				10
2	Interference and Diffraction	9	2	5	3				10
3	Quantum Mechanics	9		7	3				10
4	Waves & Acoustics	9		7	3				10
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper			2		
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4 x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					40

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	2	3	2	-	-	2	-	-	-	3	2	-	-	2	-	-	-	-	-	-	2	3	-	
2	2	3	2	-	-	2	-	-	-	3	2	-	-	2	-	-	-	-	-	-	-	3	2	
3	2	3	2	-	-	2	-	-	-	3	2	-	-	2	-	-	-	-	-	-	-	3	2	
4	2	3	2	2	-	2	-	-	-	3	3	2	-	2	-	-	-	-	-	-	-	3	3	
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS			
Module	Title	Topics	Hours
1	Problem Solving Strategies and process	Problem-solving strategies defined, Importance of understanding multiple problem-solving strategies, Trial and Error, Heuristics, Means-Ends Analysis, and Backtracking (Working backward). Computer as a model of computation, Understanding the problem, Formulating a model, Developing an algorithm, Writing the program, Testing the program, and Evaluating the solution.	9
2	Algorithm, Pseudocode and Flowchart	Algorithm and its need, Meaning and Definition of Pseudocode, Reasons for using pseudocode, The main constructs of pseudocode - Sequencing, selection (if-else structure, case structure) and repetition (for, while, repeat-until loops), Sample problems Symbols used in creating a Flowchart - start and end, arithmetic calculations, input/output operation, decision (selection), module name (call), for loop (Hexagon), flow-lines, on-page connector, off-page connector.	9
3	Python Essentials	Creating and using variables in Python, Numeric and String data types in Python, Using the math module, Using the Python Standard Library for handling basic I/O - print, input, Python operators and their precedence. Selection and Iteration: if-else, elif, for loop, range, while loop.	9
4	Modularization, Recursion and Sequence Data Types	Problem decomposition as a strategy for solving complex problems, Modularization, Motivation for modularization, Defining and using functions in Python. RECURSION:- Recursion Defined, Reasons for using Recursion, Programming Examples Sequence data types in Python - list, tuple, set, strings, dictionary, Creating and using Arrays in Python (using Numpy library).	9

LIST OF EXPERIMENTS (24 Hours)		
Instructions • Lab experiments must be implemented in Python • Minimum 12 Experiments are mandatory • Each student should maintain a record with Aim, algorithm, code, and output. • Programs should follow proper indentation and coding standards. • Continuous evaluation will be based on performance, timely submission, and viva.		
Sl. No.	Experiment	CO
1	Basic Input and Output Operations – Read the name, address, email, and phone number of a person through the keyboard and print the details.	1
2	Temperature Conversion – Convert temperature values between Celsius and Fahrenheit.	2
3	Mathematical Calculations – Write programs to find the area and perimeter of a circle and a rectangle. Write a program to calculate compound interest when principal, rate, and number of periods are given.	2

4	Simple Arithmetic Calculator – Develop a simple desktop calculator using Python that performs five basic arithmetic operations.	3
5	Decision Making Programs – Write Python programs to check whether a number is odd/even, check leap year, and find the largest among three numbers.	3,4
6	Grading System – Display the grade of a student corresponding to the marks entered.	4
7	Number Operations – Write programs to find the sum of n natural numbers, and check whether a number is an Armstrong number or palindrome.	4
8	Loops and Iterations – Generate Fibonacci sequence using a while loop and display all prime numbers in a given interval.	4
9	Pattern Generation – Implement Floyd's triangle using nested loops.	4
10	Functions and Validation – Write a Python program to : a) validate a password using a function with specific criteria (length, case, digit, special character). b) Check whether a given mobile number is valid or not using a function.	4
11	Recursion – Write a Python program to find the factorial of a number using a recursive function.	4
12	List Manipulation – Input two lists, merge them such that even numbers appear first (sorted), followed by odd numbers (sorted). Write a Python program to check whether a string is a palindrome or not.	4
13	Counting and Searching in Lists – Write a python program to Count positive, negative, and zero values; find words starting with vowels in a list.	4
14	Dictionary Operations – Perform various dictionary manipulations such as displaying student marks, finding highest marks, counting pass students, and modifying entries.	4
15	Tuple Operations – Write a Python program to perform operations on a tuple of marks — find highest, lowest, average, count above 75, create new tuple, and check for specific value.	4

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Fundamentals of Python : First Programs	Kenneth A Lambert.	Cengage Publishing	2/e, 2019s
2	How to think like a Computer Scientist: Learning with Python	Downey, A. et al.	John Wiley	2022
3	Computer Fundamentals and Programming in C	Reema Thareja	Oxford University Press	2023
REFERENCE				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Problem solving & programming concepts	Maureen Sprankle, Jim Hubbard	Pearson	9/e, 2011
2	Python for Everyone	Cay S. Horstmann, Rance D. Necaise	Wiley	3/e, 2024
3	Python Programming: An Introduction to Computer Science	J. Zelle	Franklin, Beedle & Associates Inc.	2010s
4	Introduction to Computing & Problem Solving With PYTHON	Dr. P.Sojan Lal ,Jeeva Jose	Khanna Publishing House (New Delhi)	2016

VIDEO LINKS	
1	https://onlinecourses.nptel.ac.in/noc21_cs32/preview
2	https://nptel.ac.in/courses/106106212
VIRTUAL LAB/SIMULATION TOOLS	
1	Virtual Labs (MoE / IITs) (https://www.vlab.co.in/)
2	Python Online Compiler / IDE (e.g., Replit, Programiz, Jupiter Notebook)
3	Google Colab

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
Problem Solving Strategies and process	1	Problem Solving Strategies Introduction	Problem-solving strategies defined, Importance of understanding multiple problem-solving strategies	2
	2	Problem Solving Strategies	Trial and Error, Heuristics	2
	3	Problem Solving Strategies	Means-Ends Analysis and Backtracking (Working backward).	2
	4	Problem Solving Process	Computer as a model of computation, Understanding the problem, Formulating a model, Developing an algorithm, Writing the program, Testing the program, and Evaluating the solution.	3
Algorithm, Pseudocode and Flowchart	1	Algorithm and Pseudocode basics	Algorithm and its need, Meaning and Definition of Pseudocode, Reasons for using pseudocode,	2
	2	Constructs of Pseudocode: Sequence and Selection	The main constructs of pseudocode - Sequencing, selection (if-else structure, case structure) and	2
	3	Repetition	repetition (for, while, repeat-until loops), Sample problems	3
	4	Flowcharts	Symbols used in creating a Flowchart - start and end, arithmetic calculations, input/output operation, decision (selection), module name (call), for loop (Hexagon), flow-lines, on-page connector, off-page connector	2
Python Essentials	1	Python basics	Creating and using variables in Python, Numeric and String data types in Python, Using the math module.	2
	2	Input & Output and Operators in Python	Using the Python Standard Library for handling basic I/O - print, input, Python operators and their precedence	2
	3	Selection	Selection: if-else, elif	2
	4	Iteration	Iteration: for loop, range, while loop.	3

Modularization, Recursion and Sequence Data Types	1	Modularization	Problem decomposition as a strategy for solving complex problems, Modularization, Motivation for modularization, Defining and using functions in Python.	2
	2	Recursion	RECURSION:- Recursion Defined, Reasons for using Recursion, Programming Examples	2
	3	Sequence Data Types: List & Tuple	Sequence data types in Python - list, tuple, set	2
	4	Sequence Data Types: String, Dictionary and Numpy	Strings, dictionary, Creating and using Arrays in Python (using Numpy library).	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Problem Solving Strategies	Compare two everyday problems (e.g., finding a lost item vs. planning a trip) and identify which strategy (Trial & Error, Heuristic, Means-Ends, Backtracking) best applies.	3	1	CO1	WK1, WK2	PO1, PO2
2	Problem Solving Process	Take a real-world scenario (e.g., calculating electricity bill, student grade analysis, or bus fare system). Break it down into: - Understanding the problem - Formulating a model - Developing an algorithm - Writing a Python program - Testing and evaluating the solution	3	1	CO1	WK2, WK4	PO1, PO2
3	Algorithm and Flowchart Practice	Design algorithms and draw flowcharts for basic computational problems (e.g., area, factorial, largest of three numbers) using online tools like draw.io.	4	2	CO2	WK1, WK3	PO1, PO2
4	Pseudocode Development	Write structured pseudocode for real-world problems such as grading systems or ATM transactions, emphasizing sequencing, selection, and iteration.	3	2	CO2	WK1, WK3	PO1, PO2
5	Exploring Python Basics	Practice Python fundamentals — data types, variables, operators, expressions, input/output, and type conversion — through simple coding exercises.	4	3	CO3	WK2, WK3	PO1, PO5

6	Debugging and Control Structures	Develop and test Python programs using conditional and looping constructs; identify and fix syntax and logic errors.	4	3	CO3	WK2, WK6	PO1, PO5
7	Function-based Problem Solving	Write user-defined and recursive functions to solve problems like factorial, palindrome, and Fibonacci sequence, emphasizing modularity and reusability.	5	4	CO4	WK3, WK6	PO1, PO2, PO5
8	Algorithm to Python Implementation	Select a real-world problem (e.g., billing or student marks analysis). Develop the algorithm, flowchart, and pseudocode, then implement the solution in Python.	4	4	CO4	WK3, WK6, WK8	PO2, PO3, PO5

TERM WORK ACTIVITIES (30 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Problem Solving Strategies	Apply Trial & Error, Heuristics, Means-Ends Analysis, and Backtracking to a puzzle/problem and record outcomes.	4	1	CO1	WK1, WK2	PO1, PO2
2	Problem Solving Process	Model a real-world problem (e.g., grade analysis, electricity bill) into steps: understanding → model → algorithm.	3	1	CO1	WK1, WK4	PO1, PO2
3	Algorithm Design	Prepare algorithms for basic computational problems (e.g., area calculation, sum of numbers, temperature conversion) using standard notation tools.	4	2	CO2	WK1, WK3	PO1, PO2
4	Pseudocode Writing and Representation	Write well-structured pseudocode for real-world processes involving sequencing, selection, and repetition (e.g., ATM withdrawal, grading system).	3	2	CO2	WK1, WK3	PO1, PO2
5	Python Fundamentals Practice	Develop programs to perform input/output operations, work with variables, data types, operators, and expressions. Test for correct syntax and logic.	4	3	CO3	WK2, WK3	PO1, PO5
6	Control Structures Implementation	Implement programs using decision-making and looping constructs (if-else, for, while) with validation-based examples and user inputs.	4	3	CO3	WK2, WK6	PO1, PO5

7	Function-Based Problem Solving	Design and implement Python programs using user-defined and recursive functions for problems such as factorial, Fibonacci, and prime number checks.	3	4	CO4	WK3, WK6	PO1, PO2, PO5
8	Data Structures and Modular Programming	Work with sequence data types (list, tuple, dictionary) and apply modularization concepts using function calls for reusable code.	5	4	CO4	WK3, WK6	PO2, PO5

RUBRICS FOR TERM WORK EVALUATION

Sl. No.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Problem Solving Strategies and Process (Module 1)	Clear understanding, innovative strategy, systematic process, optimized real-world solution, well-documented.	Good understanding, workable strategy, mostly correct process, relevant solution, fairly documented.	Partial understanding, basic strategy, process with gaps, functional but less refined solution, adequate documentation.	Limited understanding, vague strategy, incorrect process, weak solution, poor documentation.	No understanding, no clear strategy, no process, irrelevant solution, no documentation.
2	Algorithm Design & Pseudocode Representation (Module 2)	Accurate and logical algorithms and well-structured pseudocode	Minor logical or formatting issues; generally correct structure.	Basic algorithm and pseudocode with partial accuracy.	Incomplete or unclear steps; lacks logical sequence.	Incorrect or missing algorithm/pseudocode.
3	Python Fundamentals & Control Structures (Module 3)	Strong command of Python syntax, variables, data types, operators, and control statements; programs execute correctly without errors.	Mostly correct implementation with minor syntax or logic errors.	Basic understanding of syntax; occasional mistakes in execution.	Frequent coding or logical errors; incomplete program flow.	Unable to demonstrate basic coding concepts or logic.
4	Functions, Modularity & Problem Solving (Module 4)	Applies modular programming effectively using user-defined and recursive functions; demonstrates problem-solving through reusable code.	Function design mostly correct with minor logical errors.	Partial modularization; functions used but not efficiently structured.	Weak logic or poor understanding of function-based programming.	No use of functions or incorrect implementation.

LAB EVALUATION RUBRICS							
Sl.No	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehension	Good understanding; minor conceptual gaps; mostly correct application	Basic understanding; some confusion; limited application	Weak understanding; major gaps; incorrect application	No understanding; unable to explain concepts
2	Mental/Programming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requirements	Basic execution; several errors; simple approach; partially meets requirements	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional; does not meet requirements
3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensive; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectations	Acceptable quality; some inaccuracies; basic structure; minimal expectations met	Poor quality; many inaccuracies; weak structure; below expectations	Unacceptable quality; incorrect; no proper structure

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	60%
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	20%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	40%
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Problem Solving Strategies and process	5		3	7				10
2	Algorithm, Pseudocode and Flowchart	5	3	7					10
3	Python Essentials	6	3		7				10
4	Modularization, Recursion and Sequence Data Types	5		3	7				10
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper				2	
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	4	3	4x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					40

Course Code	Course Name				Credits
J1EST125	INTRODUCTION TO MECHANICAL AND CIVIL ENGINEERING				4
Regulation	2026	L: T:P:H:S	4:0:0: 0:6	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	Understand thermodynamic cycles and working of IC engines.
2	Understand the refrigeration cycles and psychrometric concepts.
3	Provide an introduction to the field of Civil Engineering and the fundamentals of building regulations.
4	Impart knowledge of the basic components of buildings, construction materials, and green building concepts.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the fundamental principles governing energy conversion systems, including basic thermodynamic cycles, IC engines, and refrigeration.	K2
2	Apply the concepts of psychometrics to analyse air conditioning processes and describe the working of fluid machinery (pumps and turbines).	K3
3	Summarize the key processes and applications of different manufacturing, metal joining, and machining techniques.	K2
4	Explain the role of Civil Engineering and basic building regulations	K2
5	Describe the basic components of buildings and common construction materials.	K2
6	Identify modern construction materials and explain the concept of green buildings.	K2

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	2	-	3	-	-	2	-	-	-	3	3	-	-	-	-	-	-	-	-	-	3	-	-	
2	-	2	3	-	-	2	-	-	-	3	3	-	-	2	2	-	-	-	-	-	3	-	-	
3	-	-	3	-	2	3	-	-	1	3	-	-	-	2	2	1	1	1	-	-	3	-	2	
4	2	-	3	-	2	1	3	-	3	3	-	-	-	-	3	2	2	1	1	-	1	1	1	
5	2	-	3	-	-	1	-	-	-	3	1	-	-	-	-	-	2	1	1	-	1	1	1	
6	2	-	3	1	2	2	2	-	2	3	1	-	-	-	2	2	2	1	1	-	1	1	1	
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS			
Module	Title	Topics	Hours
1	Thermodynamics, IC Engines and Refrigeration	General introduction to Mechanical Engineering: Thermodynamic cycles -Carnot Cycle -Derivation of efficiency (problems on efficiency) Otto, Diesel cycles (no derivation of efficiency and problems). IC Engines: CI & SI Engines, working of 2-Stroke & 4-Stroke engines, Listing the parts of IC Engines. Concept of CRDI, MPFI and hybrid engines. Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Psychrometric chart, Cooling and dehumidification, Layout of central air conditioning systems.	15
2	Fluid Machinery, Machine Elements, and Manufacturing Technology	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump. Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), Clutches - function and their types (basics only), Bearings and their classification (Journal bearing and ball bearing) Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications. Machining processes: Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	15

3	Introduction to Civil Engineering	Role of Civil Engineers in nation building and sustainable development; Major disciplines and scope of Civil Engineering, Types of civil infrastructures. Introduction to buildings: Basic requirements of a building, Principles of planning of a building, Selection of site for a residential building; Load bearing and non-load bearing structures, components of a residential building and their functions. Relevance of NBC, KBR and CRZ: Types of buildings as per NBC, Building area terminology, Drawing documents required for building permit as per KBR (Brief introduction only); CRZ classification and norms. Cement: Ordinary Portland cement, manufacture of Portland cement, properties, uses, grades; Aggregates: qualities, classification; Sand: qualities, types; Cement concrete: ingredients, grades, processes, slump test, compression test; Steel: types, structural steel sections, uses, types of reinforcing bars; Reinforced concrete: properties and uses Bricks and stones: classification, tests, qualities; Timber products: properties and uses of plywood, fibre board, particle board	15
4	Introduction to construction engineering	Foundations: Bearing capacity of soil (definition only); shallow and deep foundations-types (brief discussion); Brick masonry: Terms; Bonds-header, stretcher, English, Flemish (elevation and plan of one & one and a half brick wall only); Roofs and floors: Types, material used Modern materials: Architectural glass, ceramics, plastics, composites, SCMs, geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, pre-fabricated components (brief overview) Introduction to Green buildings: Basic principles of sustainable design, Sustainable construction Materials, energy and water efficiency and waste management; Introduction to Green Building Rating Systems: LEED, GRIHA, IGBC; Concept of Carbon foot print, Net-Zero Energy Buildings; Introduction to Government and non-government organisations promoting sustainable building materials; case studies on green buildings	15

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1.	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1st Edition, 2013
2	Textbook of Basic Mechanical Engineering	R.K. Rajput	Laxmi Publications	3rd Edition, 2017

3	Fundamentals of Mechanical Engineering	G.S. Sawhney	PHI Learning Pvt. Ltd.	1st Edition, 2013
4	Materials for Civil and Construction Engineering	Mamlouk, M.S., Zaniewski, J.P	Pearson Publishers	2017
5	Building Construction, Volume1	McKay, W.B., McKay, J. K.,	Pearson India Education Services	
6	Construction Technology	Chudley, R	Longman group, England Course Plan	4 th Edition, 2007

REFERENCE

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Automotive Engineering Fundamentals	Richard Stone and Jeffrey K. Ball	SAE International	1st Edition, 2014
2	Elements of Mechanical Engineering	K.P. Roy, S.K. Hajra Choudhury,	A.K. Hajra Choudhury Media Promoters & Publishers Pvt. Ltd.	Revised Edition, 2012
3	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David W. Rosen, and Brent Stucker	Springer	2nd Edition, 2015
4	Building Construction	Purnima. B.C.	Laxmi Publications	2016
5	Engineering Materials	Rangwala S.C.	Charotar Publishers	2017
6	Basic Civil Engineering	Shibu Nalpat	Nalpat Publishers	2024

VIDEO LINKS

1	https://onlinecourses.nptel.ac.in/noc22_me65/preview
2	https://www.youtube.com/watch?v=cj0-wSGGe6g
3	https://www.youtube.com/watch?v=MKc6plBumYA
4	https://onlinecourses.nptel.ac.in/noc22_ce42/preview - Introduction to civil engineering profession
5	https://nptel.ac.in/courses/105102088 - Building materials and Construction

VIRTUAL LAB/SIMULATION TOOLS

1	Online Interactive Psychrometric Chart / Calculator
2	CFD Simulation Software (e.g., ANSYS Fluent/SimScale/MATLAB Sims cape)
3	V-Lab (Virtual Lab) Manufacturing Processes
4	https://cs-iitd.vlabs.ac.in/exp/cube-test/
5	https://ms-nitk.vlabs.ac.in/exp/slump-test/

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1. Thermodynamics, IC Engines and Refrigeration (15 Hrs)	Part 1	Thermodynamics Fundamentals	General introduction to Mechanical Engineering: Thermodynamic cycles - Carnot Cycle -Derivation of efficiency (problems on efficiency) Otto, Diesel cycles (no derivation of efficiency and problems).	4
	Part 2	IC Engine Principles and Types	IC Engines: CI & SI Engines, working of 2-Stroke & 4-Stroke engines. Listing the parts of IC Engines.	4
	Part 3	Advanced IC Engine Concepts	Concept of CRDI, MPFI and hybrid engines.	3
	Part 4	Refrigeration and Psychometrics	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Psychrometric chart, Cooling and dehumidification, Layout of central air conditioning systems.	4
2. Fluid Machinery, Machine Elements, and Manufacturing Technology (15 Hrs)	Part 1	Fluid Machinery	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump.	4
	Part 2	Machine Elements	Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), Clutches - function and their types (basics only), Bearings and their classification (Journal bearing and ball bearing)	3
	Part 3	Manufacturing Processes	Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications.	4
	Part 4	Metal Joining and Machining Processes	Machining processes: Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	4

3.Introduction to Civil engineering (15 Hrs)	Part 1	Introduction to Civil Engineering	Role of Civil Engineers in nation building and sustainable development; Major disciplines and scope of Civil Engineering, Types of civil infrastructures; Introduction to buildings: Basic requirements of a building, Principles of planning of a building, Selection of site for a residential building; Load bearing and non-load bearing structures, components of a residential building and their functions;	5
	Part 2	Introduction to buildings & building rules	Relevance of NBC, KBR and CRZ: Types of buildings as per NBC, Building area terminology, Drawing documents required for building permit as per KBR (Brief introduction only); CRZ classification and norms.	4
	Part 3	Introduction to construction materials	Cement: Ordinary Portland cement, manufacture of Portland cement, properties, uses, grades; Aggregates: qualities, classification; Sand: qualities, types; Cement concrete: ingredients, grades, processes, slump test, compression test; Steel: types, structural steel sections, uses, types of reinforcing bars; Reinforced concrete: properties and uses Bricks and stones: classification, tests, qualities; Timber products: properties and uses of plywood, fibre board, particle board	6
4.Introduction to construction engineering (15 Hrs)	Part 1	Introduction to structural components	Foundations: Bearing capacity of soil (definition only); shallow and deep foundations-types (brief discussion); Brick masonry: Terms; Bonds-header, stretcher, English, Flemish (elevation and plan of one & one and a half brick wall only); Roofs and floors: Types, material used	6
	Part 2	Modern materials	Modern materials: Architectural glass, ceramics, plastics, composites, SCMs, geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, pre-fabricated components (brief overview)	5
	Part 3	Green buildings	Introduction to Green buildings: Basic principles of sustainable design, Sustainable construction Materials, energy and water efficiency and waste management; Introduction to Green Building Rating Systems: LEED, GRIHA, IGBC; Concept of Carbon foot print, Net-Zero Energy Buildings; Introduction to Government and non-government organisations promoting sustainable building materials; case studies on green buildings.	4

SELF LEARNING ACTIVITIES (45 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Research Report	Prepare a brief report on a Hybrid Engine technology or Central Air Conditioning System layout, focusing on recent innovations.	15 hrs	3	4, 5	WK4, WK8	PO8, PO12
2	Research Paper Analysis	Review an IEEE or ASME paper on sustainable IC engine technology (e.g., alternative fuels or net-zero design). Submit a 500-word summary and critical evaluation.	8 hrs	3	4	WK5, WK8	PO6, PO11
3	Civil Engineering in Media	Watch a documentary or read about two major different infrastructure projects in India and worldwide, prepare a short-illustrated report, and present it in class.	7	1,2	1,2, 3	WK1, WK3, WK4, WK6, WK8	PO1, PO6, PO9
4	Construction Material collection	Collect samples of conventional modern and sustainable construction materials for civil infrastructure and prepare a comparative chart.	8	1,2	2,3	WK1, WK3, WK4, WK5, WK6, WK8	PO1, PO6, PO7, PO9
5	Portfolio	Prepare a sketch portfolio showing different types of foundations, roofs, and floors with short notes on their uses and materials.	7	2	2	WK3, WK4, WK6	PO1, PO6, PO9

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Mechanical System Model	In a group of 3-4, create a detailed sketch or simple 3D model (using free CAD tool or physical materials) of any one key component: a 4-stroke engine system, a centrifugal pump, or a gear train.	8 hrs	3,4	4,5	WK3, WK6	PO1, PO8
2	Site Visit and Report on a Building Under Construction	Visit a multi-storeyed building site under construction within your locality. Observe the ongoing construction activities, materials used, and structural components. Prepare a report with geo-tagged photographs, illustrating your observations.	7 Hrs	1,2,	1,2, 3	WK1, WK2, WK3, WK4, WK5, WK6, WK7	PO1, PO2, PO4, PO6, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	40%
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	60%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Thermodynamics, IC Engines and Refrigeration	15	6	6	3				15
2	Fluid Machinery, Machine Elements, and Manufacturing Technology	15	7	8					15
3	Introduction to Civil engineering	11	3	12					15
4	Introduction to construction engineering	12	3	12					15
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	4	9	4 x 9	36
TOTAL MARKS					60

Course Code	Course Name					Credits
J1HMP126	LIFE SKILLS AND PROFESSIONAL COMMUNICATION					1
Regulation	2026	L: T:P:H:S	1:0:1:0:2	Notional Learning Hours/Semester		30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))						
Course Type	TP	Course delivery Mode				
Scheme of Evaluation		CIE: 100 Marks	ESE: 0 Marks		Total Marks:100	
Pre-requisite	Nil					

COURSE OBJECTIVE	
1	To foster self-awareness and personal growth, enhance communication and interpersonal connection skills, promote effective participation in groups and teams, develop critical thinking, problem-solving, and decision-making skills, and cultivate the ability to exercise emotional intelligence.
2	To equip students with the necessary skills to listen, read, write & speak, to comprehend and successfully convey any idea, technical or otherwise.
3	To equip students to build their profile in line with the professional requirements and standards.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Develop the ability to know & understand oneself, show confidence in one's potential & capabilities, set goals and develop plans to accomplish tasks	K5
2	Develop the ability to communicate and connect with others, participate in groups/teams, empathise, respect diversity, be responsible and understand the need to exercise emotional intelligence	K5
3	Develop thinking skills, problem-solving and decision-making skills	K5
4	Develop listening, reading, writing & speaking skills, ability to comprehend & successfully convey any idea, and ability to analyze, interpret & effectively summarize textual, audio & visual content	K6
5	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	K6
6	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians	K6

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	3	3		3		3												1		3				
2		3	3	3		3								1		3		3		3				
3	3		3		3	3		3			1	1		1				1		1				
4				3	3		3	3	3					1				1		2				
5														2				1		2				
6														1				1						
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS
Table 1. Activities: 76 Marks

Module	Activity	Class room (L) / Self Study (SS)	Week of completion	Group / Individual (G/I)	Marks	Skills	CO
1.1	Group formation and self-introduction among the group members	L	1	G	-	- Connecting with group members - Time management – Gantt Chart	
1.2	Familiarizing the activities and preparation of the time plan for the activities	L	1	G	-		
1.3	Preparation of Gantt chart based on the time plan	SS	1	G	2		
2.1	Take an online personality development test, self-reflect and report	SS	1	I	2	Self-awareness Writing	CO1

2.2	Role-storming exercise 1: Students assume 2 different roles given below and write about their • Strengths, • Areas for improvement, • Concerns, • Areas in which he/she hesitates to take advice, • Goals/Expectations, from the point of view of the following assumed roles • their parent/guardian/mentor • their friend/sibling/cousin	L	1	I	2	• Goal setting - Identification of skills and setting goal • Self-awareness • Discussion in groups • Group work- Compiling of ideas • Mind mapping	CO1
2.3	Role-storming exercise 2: Students assume the role of their teacher and write about the Skills required as a B.Tech graduate Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	SS	1	I	2		CO1
2.4	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	L	1	G	2		CO1
2.5	Prepare a mind map based on the role- storming exercise and exhibit/present it in class	SS	2	G	2		CO1
3	Prepare a presentation on instances of empathy they have observed in their own life or in other's life	L	2 to 4	I	2	Empathy	CO2

4.1	Each student connects and networks with a minimum of 3 professionals from industry/ public sector organizations/other agencies/NGOs/ academia (at least 1 through LinkedIn)	SS	3	I	2	• Workplace awareness • Listening • Communication - interacting with people • Networking through various media including LinkedIn • Discussion in groups • Report preparation • Creativity Goal setting - Preparation of action plan	
4.2	Interact with them to understand their workplace details including • workplace skills required their work experience • activities they have done to enhance their employability during their B.Tech years • suggestions on the different activities to be done during B.Tech years	SS	3	I	4		CO2
4.3	Discuss the different workplace details & work readiness activities assimilated by each through the interactions within their group and compile the inputs collected by the individuals Prepare the Minutes of the discussions	SS	3	G	2		CO2
4.4	Report preparation based on the discussions	SS	4	G	3		CO4
4.5	Perform a role-play based on the workplace dynamics assimilated through interactions and group discussions	L	5	G	4		CO3

4.6	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	SS	5	I	2		CO1
5.1	Select a real-life problem that requires a technical solution and list the study materials needed	L	6	G	2		CO3
5.2	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	SS	6	I	2		CO4
5.3	Use any online tech forum to gather ideas for solving the problem chosen	SS	6	G	2		CO5
5.4	Arrive at a possible solution using six thinking that exercise	L	7	G	3		CO3
5.5	Prepare a report based on the problem- solving experience	SS	7	G	2		CO4
6.1	LinkedIn profile creation	SS	1	I	2	Profile-building	CO6
6.2	Resume preparation	SS	8	I	2		CO6
6.3	Self-introduction video	SS	8	I	3		CO6
7	Prepare a presentation on instances of demonstration of emotional intelligence	SS	9	I	2	Emotional intelligence	CO2
8	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	SS	10	G	3	Diversity	CO2, CO5
9	Take online Interview skills development sessions like robotic interviews; self-reflect and report	SS	10	I	2	Interview skills	CO6
10	Take an online listening test, self- reflect and report	SS	11	I	2	Listening skills	CO6

11.1	Activities to improve English vocabulary of students	L	8	I/G	4	- English vocabulary - English language skills - Writing - Presentation - Group work - Self-reflection	CO4
11.2	Activities to help students identify errors in English language usage	L	9	I/G	2		CO4
11.3	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	L	10	I/G	2		CO4
11.4	Write a self-reflection report on the improvement in English language communication through this course	SS	12	I	2		CO4
11.5	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	L	11 to 12	G	2		CO4, CO5
12.1	Each group prepares video content for podcasts on innovative technological interventions/research work tried out in Kerala context by academicians/professionals/Govt. agencies/ research institutions/ private agencies/ NGOs /other agencies	SS	12	G	4	- Audio-visual presentations creations with the use of technology tools - Effective use of social media platforms Profile building	CO2, CO4, CO5
12.2	Upload the video content to podcasting platforms or YouTube	SS	12	G	1		CO5
12.3	Add the link of the podcast in their LinkedIn profile	SS	12	G	1		CO5

Table 2. Lab hour Activities (P): 24 Marks

Sl No	Activity	Marks	Skill	CO
1	Hands-on sessions on day-to-day engineering skills and a self-reflection report on the experience gained: 1. Drilling practice using electric hand drilling machines. 2. Cutting of MS rod and flat using electric hand cutters. 3. 4. Filing, finishing and smoothening using electrically operated hand grinders. 5. MS rod cutting using Hack saw by holding the work in bench wise. 6. Study and handling different types of measuring instruments. 7. Welding of MS, SS work pieces. 8. Pipe bending practice (PVC and GI). 9. Water tap fitting. 10. Water tap rubber seal changing practice. 11. Union and valves connection practice in pipes. 12. Foot valve fitting practice. 13. Water pump seal and bearing changing practice.	24	Basic practical engineering skills	3
2	Language Lab sessions	-	Language Skills	4

(AUTONOMOUS)
 CREATING TECHNOLOGY
 LEADERS OF TOMORROW
 ESTD 2002

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Life Skills & Personality Development	Maithry Shinde et.al.	Cambridge University Press	2022
2	Emotional Intelligence: Why it can matter more than IQ	Daniel Goleman	Bloomsbury, Publishing PLC	2020
3	Think Faster, Talk Smarter: How to speak successfully when you are put on the spot	Matt Abrahams	Macmillan Business	2023

REFERENCE				
SL.	Name of Book	Name of Author/s	Publisher	Year
1	English Grammar in Use	Raymond Murphy	Cambridge University Press	2023
2	Life Skills for Engineers	Remesh S., Vishnu R.G.	Ridhima Publications	2016
3	Effective Technical Communication	Ashraf Rizvi	McGraw Hill Education	2017
VIDEO LINKS				
1	https://www.youtube.com/watch?v=qUUwojhmZOU&t=1s			
2	https://www.youtube.com/watch?v=TjE4IoSyT9U&t=1s			
3	https://www.youtube.com/watch?v=K9b3Z_v8lQI			
VIRTUAL LAB/SIMULATION TOOLS				
1	https://flipgridapp.com/			
2	https://www.canva.com/online-whiteboard/			
3	https://trello.com/			
4	https://www.todoist.com/			

COURSE CONTENTS AND LECTURE SCHEDULE (20 HOURS)				
Module	Part	Part Name	Topics Covered	Hours
1, Introduction	Part 1	Group creation	Group formation and self-introduction among the group members	1
	Part 2	Activity planning	Familiarizing the activities and preparation of the time plan for the activities	1
	Part 3	Gantt chart	Preparation of Gantt chart based on the time plan	1
2, skills and Self-awareness	Part 1	Role-storming exercise-1	Students assume 2 different roles given below and write about their • Strengths, • Areas for improvement,	3

			• Concerns, • Areas in which he/she hesitates to take advice, • Goals/Expectations, from the point of view of the following assumed roles • their parent/guardian/mentor - their friend/sibling/cousin <u>Skills to be developed:</u> • Goal setting - Identification of skills and setting goal • Self-awareness • Discussion in groups Group work- Compiling of ideas Mind mapping	
	Part 2	Share and refine skills	Discuss the skills identified through role storming exercise by each one within their own group and improvise the list of skills	1
3, Empathy	Part 1	presentation on empathy	Prepare a presentation on instances of empathy they have observed in them own life or in other's life	2
4, Contextual problem	Part 1	Real-life problems	Select a real-life problem that requires a technical solution and list the study materials needed	1
	Part 2	Six thinking hat	Arrive at a possible solution using six thinking that exercise	1
5, English Language	Part 1	English vocabulary	Activities to improve English vocabulary of students	2
	Part 2	Errors in English language	Activities to help students identify errors in English language usage	2
	Part 3	English spelling, pronunciation, and confusing word	Activity to help students identify commonly misspelled words, commonly mispronounced words and confusing words	3
	Part 4	online collaboration tools	Presentation by groups on the experience of using online collaboration tools in various group activities and time management experience as per the Gantt chart prepared	2

SELF LEARNING ACTIVITIES (10 Hrs)							
Sl.	Activity	Description	Time	Module	CO	W K	P O
1	Gantt chart preparation	Preparation of Gantt chart based on the time plan	1	1	CO1	1	1
2	Self-awareness Writing	Take an online personality development test, self-reflect and report	1	2	CO1	1	2
3	Role-storming exercise	Students assume the role of their teacher and write about the • Skills required as a B.Tech graduate • Attitudes, habits, approaches required and activities to be practised during their B.Tech years, in order to achieve the set goals	1	2	CO1	1	1
4	Goal setting - Preparation	Identify their own goal and prepare an action plan for their undergraduate journey to achieve the goal	1	4	CO1	2	2
5	online international talks	Listen to TED talks & video lectures from renowned Universities related to the problem and prepare a one-page summary (Each group member should select a different resource)	1	5	CO4	4	3
6	Portfolio Personal creation	LinkedIn and Resume profile creation	1	6	CO6	6	5
7	emotional intelligence	Prepare a presentation on instances of demonstration of emotional intelligence	1	7	CO2	2	5
8	diversity aspects	Prepare a short video presentation on diversity aspects observed in our society (3 to 5 minutes)	1	8	CO2, CO5	7	5
9	Interview skills	Take online Interview skills development sessions like robotic interviews; self-reflect and report	1	9	CO6	6	5
10	listening test	Take an online listening test, self-reflect and report	1	10	CO6	8	7

RUBRICS FOR TERM WORK EVALUATION						
Sl .	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Completeness	All tasks done with extra depth, innovative additions	All tasks completed , few minor gaps	Most tasks done, limited depth	Some tasks missing or incomplete	Very little completed
2	Technical Accuracy	Algorithms and implementations are correct and efficient	Mostly correct, minor issues	Some conceptual errors	Major conceptual gaps	Incorrect or no implementation
3	Documentation & Presentation	Well-structured, clear, professional	Structured but with small lapses	Understandable but lacks clarity	Poorly structured	No documentation

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	100%
Lab Evaluation	24%
Learning Activity (Self Learning, Term Work, Assignments,)	76%
Attendance	0 %
Internal Examination	NA
Course Project	NA
End Semester Examination	0%
Total	100

Course Code	Course Name				Credits
J1ESL137	MECHANICAL AND CIVIL ENGINEERING WORKSHOP				1
Regulation	2026	L: T:P:H:S	0:0:2: 0:1	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	PL	Course delivery Mode		Practical	
Scheme of Evaluation		CIE: 100 Marks	ESE: Nil	Duration of ESE: NA	
Pre-requisite	NA				

COURSE OBJECTIVE	
1	To enable the student to familiarize various tools, measuring devices, practices and different methods employed in the industry.
2	To enable the students to apply this experience while developing product/project for the benefit of society.
3	To impart practical skills in basic site setting-out, quantity estimation, and building plan preparation.
4	To develop competency in evaluating construction materials and understanding building components and utilities.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Identify basic workshop practices, safety procedures, measuring instruments, and various mechanical components used in manufacturing	K2
2	Demonstrate fundamental manufacturing processes including foundry, smithy, and metal joining operations, and evaluate material properties and joint quality.	K3
3	Explain and demonstrate the working principles of conventional machine tools, automobile systems, and modern manufacturing technologies such as CNC machining, additive manufacturing, and industrial robotics.	K3
4	Identify and use basic construction tools, and building materials.	K2
5	Perform basic fieldwork and construction activities including setting out, level transfer using a water level, brick masonry, and calculation of material requirements.	K3
6	Prepare building drawings, site and utility plans, and conduct basic field and laboratory tests on construction materials.	K3

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	3	3	2	–	–	–	–	–	–	3	2	–	–	–	–	–	–	–	–	–	2	–	–	
2	–	2	3	2	–	–	–	–	–	3	2	1	–	–	–	–	–	–	–	–	2	1	–	
3	–	–	3	2	2	–	–	–	–	3	2	2	1	–	–	–	–	–	–	–	3	2	–	
4	3	3	-	-	3	-	-	-	-	3	3	-	2	2	-	-	-	-	2	3	2	2	1	
5	3	-	-	3	-	2	-	-	-	3	3	-	3	-	-	-	-	-	3	3	2	3	2	
6	3	-	3	-	3	-	-	-	-	3	3	3	-	-	-	2	-	2	-	3	2	3	2	
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS			
Module	Title	Topics	Hours
1	Manufacturing & Metal Joining Processes	Introduces basic workshop practices focusing on safety, measurements, and manufacturing processes. Includes the study and use of measuring tools, mechanical components, and basic foundry, smithy, and welding operations. Exercises involve sand and die casting, forging, and electric arc welding. Emphasis is placed on safe working habits, accuracy in measurement, and understanding fundamental production techniques.	3
2	Automobile & Conventional Machines	Demonstration of automobile parts, IC engine or similar machines. Study and demonstration of lathe, shaping and slotting, milling, drilling, and grinding machines, their construction, working principles, and applications.	4
3	Modern Manufacturing Techniques	Demonstration of CNC machine tools, additive manufacturing methods like 3D printing, and industrial robots including their configuration, end effectors, and sensors.	3
4	Building Layout and Planning	Introduction to masonry tools and pipe fittings, setting out practice building layouts. Determination of plot and built-up areas and computation of Floor Area Ratio (FAR). Transfer of levels using a water level. Preparation of standard 1BHK building, site, and utility plans showing room arrangement, access, setbacks, and service connections.	4
5	Brick Masonry and Quantity Estimation	Study of bonding patterns, alignment, and joint details through demonstration of brick masonry construction through 1½-brick-thick wall using English bond and Flemish bond. Estimation of the number of bricks required for a wall. Discussion on standard brick sizes and their influence on layout and bonding.	3
6	Material Testing and Evaluation	Testing of basic construction materials for strength and quality. Conducting compressive strength tests on bricks and concrete cubes. Testing timber specimens parallel and perpendicular to the grain. Comparison of test results with standard specifications to evaluate material performance.	3

LIST OF EXPERIMENTS (20 Hours)

Instructions

- Minimum 6 Experiments are mandatory from each session
- Students should maintain a record of the lab experiments.

Sl. No.	EXPERIMENT	CO
PART A		
1	To measure lengths, angles, and radii using tools such as Vernier Calipers, Micrometers, Height Gauge, Depth Gauge, and Bevel Protractor. Study small mechanical parts including bearings, seals, O-rings, circlips, and keys.	CO1
2	To perform the process of pattern making or die selection and carry out sand casting or die casting to produce a simple component.	CO1
3	To forge metals by hand and machine, and to observe the differences in hardness of the materials before and after forging.	CO1
4	To join metal pieces using electric arc welding and practice making proper welded joints (butt, lap, and T-joints).	CO1
5	To identify various automobile parts and understand the working principle of an Internal Combustion (IC) engine through demonstration.	CO2
6	To study the working of conventional machining machines such as the Lathe, Shaping & Slotting Machine, Milling Machine, Drilling Machine, and Grinding Machine through demonstration and understand their parts, operations, and applications.	CO2
7	To study the working of CNC machines and understand how they perform automatic machining operations to produce accurate components.	CO3
8	To understand the basics of 3D printing — slicing a CAD model and observing the additive manufacturing process.	CO3
9	To study the working of an industrial robot and practice basic operations such as pick-and-place using robotic end effectors.	CO3
PART B		
1	a. Identification and use of masonry tools. b. Identification of various types of pipe fittings and their uses.	CO4
2	a. Setting out practice. b. Transfer the level from one point to another using a water level.	CO5
3	a. Estimate the quantity of bricks required for a given brick masonry wall. b. Calculate the material quantities required for a specified volume and mortar mix ratio. c. Calculate the material quantities required for a specified volume and concrete mix ratio.	CO4, CO5
4	Construct 1 ½ - brick thick masonry wall using English bond and Flemish bond.	CO5
5	Draft a plan for 1BHK residential building using the given dimensions.	CO6
6	a. Determine the built-up area, plot area, and calculate Floor Area Ratio for the given building. b. Prepare a site plan and utility plan for the given plot.	CO6
7	Conduct field tests on cement and bricks.	CO6
8	Determine the compressive strength of bricks and concrete cubes.	CO6
9	Determine the compressive strength of timber parallel and perpendicular to the grain.	CO6

TEXTBOOKS				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1.	Elements of Workshop Technology Vol-1- Manufacturing Processes	S K Hajra Choudhury A K Hajra Choudhury Nirjhar Roy	MPP Media Promoters and Publishers	2008
2	Mechanical Workshop Practice	K C John	PHI Learning	Edition 2 2010
3	Workshops: Engineering Practice Laboratory Manual	P. Kannaiah	Scitech Publications	2021
4	Essentials of Civil Engineering	S. C. Charotar	Publishing House	2012
5	Building Construction, Volumes 1 to 4	W. B. Mckay, J. K. Mckay	Pearson India Education Services	
6	Introduction to building services	E. F. Curd, C. A. Howard	Macmillan	1996
REFERENCE				
Sl.	Name of Book	Name of Author/s	Publisher	Year
1	Workshop Technology, Vol. I	S. K. Hajra Choudhury, A. K. Hajra Choudhury, Nirjhar Roy	Media Promoters & Publishers Pvt. Ltd.	2019
2	Workshop Practice	B. S. Raghuwanshi	Dhanpat Rai Publications	2018
3	The Civil Engineering Handbook	Chen W.F, Liew J Y R	CRC (Taylor and Francis), Canada	2002
VIDEO LINKS				
1	https://nptel.ac.in/courses/112107219 Fundamentals of Manufacturing Processes			
2	https://nptel.ac.in/courses/112104195 Manufacturing Process Technology -Part I			
3	https://onlinecourses.nptel.ac.in/noc22_ce42/preview Introduction to the civil engineering profession			
4	https://nptel.ac.in/courses/105102088 Building materials and Construction			
VIRTUAL LAB/SIMULATION TOOLS				
1	CNC Simulator			
2	Robot Studio			
3	Virtual Concrete Lab			

SELF LEARNING ACTIVITIES (4 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Manufacturing Processes Study	Virtual measurement practice and study of foundry, smithy, and welding operations.	2	1	CO1–CO2	WK1 WK2	PO1, PO2, PO6, PO7
2	Modern Machining & Robotics	Study of machine tools, CNC/3D printing simulation, and industrial robot applications.	2	2-3	CO3	WK2, WK3	PO1, PO2, PO5
3	Manual Planning & Utility Layout of one's own house	Students shall prepare a manual sketch of their own house plan including room layout, dimensions, setbacks, and orientation, along with a simple water supply & drainage (utility) layout. Submit the sheet with proper symbols and legend.	2	4	CO4	WK1, WK2, WK4	PO1, PO2, PO3, PO7
4	Area Calculation & FAR Analysis for Residential Plot	Students shall collect the plot dimensions of their own residence or a nearby house, calculate plinth area, built-up area, permissible & achieved FAR, and prepare a comparison sheet with local bye-law requirements (setbacks, coverage, height limits).	2	4	CO5	WK2, WK4, WK5	PO1, PO2, PO3, PO6, PO7

TERM WORK ACTIVITIES (6Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Conventional Manufacturing Practice	Perform measurement using Vernier Caliper, Micrometer, and Bevel Protractor. Prepare brief reports on foundry, smithy, and welding processes with observations.	3	1	CO1	WK2, WK3	PO1, PO2, PO6, PO7
2	Modern Machining and Robotics Study	Prepare a summary of machine tool demonstrations, CNC & 3D printing simulations, and industrial robot applications with process documentation.	3	2-3	CO2 – CO3	WK3	PO1, PO2, PO5
3	Site Visit Observation Report	Visit a completed multistoried building and document key observations including building footprint, setbacks, circulation, orientation, access, and service locations (water tank, septic tank, drainage lines, electrical entry, parking). Submit notes with photos.	3	6	CO6	WK2, WK3	PO1, PO7
4	Building Site & Utility Plan Preparation	From the site visit, prepare the Site Plan and Utility Plans (water supply, drainage, Rainwater harvesting/ network) using manual drafting or CAD. Include labels, symbols, and scale. Submit final sheets.	3	5	CO6	WK3, WK4	PO2, PO5

RUBRICS FOR TERM WORK EVALUATION

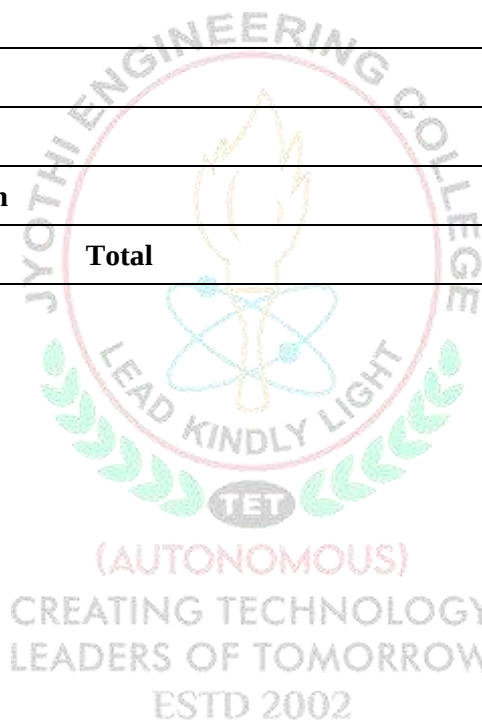
Sl. No.	Evaluation Criteria	Weightage	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehension	Good understanding; minor conceptual gaps; mostly correct application	Basic understanding; some confusion; limited application	Weak understanding; major gaps; incorrect application	No understanding; unable to explain concepts
2	Experimental/Programming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requirements	Basic execution; several errors; simple approach; partially meets requirements	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional; does not meet requirements
3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensive; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectations	Acceptable quality; some inaccuracies; basic structure; minimal expectations met	Poor quality; many inaccuracies; weak structure; below expectations	Unacceptable quality; incorrect; no proper structure

RUBRICS FOR CONTINUOUS INTERNAL ASSESSMENT

Sl. No.	Evaluation Criteria	Weightage	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Preparation & Pre-lab Work	20%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understands	Partially completed, some confusion	Minimal effort, weak comprehension	No prep, unable to explain
2	Experimental/Programming Skills	20%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	10%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretation	Minimal interpretation, errors	No analysis
4	Attendance and Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted

5	Viva	10%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer
6	Internal Lab Examination	30%	Marks Scored by the student can be proportionally added to the Assessment based on the weightage.				

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	100%
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work)	20%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	-
Total	100



COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	2	2		-	-	-	-	3	3	-	2	2	-	-	-	-	-	2	-	-	-
2	2	3	3	2		-	-	-	-	3	3	-	3	2	-	-	-	-	-	2	-	-	-
3	2	3	2	3		-	-	-	-	3	3	-	3	2	-	-	-	-	-	2	-	-	-
4	2	3	3	3		-	-	-	-	3	3	-	3	2	-	-	-	-	-	2	-	-	-

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS

Module	Title	Topics	Hours
1	Partial Derivatives	Limits and continuity, Partial derivatives, Partial derivatives of functions with two variables, Partial derivatives viewed as rate of change and slopes, Partial derivatives of functions with more than two variables, Higher order partial derivatives, Local Linear approximations, Chain rule, Implicit differentiation, Maxima and minima of functions of two variables - relative maxima and minima (Text 1: Relevant topics from sections 13.2, 13.3, 13.4, 13.5, 13.8)	11
2	Multiple Integrals	Double integrals, Reversing the order of integration in double integrals, change of coordinates in double integrals (Cartesian to polar), Evaluating areas using Double integrals, finding volumes using double integration, Triple integrals, Volume calculated as triple integral, Triple integral in Cartesian and cylindrical coordinates. (Text 1: Relevant topics from section 14.1, 14.2, 14.3, 14.5, 14.6)	11
3	Vector Calculus	Vector valued function of single variable - derivative of vector valued function, Concept of scalar and vector fields, Gradient and its properties, Directional derivative, Divergent and curl, Line integrals of vector fields, Work done as line integral, Conservative vector field, independence of path, Potential function (results without proof). (Text 1: Relevant topics from section 12.1, 12.2, 13.6, 15.1, 15.2, 15.3)	12
4	Vector Integral Theorems	Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals, finding areas using Green's theorem, Surface integrals over surfaces of the form $z = g(x, y)$, Flux integrals over surfaces of the form $z = g(x, y)$, Sources and sinks in incompressible field. Divergence theorem (without proof), Using Divergence theorem to find flux, Stokes' Theorem (without Proof) (Text 1: Relevant topics from section 15.4, 15.5, 15.6, 15.7, 15.8)	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SLNo	Name of Book	Name of Author/s	Publisher	Year
1	Calculus	H. Anton, I. Biven, Davis	Wiley 12th edition	2024

REFERENCE				
Sl No	Name of Book	Name of Author/s	Publisher	Year
1	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher	Przemyslaw Bogacki Pearson 15th edition.	2023
2	Advanced Engineering Mathematics	Erwin Krey zig	John Wiley & Sons	10th edition, 2016
2	Higher Engineering Mathematics B. V. Ramana McGraw-Hill Education 39th edition, 2023	B. V. Ramana	McGraw-Hill Education 39th edition	2023
3	Bird’s Higher Engineering Mathematics John Bird Taylor & Francis 9th edition, 2021	John Bird	Taylor & Francis 9th edition	2021
VIDEO LINKS				
1	https://nptel.ac.in/courses/111107108			
2	https://nptel.ac.in/courses/111107108			
3	https://nptel.ac.in/courses/111107108			
4	https://nptel.ac.in/courses/111107108			
VIRTUAL LAB/SIMULATION TOOLS				
1	PYTHON			
2	MATLAB			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
Partial Derivatives (11 Hrs)	Part 1	Partial Derivatives	Concept of limit and continuity of functions of two variables, partial derivatives	2
	Part 2	Differentials	Differentials, Local Linear approximations	2
	Part 3	Chain Rule	Chain rule for partial Derivatives, Total derivative	4
	Part 4	Maxima and minima	Relative maxima and minima, Absolute maxima and minima on closed and bounded set.	3
Multiple Integrals (12 hours)	Part 1	Double integrals	Double integrals over rectangular regions, Reversing the order of integration in double integrals, change of coordinates in double integrals (Cartesian to polar).	3
	Part 2	Areas and Volume using Double integrals	Computing the area and volume using double integrals.	3
	Part 3	Triple integrals	Computing the volume using Triple integrals.	3
	Part 4	Triple integral in Cartesian and cylindrical coordinates	To obtain the volume of the solid using triple integrals.	3

Vector Calculus (11 hours)	Part 1	Vector valued function of single variable.	Vector valued function of single variable - derivative of vector valued function, Concept of scalar and vector fields	2
	Part 2	Gradient, Divergent and curl	Gradient and its properties, Directional derivative, Divergent and curl	3
	Part 3	Line Integrals	Line integrals of vector fields, Work done as line integral,	3
	Part 4	Conservative vector field,	Conservative vector field, independence of path, Potential function (results without proof)	3
Vector Integral Theorems (11 hours)	Part 1	Green's theorem	Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals, finding areas using Greens theorem.	3
	Part 2	Surface integrals	Surface integrals over surfaces of the form $z = g(x, y)$	3
	Part 3	Divergence theorem	Divergence theorem (without proof), Using Divergence theorem to find flux, Sources and sinks in incompressible field.	3
	Part 4	Stoke's theorem	Verification of Stoke's theorem, using Stoke's theorem to evaluate line integrals.	2

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Multivariable Optimisation Study	Solve a graded set of maxima/minima problems for functions of two variables; verify critical points numerically in Python.	7 hrs	1	1	WK1 WK2 WK3	PO1, PO2, PO4 PO11
2	Multiple Integral Visualisation	Use a spreadsheet/Python to evaluate double and triple integrals numerically and visualise the regions of integration; compare with analytical results.	8 hrs	2	2	WK2 WK3	PO1, PO2, PO4 PO5
3	Vector Field Visualisation	Use GeoGebra 3D / Python to visualise gradient, divergence and curl of sample fields; identify conservative fields and potential functions.	7 hrs	3	3	WK2 WK3 WK4	PO1, PO2, PO4 PO5
4	Integral Theorems Problem Set	Solve problems applying Green's, divergence and Stokes' theorems; verify the equality of the two sides for sample regions.	8 hrs	4	4	WK1 WK2 WK3 WK4	PO1, PO2 PO4

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Partial Derivatives Problem.	Submit a computational report by solving 5 problems on partial derivatives, the chain rule and optimisation of two-variable functions.	5 hrs	1	CO1	WK2 WK3 WK4	PO1, PO2, PO4
2	Integrals Mini-Report	Submit a graded mini-report applying multiple integrals to area/volume problems.	5 hrs	2	CO2	WK2 WK3 WK4	PO1, PO2, PO4
3	Vector Calculus Computational Report	Submit a computational report with two vector-field problems (gradient/divergence/curl, line integral) and one application of an integral theorem.	5 hrs	3,4	CO3 CO4	WK1 WK2 WK3	PO1, PO2, PO4

RUBRICS FOR TERM WORK EVALUATION						
Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	40%
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	60%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Partial Derivatives	11		3	12				15
2	Laplace Transforms	12		3	12				15
3	Vector Calculus	11		3	12				15
4	Vector Integral Theorems	11		3	12				15
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					60

Course Code	Course Name					Credits
J1BSP222	ENGINEERING CHEMISTRY					4
Regulation	2026	L: T:P:H:S	3:0:2: 0:5.5	Notional Learning Hours/Semester		120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))						
Course Type	TP	Course delivery Mode		Theory + Practical		
Scheme of Evaluation		CIE: 60 Marks	ESE:40 Marks	Duration of ESE: 2 Hr 30 Min.		
Pre-requisite	Basic Electrochemistry, Introduction to Organic Chemistry, Redox Reactions, Polymers					

COURSE OBJECTIVE	
1	To equip students with a thorough understanding of chemistry concepts relevant to engineering applications.
2	To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3	To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on quality of life.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply electrochemical principles to analyse electrochemical cells, energy storage and conversion devices, and corrosion protection techniques for engineering applications.	K3
2	Explain the properties and applications of fuels, lubricants, polymers, and nanomaterials used in engineering applications.	K3
3	Apply the principles of molecular spectroscopy, XRD, SEM, and thermal analysis to characterize engineering materials.	K3
4	Apply water quality assessment, treatment, and sewage management principles to address engineering problems for societal well-being.	K3
5	Apply the concepts of air pollution control and sustainable development to evaluate environmental issues and recommend sustainable engineering practices.	K3

COURSE ARTICULATION MATRIX																								
C O	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2		
1	3	2	2	2	-	-	-	-	-	3	2	-	2	-	-	-	-	-	-	-	2	-		
2	3	2	2	-	-	2	-	-	-	3	-	-	-	2	-	-	-	-	-	2	2	-		
3	3	3	2	-	3	2	-	2	2	2	2	3	-	-	2	-	-	-	2	-	2	-		
4	3	2	2	2	-	-	3	-	2	2	-	-	-	-	-	3	1	-	-	-	-	2		
5	2	2	2	-	3	-	3	3	2	2	-	-	-	-	-	3	1	-		2	-	2		

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

SYLLABUS			
Module	Title	Topics	Hours
1	Electrochemistry and Corrosion Science	Electrochemical Cell - Electrode potential - Electrochemical series – Applications - Nernst equation for single electrode and cell (Numerical problems). Reference Electrodes - SHE, Calomel electrode - Glass electrode (construction only). Energy conversion devices - Li-ion battery - Fuel cell - Phosphoric acid fuel cell and Polymer electrolyte membrane fuel cell (PEMFC) - Solar cells - Photovoltaic cell (silicon based) - Photo electrochemical cell - DSSC (Dye sensitised solar cell). Corrosion - Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and Impressed current cathodic protection - Electroplating of copper - Electro less plating of copper.	10
2	Engineering Materials	Fuels - Calorific value - HCV and LCV - Experimental determination of calorific value of solid fuels. Analysis of coal - Proximate analysis. Octane & Cetane Number. Biofuels - Biodiesel - Green Hydrogen. Lubricants - Classification - Solid, Semisolid and Liquid lubricants - Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point, Pour Point & Aniline Point. Cement - Manufacture of Portland cement - Theory of setting and hardening of cement. Polymers - ABS & Kevlar - Synthesis, properties and applications - Conducting Polymers - Classification - Application. Nanomaterials - Classification based on Dimension & Materials. Synthesis - Sol gel & Chemical Reduction - Applications of nanomaterials - Super capacitor Materials - Carbon Nanotubes, Fullerenes & Graphene - Structure, properties & application.	8
3	Instrumental Methods of Analysis	Molecular Spectroscopy - Types of spectra - Molecular energy levels - Beer Lambert's law - Numerical problems Electronic Spectroscopy - Principle, Types of electronic transitions - Role of Conjugation in absorption maxima - Instrumentation - Applications X-ray Diffraction (XRD) - Principle and applications in determining crystal structure and phase identification. Scanning Electron Microscope (SEM) - Principle, instrumentation and Applications. Thermal analysis - TGA - Principle, instrumentation (block diagram) and applications - TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and polymers - DTA - Principle, instrumentation (block diagram) and applications - DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.	9

4	Environmental Chemistry	Water characteristics - Hardness - Types of hardness - Temporary and Permanent - Disadvantages of hard water - Degree of hardness (Numerical) Water softening methods - Ion exchange process - Principle, procedure and advantages - Reverse osmosis - principle, process and advantages. Water disinfection methods - Chlorination - Break point chlorination - Ozone and UV irradiation. Dissolved oxygen (DO), BOD and COD- Definition & Significance. Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Air Pollution- Sources & Effects - Greenhouse effect - Ozone Depletion - Sustainable Development - An introduction to Sustainable Development Goals.	9
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LIST OF EXPERIMENTS (24 hours)		
Instructions Minimum 10 Experiments		
Sl. No.	Experiment	CO
1	Estimation of iron in iron ore	1
2	Estimation of copper in brass	1
3	Determination of cell constant and conductance of solutions	1
4	Calibration of pH meter and determination of pH of a solution	1
5	Synthesis of polymer Urea-formaldehyde resin	2
6	Synthesis of polymer Phenol-formaldehyde resin	2
7	Synthesis of polymer Poly aniline.	2
8	Analysis of IR spectra	3
9	Identification of drugs using TLC	3
10	Determination of molar absorptivity of a compound (KMnO ₄ or any water-soluble food colorant)	3
11	Determination of saponification value of a given vegetable oil	2,5
12	Determination of calorific value using Bomb calorimeter	2,5
13	Estimation of chlorine in water (Mohr's method)	4,5
14	Estimation of total hardness of water-EDTA method	4,5
15	Estimation of dissolved oxygen by Winkler's method	4,5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Chemistry	B. L. Tembe, Kamal Uddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition-2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition-2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17th Edition - 2015

REFERENCE

SL. No.	Name of Book	Name of Author/s	Publisher	Year
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4th Edition., 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc.	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Organic Electronics Materials and Devices	Shuichiro Ogawa	2024

VIDEO LINKS (NPTEL, SWAYAM...)

1	https://onlinecourses.nptel.ac.in/noc20_mm04/preview
2	https://onlinecourses.nptel.ac.in/noc21_mm38/preview
3	https://onlinecourses.nptel.ac.in/noc20_cy08/preview
4	https://onlinecourses.nptel.ac.in/noc19_ce32/preview

VIRTUAL LAB/SIMULATION TOOLS

1	https://ccnsb06-iiith.vlabs.ac.in/exp/infra-red-spectroscopy/simulation.html?authuser=0
2	https://mas-iiith.vlabs.ac.in/exp/uv-visible-spectroscopy/simulation.html

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
1. Electrochemistry and Corrosion Science	Part 1	Electrochemical Cells and Electrode Potentials	Electrochemical Cell - Electrode potential - Electrochemical series - Applications - Nernst equation for single electrode and cell (Numerical problems)	3
	Part 2	Reference Electrodes	Standard Hydrogen Electrode (SHE) - Calomel electrode - Glass electrode (construction only)	2
	Part 3	Energy Conversion Devices	Li-ion battery - Fuel cell - Phosphoric acid fuel cell and Polymer electrolyte membrane fuel cell (PEMFC) - Solar cells - Photovoltaic cell (silicon based) - Photo electrochemical cell - DSSC (Dye sensitised solar cell).	3
	Part 4	Corrosion and Corrosion Control Methods	Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection - Electroplating of copper - Electroless plating of copper	2
2. Engineering Materials	Part 1	Fuels	Calorific value - HCV and LCV - Experimental determination of calorific value of solid fuels - Analysis of coal - Proximate analysis Octane & Cetane number - Biofuels - Biodiesel - Green Hydrogen	2
	Part 2	Lubricants	Classification - Solid, Semisolid and Liquid lubricants - Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point, Pour Point & Aniline Point.	2
	Part 3	Cement and Polymers	Manufacture of Portland cement - Theory of setting and hardening of cement. ABS & Kevlar - Synthesis, properties and applications, Conducting Polymers - Classification - Application.	2
	Part 4	Nanomaterials	Classification based on Dimension & Materials Synthesis - Sol gel & Chemical Reduction - Applications of nanomaterials - Super capacitor Materials - Carbon Nanotubes, Fullerenes & Graphene - Structure, properties & application.	2
3. Instrumental Methods of Analysis	Part 1	Molecular Spectroscopy	Types of spectra - Molecular energy levels - Beer Lambert's law - Numerical problems	2
	Part 2	Electronic Spectroscopy	Principle - Types of electronic transitions - Role of Conjugation in absorption maxima - Instrumentation - Applications	2
	Part 3	Characterization Techniques	X-ray Diffraction (XRD) - Principle and applications in determining crystal structure and phase identification. Scanning Electron Microscope (SEM) - Principle, instrumentation and Applications.	2
	Part 4	Thermal Analysis	TGA - Principle, instrumentation (block diagram) and applications - TGA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ and polymers. DTA - Principle, instrumentation (block diagram) and applications - DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$.	3

4.Environmental Chemistry	Part 1	Water Characteristics and Hardness	Water characteristics - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numerical).	3
	Part 2	Water Softening Methods	Ion exchange process - principle, procedure and advantages. Reverse osmosis - principle, process and advantages.	3
	Part 3	Water Disinfection and Waste water Treatment	Water disinfection methods – Chlorination - Break point chlorination, Ozone and UV irradiation - Dissolved oxygen (DO) - BOD and COD - Definition & Significance - Waste Management - Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	3
	Part 4	Climate Change and Sustainable Development	Air Pollution - Sources & Effects - Greenhouse effect - Ozone Depletion-Sustainable Development- an introduction to Sustainable Development Goals.	

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Electrochemical Cells & Corrosion	Watch a short NPTEL video on electrochemical cells, reference electrodes, and corrosion mechanisms. Write one-page notes on corrosion control (sacrificial protection & electroplating).	6	1	CO1	WK1 WK2 WK3 WK4	PO1 PO2 PO4
2	Material Selection Case Study	Explore selection of polymers or nanomaterials for an engineering application and document the rationale.	6	2	CO2	WK1 WK2 WK3 WK6	PO1 PO5 PO11
3	Spectroscopy Simulation (UV-Vis / IR)	Use Virtual Lab to simulate UV-Vis or IR spectroscopy. Observe how wavelength affects absorbance and record your results	6	3	CO3	WK1 WK2 WK3 WK5 WK6 WK8 WK9	PO1 PO2 PO3 PO10

4	Water Treatment and Hardness	Watch NPTEL video on water softening and hardness measurement. Prepare a short write-up on ion-exchange and RO methods	6	4	CO4	WK1 WK2 WK3 WK4 WK7 WK9	PO1 PO7 PO8
5	Climate Change Awareness Activity	Make a one-page infographic showing greenhouse gases and their impact on climate change.	6	4	CO5	WK1 WK2 WK3 WK5 WK7 WK8 WK9	PO1 PO7 PO8 PO11

TERM WORK ACTIVITIES (30 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Case Study on Electrochemical Applications	Study real-world applications of electrochemistry (e.g., batteries, corrosion prevention, electroplating). Prepare a short report or presentation including diagrams and reactions.	10 Hrs	1	CO1	WK1 WK2 WK3 WK4	PO1 PO2 PO4
2	Identification of octane number and certain number of fuels	Students collect and analyse information about petrol and diesel fuels marketed by any two major petroleum companies and compare the octane number and certain number of the samples.	10 Hrs	2,3	CO2, CO3	WK1 WK2 WK3 WK5 WK6 WK8 WK9	PO1 PO2 PO3 PO5 PO10 PO11
3	Water Quality Investigation	Investigate water hardness, chlorine and dissolved-oxygen content, analyse results against standards and present a sustainability-focused report.	5 Hrs	4	CO4	WK1 WK2 WK3 WK4 WK7 WK9	PO1 PO7 PO8
4	Environmental Chemistry Presentation	Prepare a short group presentation or poster on Climate change / Sustainable Development Goals (SDGs). Emphasize chemistry's role in sustainability.	5 Hrs	4	CO5	WK1 WK2 WK3 WK5 WK7 WK8 WK9	PO1 PO7 PO8 PO11

RUBRICS FOR TERM WORK EVALUATION

Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

LAB EVALUATION RUBRICS

Sl. No	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Preparation & Pre-Lab Work	30%	Comes fully prepared with pre-lab work completed; demonstrates clear understanding of objectives and procedure.	Minor gaps in pre-lab preparation; understands most objectives and procedures.	Partial pre-lab work done; limited understanding of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives/procedure.
2	Experimental Skills & Performance	40%	Performs experiment independently with precision, follows correct procedure	Performs experiment with minor guidance; procedure mostly correct.	Needs frequent guidance; some procedural errors.	Struggles with procedure; requires constant help.	Unable to perform experiment correctly even with help
3	Analysis, Interpretation and Documentation	30%	Analyse, Interpret and Document results correctly	Minor interpretation issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/interpretation.

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	60%
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	20%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	40%
Total	100

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Electrochemistry and Corrosion Science	10	3	5	2				10
2	Engineering Materials	8	3	5	2				10
3	Instrumental Methods of Analysis	9		7	3				10
4	Environmental Chemistry	9		7	3				10
Total		36	6	24	10				40
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper			2		
Part	No. of Questions/ Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	1 (No choice)	8	2	8x2	16
B	2 (Including Choice)	8	6	4 x 6	24
TOTAL MARKS					40

Course Code	Course Name					Credits
J1EST243	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING					4
Regulation	2026	L: T:P:H:S	4:0:0: 0:6	Notional Learning Hours/Semester		120
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))						
Course Type	TC	Course delivery Mode				Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks		Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil					

COURSE OBJECTIVE	
1	To Develop a strong foundation in electrical engineering fundamentals by understanding DC and AC circuits.
2	To Describe the fundamental concepts of essential electrical machines, power supply systems, renewable energy resources and electrical safety practices.
3	To Describe the fundamental concepts, characteristics, and applications of electronic components, devices, basic circuits and digital systems.
4	To develop an understanding of electronic instrumentation, sensors, transducers, and IoT-based measurement systems, fostering awareness of modern technologies and their role in smart and sustainable applications.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply fundamental electrical circuit laws and concepts (Ohm's law, Kirchhoff's laws, AC/DC circuits, power factor, and three-phase systems) to solve basic electrical engineering problems in practical applications.	K3
2	Explain the construction, operating principles and applications of electrical machines, transformers, renewable energy sources, and electrical safety devices.	K2
3	Explain the working principles of basic electronic components and semiconductor devices, and apply them to interpret the operation of simple electronic circuits including rectifiers, transistor switching and amplification, and logic gate operations.	K3
4	Explain the principles of measurement systems, sensors, and transducers, and apply them to understand their role in engineering applications such as industrial measurement and basic IoT-based systems.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2	3	3	2	-	2	-	-	-	3	3	2	-	-	-	-	-	-	-	2	-	-	-
2	2	2	3	3	2	3	-	-	2	3	2	-	-	-	2	-	-	-	-	2	-	-	-
3	3	2	3	3	-	3	-	-	-	3	2	2	-	2	-	-	-	2	-	2	-	-	-
4	2	1	3	2	-	3	-	-	-	3	2	-	-	-	-	-	-	2	-	2	-	-	-
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																							

SYLLABUS

Module	Title	Topics	Hours
1	Introduction to Electrical Circuits and AC Systems	DC Circuits: Resistance in Series and Parallel, Ohm's Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems). Faraday's laws of Electromagnetic induction, Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveform: frequency, time period, average, RMS values and form factor (Simple numerical problems). AC circuits: Purely resistive, inductive and capacitive circuits; RL, RC & RLC circuit, concept of impedance. (Simple numerical problems) Three phase AC systems: Representation of three phase voltages, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents. Power in AC circuits: Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems).	15
2	Introduction to Electrical Supply, Machines, and Protection Systems	Generation of electrical energy: Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description). Electrical supply system: simple layout of Generation, transmission and Distribution of power. Distribution system: Feeder, distributor, service mains. Introduction to renewable energy resources: Solar- Photovoltaic, wind. Transformers: Construction and Working principle of a single-phase Transformer. DC Motor: Construction, principle of operation, Different types of DC motors, significance of back EMF, applications. Introduction to AC motors: Three Phase Induction Motor, Construction and Principle of Operation. Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing. Safety devices: MCB, ELCB.	15

3	Basics of Electronic Devices and Circuits	Introduction to electronic components: passive (resistors, capacitors, inductors) and active components; basic specifications of components. Semiconductor devices: PN junction diode – principle of operation and V–I characteristics; Bipolar Junction Transistors (BJT) – PNP and NPN structures and principle of operation. Basic electronic circuits: block diagram of DC power supply; working of full-wave bridge rectifier, capacitor filter, and Zener voltage regulator. Transistor applications: BJT as a switch and basic amplifier concept; block diagram of a public address system. Introduction to digital electronics: binary number system, Boolean algebra, logic gates, and universal gates.	16
4	Electronic Instrumentation and Sensors	Quality of measurements: accuracy, precision, sensitivity, and resolution. Sensors and transducers: working principles and applications of pressure sensors (strain gauge, Bourdon gauge), temperature sensors (RTD, thermocouple), proximity sensors (capacitive and ultrasonic), and motion sensors (accelerometer). Introduction to Internet of Things (IoT): basic concepts and architecture; applications in smart systems such as smart street lighting and smart parking.	14

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL. No	Name of Book	Name of Author/s	Publisher	Year
1.	Basic Electrical Engineering	D. P Kothari and I. J Nagrath	Tata McGraw Hill	2019
2	Basic Electrical Engineering	V. K. Mehta, Rohit Mehta	S. Chand & Company, Limited	2006
3	Basic Electronics and Linear Circuits	N N Bhargava D C, Kulshreshtha	McGraw Hill	2017
4	Doebelin's Measurement Systems	Ernest O. Doebelin	McGraw Hill	2019
5	Electronic Instrumentation and Measurements	Kalsi HS	McGraw Hill	2019

REFERENCE

SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2019
2	Electrical Engineering Fundamentals	Del Toro V	Pearson Education	2019
3	Electronics: A Systems Approach	Neil Storey	Pearson	2017
4	Electronic Devices and Circuit Theory	Robert L. Boylestad	Pearson	2015
5	Electrical and Electronics Measurements and Instrumentation	Sawhney AK	Dhanpat Rai and Sons	2001
6	Electronic Devices and Circuits	David A. Bell	Oxford University Press	5th Ed., 2017
7	Principles of Electronic Communication Systems	Louis E. Frenzel	McGraw Hill	2023

VIDEO LINKS	
1	Fundamentals of Electrical Engineering (NPTEL) - https://nptel.ac.in/courses/108105112
2	Transformer Basics (NPTEL) - https://www.youtube.com/watch?v=NkRk_xaRwjg&t=16s
3	Fundamentals of Three Phase Induction Motor (NPTEL) - https://www.youtube.com/watch?v=tqYzGdSbTFE
4	Digital Circuits (NPTEL) - https://nptel.ac.in/courses/108105132
5	Analog Circuits-NPTEL – Analog Electronic Circuits (IIT Kharagpur) - https://nptel.ac.in/courses/108105158
6	IoT Basics- NPTEL – Introduction to Internet of Things (IIT Kharagpur) https://nptel.ac.in/courses/106105166
7	NPTEL – Sensors and Actuators (IIT Delhi) - nptel.ac.in/courses/108105064
8	MOSFET and Amplifier Basics, Electronics Tutorials – Transistor & MOSFET Explained (YouTube) https://www.youtube.com/@ElectronicsTutorials
VIRTUAL LAB/SIMULATION TOOLS	
1	https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html
2	https://www.circuitlab.com/
3	TINA-TI / Multisim Simulation
4	Falstad Circuit Simulator https://falstad.com/circuit/
5	Proteus Design Suite (Optional)

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1. Introduction to Electrical Circuits and AC Systems (15 Hrs)	Part 1	DC Circuits	Resistance in Series and Parallel, Ohm's Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems).	3
	Part 2	Generation of Alternating Voltages	Faraday's laws of Electromagnetic induction, Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveform: frequency, time period, average, RMS values and form factor (Simple numerical problems).	3
	Part 3	AC circuits	Purely resistive, inductive and capacitive circuits; RL, RC & RLC circuit, concept of impedance. (Simple numerical problems).	4
	Part 4	Three phase AC systems & Power in AC circuits	Representation of three phase voltages, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents. Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems).	5

2.Introduction to Electrical Supply, Machines, and Protection Systems (15 Hrs)	Part 1	Generation of Electrical energy & Electrical supply system	Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description). Electrical supply system: simple layout of Generation, transmission and Distribution of power.	3
	Part 2	Introduction to renewable energy resources	Distribution system: Feeder, distributor, service mains. Solar- Photovoltaic, wind	2
	Part 3	Transformers & DC motors	Transformers: Construction and Working principle of a single-phase Transformer. DC Motor: Construction, principle of operation, Different types of DC motors, significance of back EMF, applications.	4
	Part 4	Introduction to AC & Earthing	Introduction to AC motors: Three Phase Induction Motor, Construction and Principle of Operation. Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing. Safety devices: MCB, ELCB	6
3.Introduction to Electronic devices (16 Hrs)	Part 1	Basic Electronic Components and Diode Fundamentals	Introduction to electronics (why ME students need it); Passive components: Resistor, Capacitor, Inductor (function only), Basic specifications (very brief); Active vs Passive components; PN Junction Diode: Basic concept (depletion region idea), Working principle; V-I characteristics (qualitative only).	4
	Part 2	Transistors and Basic Applications	Introduction to BJT: PNP & NPN structure, Basic operation (no deep physics); BJT as a switch (important), ON/OFF concept, Real-world examples; BJT as an amplifier (concept only)-Idea of signal amplification; Application: Block diagram of Public Address system	4
	Part 3	DC Power Supply	Need for DC power supply; Block diagram: Transformer → Rectifier → Filter → Regulator; Full-wave bridge rectifier: Working (no waveform analysis); Capacitor filter: Ripple reduction concept; Zener diode regulator: Voltage regulation idea.	3
	Part 4	Digital Electronics	Binary number system; Basic Boolean algebra rules; Logic gates: AND, OR, NOT; Universal gates: NAND, NOR; Simple logic examples	5

4. Electronic Instrumentation (14 Hrs)	Part 1	Fundamentals of Measurement Systems	What is measurement? Why it is important in engineering; Block diagram of an instrumentation system - Sensor → Signal processing → Display; Quality of measurements: Accuracy, Precision, Sensitivity, Resolution; Simple examples (thermometer, pressure gauge)	3
	Part 2	Sensors and Transducer Fundamentals	What is a sensor and transducer; Sensor vs Transducer; Principle of transduction; Basic characteristics (qualitative only) - Range, Sensitivity, Accuracy; Pressure sensors (strain gauge and Bourdon gauge): basic working principles and applications.	4
	Part 3	Sensors for Mechanical Systems	Temperature sensors: RTD, Thermocouple; Proximity sensors: Capacitive, Ultrasonic; Motion sensors: Accelerometer; Real-world applications: Industrial measurement, Automation examples.	4
	Part 4	Modern Transducers and Emerging Trends	Introduction to IoT-What and why; Basic IoT architecture (very simple)- Sensor → Controller → Network → User; Applications: Smart Street lighting, Smart parking; Role of sensors in IoT systems	3

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Virtual lab	Perform verification of ohms law, Kirchoff's law, diode and transistor characteristics using simulation tools.	5	1,3	CO1 CO3	WK1 WK3	PO1 PO2 PO5
2	Video Study	Watch short documentary clips on how each power plant works and prepare a table comparing efficiency, cost, and environmental impact of each plant.	5	2	CO2	WK1 WK4 WK7	PO1 PO2
3	Application Research	List 10 real-world applications of DC motors in your home/college. Identify which type (series/shunt/compound) is likely used in each and justify why.	5	2	CO2	WK1 WK4	PO1 PO2
4	Diode and Rectifier Simulation	Simulate PN junction diode characteristics and full-wave rectifier using a circuit simulator and observe output behaviour and rectification process.	4	3	CO3	WK2 , WK3	PO1, PO2, PO5

5	Transistor and Logic Gate Study	Study the operation of a transistor as a switch and verify basic logic gates (AND, OR, NOT, NAND, NOR) using truth tables or simulation.	4	3	CO3	WK3	PO1, PO2
6	Sensor Identification and Application Study	Identify sensors used in mechanical systems (pressure, temperature, proximity) and explain their working principles and applications with examples.	4	4	CO4	WK4	PO1, PO2
7	IoT-Based System Study	Study a simple IoT system (e.g., smart parking or smart lighting) and explain its architecture using a basic block diagram and sensor role.	3	4	CO4	WK5	PO2, PO3

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Simulation of R, L and C Circuits	Simulate purely resistive, inductive, and capacitive circuits and observe the phase difference between the voltage and current waveforms.	5	1	CO1	WK1 WK6	PO1 PO2
2	Safety Awareness	Prepare a poster regarding safety checklist for electrical lab work.	5	2	CO2	WK5	PO1 PO7
3	Assignment	AC Circuits Analysis Portfolio	5	2	CO1	WK1	PO1 PO2
4	Simulation and Analysis Task	Simulate basic electronic circuits (diode, rectifier, logic gates) using a circuit simulator and analyze their behaviour. Submit a brief report with observations.	6	3	CO3	WK3 , WK4	PO1, PO2, PO5, PO9
5	Sensor Study and Demonstration	Study selected sensors (temperature, pressure, proximity) and present their working principles, applications, and real-life usage with simple illustrations or demo.	5	4	CO4	WK5	PO1, PO2, PO9, PO10
6	IoT Application Presentation	prepare and present a simple IoT-based system (e.g., smart parking/street lighting) explaining block diagram, components, and working.	4	4	CO4	WK6	PO2, PO3, PO9, PO10

RUBRICS FOR TERM WORK EVALUATION						
Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, connects theory and practice.	Clear with minor gaps.	Basic but lacks depth.	Partial understanding.	Very limited understanding.
2	Implementation & Simulation	Correct, verified, and documented.	Mostly correct, few errors.	Basic setup, limited checks.	Incomplete or major errors.	No valid attempt.
3	Analysis & Interpretation	Accurate results with clear justification.	Mostly correct, minor gaps.	Basic analysis, lacks detail.	Minimal or unclear analysis.	No analysis.
4	Report & Presentation	Well-organized, clear, with references.	Neat, minor issues.	Acceptable but lacks detail.	Poorly structured.	Not submitted.
5	Teamwork & Engagement	Active, consistent contribution	Regular participation	Moderate effort.	Minimal effort.	No participation.

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	40%
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	60%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom’s Level)						Total Marks
			R	U	A	An	E	C	
1	Introduction to Electrical Circuits and AC Systems	15	3	6	6				15
2	Introduction to Electrical Supply, Machines, and Protection Systems	15	6	9					15
3	Introduction to Electronic devices	16	6	6	3				15
4	Electronic Instrumentation	14	6	6	3				15
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN

No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					60

COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	2	1							3	2	-	-	1	-	-	-	-	-	-	3	-	-
2	3	3	2	1						3	2	2	-	2	-	-	-	-	-	-	3	-	-
3	3	3	2	2	1					3	2	2	1	2	-	-	-	-	-	-	3	2	-
4	2	3	3	2	1					2	2	3	1	3	-	-	-	-	-	-	3	2	-
5	2	3	3	3	2					2	3	3	2	3	-	-	-	-	-	-	3	3	2

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

SYLLABUS			
Module	Title	Topics	Hours
1	Projection of Points, Lines & Planes	Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. Inclination of lines with reference planes. True length and true inclinations of line inclined to both the reference planes. Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.	12
2	Projection of Solids	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cube, Tetrahedron, Cone and Cylinder only. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes.	10
3	Section and Development of Solids	Sections of Solids: Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems). Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes)	11
4	Isometric & CAD	Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere and their combinations. Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation)	12

ESTD 2002

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1.	Engineering Graphics	Varghese, P. I.	V I P Publishers	2018
2	Engineering Graphics	John, K. C.	Prentice Hall India Publishers	2017
3	Engineering Drawing	Bhatt, N., D.	Charotar Publishing House Pvt Ltd.	2019
4	Engineering Graphics	Anilkumar, K. N.	Adhyuth Narayan Publishers	2022

REFERENCE				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Graphics with AutoCAD	Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K.	Prentice Hall India Publishers	2020
2	Engineering Graphics	Benjamin, J.	Pentex Publishers	2016
3	Engineering Drawing & Graphics	Venugopal, K.	New Age International Publishers	2011
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc25_me173/preview			
2	https://onlinecourses.nptel.ac.in/noc24_me140/preview			
VIRTUAL LAB/SIMULATION TOOLS				
1	CAD Software			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1. Projection of Points, Lines & Multi View Projections. (12 Hrs)	Part 1	Projection of Points	Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. Projection of points in different quadrants	4
	Part 2	Projection of Lines	Projection of straight lines inclined to one plane and inclined to both planes. Trace of a line. Inclination of lines with reference planes.	2
	Part 3	Line inclined to both the planes	True length and true inclinations of line inclined to both the reference planes.	3
	Part 4	Projection of Planes	Projections of plane lamina of geometrical shapes - Plane lamina parallel to one of the reference planes - Inclined to one and perpendicular to the other reference plane - Inclined to both the reference planes - Inclined to the two reference planes but perpendicular to the profile plane.	3
2. Projection of Solids (10 Hrs)	Part 1	Simple solids	Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder only.	3
	Part 2	Solid inclined to HP	Projection of solids with axis inclined to Horizontal planes.	2
	Part 3	Solid inclined to VP	Projection of solids with axis inclined to Vertical planes.	2
	Part 4	Solid inclined to both the planes	Projection of solids with axis inclined to both reference planes.	3

3. Section and Development of Solids (11 Hrs)	Part 1	Section of plane with HP	Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by HP section planes. True shape of the sections.	3
	Part 2	Section of plane with VP	Sections of Prisms, Pyramids, Cone and Cylinder only, with axis in vertical position and cut by VP section planes. True shape of the sections.	3
	Part 3	Development of surfaces	Development of surfaces of the solids and solids	3
	Part 4	Development of truncated solids	Development of surfaces of the solids cut by different section planes.	2
4. Isometric & CAD (12 Hrs)	Part 1	Isometric view	Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere.	3
	Part 2	Isometric Projection	Isometric scale - Isometric Projections of Prisms, Pyramids, Cone, Cylinder, Sphere.	2
	Part 3	Combination of solids	Combination of solids of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere of Isometric View and Projection.	3
	Part 4	Computer Aided Drawing (CAD)	Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two dimensional drawing with dimensions using suitable software.	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Technical Drawing Practice	Practice projection of points and lines located in different quadrants; identify errors and prepare neat engineering sheets.	6	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
2	Planes	Prepare different planes, Projections of plane lamina of geometrical shapes.	6	1	CO1	WK2, WK3, WK4	PO1, PO2, PO3, PO5
3	Sectional and Development Drawing	Prepare sectional and development views of prisms, pyramids, and cylinders, showing true shape and surface development.	6	3	CO3	WK3, WK4, WK5	PO1, PO2, PO3, PO5
4	CAD Practice	Use any CAD software to create 2D drawings of simple mechanical components and convert them into 3D isometric projections.	6	4	CO4, CO5	WK4, WK5, WK6, WK7	PO1, PO2, PO3, PO5, PO11
5	Reflective Journal	Maintain a report documenting learning progress, challenges, and solutions across all modules.	6	All	CO1 – CO5	WK8, WK9	PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Drawing & Modeling Assignments	Complete detailed drawings of points, lines, and solids manually; construct 3D models of simple solids (prisms, pyramids, cones, cylinders) using chart paper.	5	1, 2, 3	CO1, CO2, CO3	WK1, WK2, WK3, WK4	PO1, PO2, PO5
2	Sectional & Development Drawing	Prepare sectional views and develop surfaces of prisms, pyramids, cones, cylinders, showing true shape and surface development.	5	3	CO3	WK3, WK4, WK5	PO1, PO2, PO3, PO5
3	CAD Project	Create 2D and 3D isometric projections of simple components using CAD software; submit a report with screenshots and observations.	5	4	CO4, CO5	WK4, WK5, WK6	PO1, PO2, PO3, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Clear, in-depth, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	60%
Learning Activity (Self Learning, Drawing Sheet, Assignments, Module Test, Tutorials)	50 %
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	40%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Projection of Points, Lines & Planes	12	10						10
2	Projection of Solids	10			10				10
3	Section and Development of Solids	11			10				10
4	Isometric & CAD	12	10						10
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		1			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (Including Choice)	8	10	4 x 10	40
TOTAL MARKS					40

Course Code	Course Name					Credits
J1EST205	ENGINEERING ENTREPRENEURSHIP AND IPR					2
Regulation	2026	L: T:P:H:S	2:0:0: 0:3	Notional Learning Hours/Semester		60
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))						
Course Type	TC	Course delivery Mode				Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks		Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil					

COURSE OBJECTIVE

1	Introduce the concepts of innovation, creativity, and entrepreneurship in the context of engineering applications, helping students understand how ideas evolve into viable ventures.
2	Develop the ability to identify real-world engineering problems and apply structured frameworks such as design thinking, problem-solution canvas, and Lean Canvas to create potential business ideas.
3	Equip students with the skills to prepare a simplified business plan, covering aspects such as market analysis, customer validation, financial feasibility, and prototype development.
4	Provide a fundamental understanding of Intellectual Property Rights (IPR) and their application in protecting and commercializing engineering innovations within the start-up ecosystem.

COURSE OUTCOMES

Upon successful completion of this course, students will be able to:		Blooms Level
1	Describe the principles of innovation, ideation, and entrepreneurship, and relate them to the process of developing engineering-based start-ups.	K2
2	Identify real-world problems and apply structured approaches such as design thinking and Lean Canvas to generate feasible business ideas.	K3
3	Develop a simplified business plan integrating customer validation, market strategy, and prototype planning.	K4
4	Apply the concepts and legal procedures of Intellectual Property Rights (IPR) to safeguard and commercialize innovative engineering solutions.	K3
5	Demonstrate teamwork, entrepreneurial communication, and creativity through SLA and term evaluation activities such as pitch decks and prototype concepts.	K4

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	–	–	–	–	–	3	3	2	2	1	–	–	–	–	1	–	3	2	–
2	2	3	3	2	2	–	–	–	–	3	3	3	2	2	1	–	–	2	–	–	3	3	2
3	2	3	3	2	2	–	–	–	–	3	3	3	2	3	1	–	2	2	2	–	3	3	3
4	2	3	3	2	3	–	–	–	–	3	3	3	3	3	2	1	2	2	2	1	2	3	2
5	3	3	2	2	3	2	–	–	2	2	2	3	3	3	2	3	3	3	3	2	2	2	3

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

SYLLABUS

Module	Title	Topics	Hours
1	Ideation, Innovation & Entrepreneurial Foundation	Introduction to ideation and innovation – concepts, need and importance; design thinking process; types and stages of entrepreneurship; characteristics of successful entrepreneurs; startup ecosystem in India – Startup India, MSME, incubation centers; fundamentals of Intellectual Property Rights (IPR) – patents, trademarks, copyrights, and designs; significance of IPR in engineering and technology ventures.	7
2	Problem Identification and Business Model Design	Problem and solution canvas; identification of real-world problems; customer discovery and need assessment; market segmentation and validation; Lean Canvas and value proposition design; competitor analysis and differentiation strategy; legal and ethical considerations in entrepreneurship.	7
3	Business Plan and Prototype Planning	Elements of a business plan – market analysis, product/service description, operational plan, marketing and financial strategy; Minimum Viable Product (MVP) concept; prototype requirement analysis and development approach; project scheduling and resource planning; risk management and documentation; pitch deck preparation and presentation skills.	8
4	IPR for Innovation and Commercialization	Overview of intellectual property laws; patent filing procedures (Indian and international); patentability criteria and prior art search; copyright and industrial design rights; trademark registration and trade secrets; technology transfer and licensing; commercialization strategies; case studies of Indian startups utilizing IPR; emerging IPR issues in digital and AI-based innovations.	8

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL NO	Name of Book	Name of Author/s	Publisher	Year
1.	Innovation and Entrepreneurship for Engineers	Bharat Bhushan & Seema Bhushan	CRC Press	2016
2	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley	2010
3	The Startup Owner's Manual	Steve Blank & Bob Dorf	Wiley	2020
4	Indian Patent Law	P. Narayanan	Eastern Book Company	2020

REFERENCE

SL NO	Name of Book	Name of Author/s	Publisher	Year
1	Intellectual Property Rights: In the Digital Age	Prabuddha Ganguli	Tata McGraw Hill	2021
2	Start with Why	Simon Sinek	Penguin	2011
3	The Innovator's DNA	Clayton M. Christensen & Jeffrey H. Dyer	Harvard Business Review Press	2019
4	The Startup India Manifesto: A Guide to the Indian Startup Ecosystem	Rashmi Bansal & Deepinder Goyal	Westland Publications	2020

VIDEO LINKS

1	Entrepreneurship - https://nptel.ac.in/courses/110106141
2	Intellectual Property - https://onlinecourses.nptel.ac.in/noc22_hs59
3	Business Fundamentals for Entrepreneurs - https://onlinecourses.nptel.ac.in/noc25_mg13
4	Innovation, Business Models and Entrepreneurship - https://nptel.ac.in/courses/110107094

VIRTUAL LAB/SIMULATION TOOLS

1	I2E (Idea to Execution) Startup Simulation Tool - Interactive business simulation used in management and entrepreneurship education. Allows students to experience business model design, pricing, funding, and growth strategies in a virtual environment.
2	IP India – Patent Search and Filing Portal (Government of India) - Official Indian Patent Office platform for prior art search, patent filing, and IP management. Enables students to explore patent databases, file provisional applications, and understand the IPR process workflow.
3	BMC Simulator (Business Model Canvas Simulation Tool) -Digital tool to practice Business Model Canvas creation, mapping customer segments, value propositions, and revenue streams. Enables collaborative innovation exercises for project-based learning.

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
1. Foundations of Innovation and Entrepreneurship (7 hours)	Part 1	Introduction to Entrepreneurship	Definition, scope, and significance of entrepreneurship; evolution of entrepreneurship in engineering; characteristics and competencies of successful entrepreneurs.	2
	Part 2	Innovation and Creativity	Concept and importance of innovation; types of innovation (incremental, disruptive, process, and product); creativity techniques; fostering innovation among engineers.	2
	Part 3	Design Thinking and Ideation	Stages of design thinking—empathize, define, ideate, prototype, test; idea generation and selection methods; creative problem-solving.	2
	Part 4	Startup Ecosystem in India	Overview of Startup India, MSME, and Make in India initiatives; incubation centers, accelerators, and funding opportunities; role of government and private sectors in promoting startups.	1
2. Opportunity Identification and Business Modelling (7 hours)	Part 1	Problem Identification and Validation	Identifying engineering and societal problems; converting challenges into opportunities; defining and validating problem-solution fit through user feedback and field studies.	2
	Part 2	Market Research and Customer Profiling	Conducting market research; market segmentation, targeting, and positioning; customer persona creation; data collection and validation using survey tools.	2
	Part 3	Business Model Canvas (BMC)	Key components of BMC – customer segments, value propositions, key partners, resources, channels, and revenue streams; comparison with Lean Canvas approach.	2
	Part 4	Competitor and Industry Analysis	Understanding competitors and industry trends; SWOT analysis, Porter's five forces; developing differentiation and positioning strategies.	1
3. Business Planning and Prototype Development (8 hours)	Part 1	Business Plan Preparation	Framework and importance of a business plan; structure – executive summary, business objectives, marketing, operational, and financial plans.	2
	Part 2	Prototype Planning and Development	Concept of Minimum Viable Product (MVP); prototype design stages; tools and techniques for rapid prototyping; iterative testing and validation.	2
	Part 3	Financial and Resource Planning	Cost estimation, budgeting, and resource allocation; funding sources – bootstrapping, venture capital, crowdfunding; preparing financial projections.	2
	Part 4	Risk Management and Pitching	Risk identification and mitigation; crafting effective pitch decks; investor communication and presentation skills; storytelling in entrepreneurial pitches.	2

4. Intellectual Property Rights (IPR) and Commercialization (8 hours)	Part 1	Introduction to IPR	Overview and importance of Intellectual Property Rights; types – patents, copyrights, trademarks, industrial designs; role of IPR in promoting innovation and entrepreneurship.	2
	Part 2	Patent Filing and Legal Aspects	Patent system in India; criteria for patentability; process of patent filing; patent databases and prior art search; legal procedures and documentation.	2
	Part 3	Technology Transfer and IP Commercialization	IP ownership and licensing; technology transfer and commercialization models; IP valuation; protecting intellectual assets in startups.	2
	Part 4	Case Studies and Emerging Trends	Case studies of Indian IP-based startups; IPR in AI and digital technology; global IP policies, open-source innovation, and future challenges.	2

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Lean Canvas Development for a Startup Idea	Students will identify a real-world engineering or social problem and develop a Lean Canvas model covering value proposition, customer segments, channels, and revenue streams. A brief presentation of the idea and validation findings will be submitted as a report.	8 hrs	2	CO2, CO3	WK3, WK4	PO3, PO4, PO5
2	Mini Patent Search and IPR Case Study	Students will perform a prior art search using the Indian Patent Office database or Google Patents for an innovative concept. They will summarize findings and discuss the relevance of IPR to their identified product or startup idea.	7 hrs	4	CO4, CO5	WK1, WK5, WK9	PO6, PO7, PO11

RUBRICS FOR SELF LEARNING ACTIVITIES EVALUATION						
Sl.No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept / Application	Demonstrates deep understanding of entrepreneurial and IPR concepts with clear real-world linkage.	Shows good understanding and applies concepts with minor gaps.	Demonstrates basic understanding but lacks clear practical connection.	Limited understanding; weak linkage between theory and application.	No conceptual understanding demonstrated.

2	Quality of Analysis and Innovation	Highly innovative idea or approach with thorough analysis and original insights.	Good innovative approach; analysis is logical and relevant.	Moderate creativity and analysis; lacks depth.	Minimal innovation or analytical reasoning.	No innovation or critical thinking evident.
3	Use of Tools / Frameworks	Effectively uses relevant tools (e.g., Lean Canvas, patent search database) with accurate and complete data.	Appropriate use of tools with minor errors or omissions.	Partial use of tools; limited accuracy.	Incomplete or incorrect application of tools/frameworks.	No use of relevant tools or methods.
4	Documentation and Presentation	Clear, professional documentation and presentation with visuals and well-structured content.	Good structure; minor errors in formatting or clarity.	Adequate presentation; lacks strong organization or clarity.	Poor structure; weak visual or written presentation.	Unorganized or incomplete submission.
5	Engagement and Effort	Demonstrates exceptional initiative, teamwork, and consistent engagement throughout SLA.	Shows good effort and engagement with minor lapses.	Moderate effort; limited team participation.	Minimal participation or incomplete effort.	No effort or engagement demonstrated.

(AUTONOMOUS)

RUBRICS FOR TERM WORK EVALUATION						
Sl.No.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Quality of Business Plan / Report	Business plan is comprehensive, logically structured, and clearly communicates objectives, strategy, and feasibility.	Plan is well-structured with minor gaps in detail or analysis.	Plan covers main points but lacks depth and clarity in certain areas.	Limited scope or incomplete sections; poor analysis.	Lacks structure, detail, or coherence.
2	Innovation and Practical Feasibility	Demonstrates a highly innovative idea that is technically and commercially feasible.	Innovative and relevant, but minor gaps in practicality.	Moderate innovation; feasibility is partially addressed.	Weak innovation or limited feasibility assessment.	No innovative or feasible aspect identified.

3	Prototype / Pitch Deck Design	Prototype or pitch deck is visually clear, well-organized, and effectively communicates technical and business value.	Clear and informative presentation with minor design flaws.	Adequate presentation but lacks strong clarity or structure.	Poorly organized pitch; unclear concept communication.	Incomplete or missing prototype/presentation.
4	Team Collaboration and Role Distribution	Excellent teamwork with clear roles, mutual coordination, and equal participation throughout the activity.	Good teamwork; minor role imbalance.	Fair participation with some coordination issues.	Weak collaboration or unequal workload distribution.	No evidence of teamwork or coordination.
5	Communication and Presentation Skills	Outstanding verbal and visual communication; confident, engaging, and professional delivery.	Clear and confident presentation with minor issues.	Adequate communication; needs improvement in clarity or flow.	Unclear delivery; lacks confidence and organization.	Poor communication; unstructured and unengaging

TERM WORK ACTIVITIES (15 Hrs)

Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Preparation of a Comprehensive Business Plan	Students will prepare a concise business plan for an innovative engineering startup idea. The plan should include executive summary, product/service description, market analysis, operations plan, and financial overview.	8 hrs	3	CO3, CO5	WK2, WK3, WK4	PO3, PO4, PO5
2	Prototype Concept / Pitch Deck Presentation	Teams will design a prototype concept or MVP (conceptual model) and present it through a structured pitch deck. Evaluation based on innovation, feasibility, presentation quality, and teamwork.	6 hrs	3,4	CO3, CO4, CO5	WK3, WK6, WK9	PO6, PO8, PO10

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	40%
Learning Activity (Self Learning, Term Work, Assignments, Module Test, Tutorials)	40 %
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	60%
Total	100 %

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Foundations of Innovation and Entrepreneurship	7	5	10					15
2	Opportunity Identification and Business Modelling	7	5	5	5				15
3	Business Planning and Prototype Development	8	2	4	4	5			15
4	Intellectual Property Rights (IPR) and Commercialization	8	5	5	5				15
This shall be treated as a general guideline for students and teachers for distribution of marks.									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					60

Course Code	Course Name				Credits
J1HWP126	HEALTH AND WELLNESS				1
Regulation	2026	L: T:P:H:S	1:0:1: 0:2	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode			Theory & practical
Scheme of Evaluation		CIE:100 Marks	ESE: 0 Marks	Total Marks:100	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To provide essential knowledge on physical activity, health, and wellness. To ensure students understand body systems, exercise principles, nutrition, mental health, and disease management.
2	To educate students on the benefits of yoga, the risks of substance abuse and basic first aid skills. To equip students with the ability to lead healthier lifestyles.
3	To enable students to design effective and personalized exercise programs.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the FITT principle to design a basic exercise programme by relating the functions of the respiratory, cardiovascular, and musculoskeletal systems to the components of health-related physical fitness and appropriate exercise intensity levels.	K3
2	Apply principles of balanced nutrition and wellness to evaluate dietary choices and recommend appropriate lifestyle modifications for improving physical and mental health.	K3
3	Apply yogic practices and lifestyle management strategies to prevent and manage common hypokinetic diseases and musculoskeletal disorders, and assess the health consequences of psychoactive substance abuse.	K3
4	Describe first aid procedures, including primary survey, CPR, and the Heimlich maneuver, to manage common sports injuries and medical emergencies effectively.	K2

COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1		2	2	-	-	-	-	-	-	-	2	1	-	-	-	2	1	-	1	1			
2	-	1	2	2	-	-	2	-	1	-	1	2	2	-	-	3	2	2	2	2			
3	1	1	2	-	-	-	2	-	2	1	1	1	-	-	-	3	2	3	1	1			
4	2	-	2	1	-	2	2	-	1	-	1	1	1	-	1	3	-	2	2	2			
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”2																							

SYLLABUS			
Module	Title	Topics	Hours
1	Introduction to Physical Activity and Body Systems	Introduction of the importance of physical activity in daily life. Human Body Systems related to Physical activity and its functions: Respiratory System - Cardiovascular System. Musculoskeletal System and the Major Muscle groups of the HumanBody. Quantifying Physical Activity Energy Expenditure and Metabolicequivalent of task (MET) Exercise Continuum: Light-intensity physical activity, Moderate -intensity physical activity, Vigorous -intensity physical activity. Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme Components of Health-related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	5
2	Health, Wellness, and Nutrition	Concept of Health and Wellness: Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health. Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet, Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	3
3	Yoga, Lifestyle Diseases, and Substance Abuse	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes Osteoporosis, Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis, flat foot, Knock knee) Meaning, Aims and objectives of yoga - Classification and importance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis -Sedative - Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	4
4	First Aid and Sports Injuries	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)	3

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL. NO	Name of Book	Name of Author/s	Publisher	Year
1.	Foundations of Nutrition	Bhavana Sabarwal	Commonwealth Publishers	1999
2	Anatomy and physiology in health and illness.	Ross and Wilson	Waugh, A., & Grant, A.	2022

REFERENCE

SL. NO	Name of Book	Name of Author/s	Publisher	Year
1	Fit to be Well Essential Concept	Thygerson, A. L., Thygerson, S. M., & Thygerson, J. S.	Jones & Bartlett Learning.	2018
2	Introduction to physical education, fitness, and sport.	Siedentop, D., & Van der Mars, H.	Human kinetics.	2022
3	Substance Use Disorders. Manual for Physicians.	Lal, R., & Ambekar, A. (2005).	National Drug Dependence Treatment Centre, New Delhi	2005
4	The exercise health connection-how to reduce your risk of disease and other illnesses by making exercise your medicine.	Nieman, D. C., & White, J. A	Public Health	1998
5	ACSM's resource manual for guidelines for exercise testing and prescription.	Lippincott Williams & Wilkins.	American College of Sports Medicine.	2012
6	Exercise Physiology: energy, nutrition and human performance.	Katch, F. I., Katch, V. L., & McArdle, W. D.	Lippincott Williams & Wilkins	2010

VIDEO LINKS

1	https://youtu.be/GdyGcPCl5cs?si=LYHNNxDt1D7p4lpq
2	https://youtu.be/Zlk2BvPtySo?si=-2rCDuIwiUanCcM4

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
1. Introduction to Physical activity and Body systems (5 Hrs)	Part 1	Introduction to Physical activity	Major benefits of physical activity, Essential measures before and after exercise	1
	Part 2	Respiratory system and vital exercise performance	Anatomy and Physiology of the respiratory system, Vital exercise for respiratory health	1
	Part 3	Cardiovascular system and Exercise	Anatomy and Physiology of Cardiovascular system, Cardiovascular health and Exercise.	1
	Part 4	Musculoskeletal system and Exercise	Anatomy and physiology Musculoskeletal system, Musculoskeletal system and Exercise	1
	Part 5	FITT principle to design an Exercise programme	Components of Health-related Physical Fitness: - Cardiorespiratory Fitness- Muscular strength- Muscular endurance- Flexibility- Body composition.	1
2. Concept of Health and Wellness (3 Hrs)	Part 1	Concept of health and wellness	Health and wellness differentiation, Factors affecting health and wellness. Mental health and Factors affecting mental health.	1
	Part 2	Human welfare and sports, Concept of balanced Diet	Sports and Socialization: Sports and character building - Leadership through Physical Activity and Sports Diet and nutrition: Exploring Micro and Macronutrients: Concept of Balanced diet	1
	Part 3	Different Dietary options and essential Vitamins and minerals	Carbohydrate & the Glycemic Index Animal & Plant - based Proteins and their Effects on Human Health Dietary Fats & their Effects on Human Health Essential Vitamins and Minerals	1
3. Yoga and Substance abuse (4 Hrs)	Part 1	lifestyle management through Yoga	Lifestyle management strategies to prevent / manage common hypokinetic diseases and disorders - Obesity - cardiovascular diseases (e.g., coronary artery disease, hypertension) - Diabetes - Osteoporosis - Musculoskeletal disorders (e.g., osteoarthritis, Low back pain, Kyphosis, lordosis, flat foot, Knock knee)	2
	Part 2	Yoga - Meaning, Aim and objectives	Meaning, Aims and objectives of yoga - Classification and importance of of Yogic Asanas (Sitting, Standing, lying) Pranayama and Its Types - Active Lifestyle and Stress Management Through Yoga	1
	Part 3	Understanding substance abuse	Understanding on substance abuse and addiction - Psychoactive substances & its ill effects- Alcohol- Opioids- Cannabis - Sedative - Cocaine -Other stimulants, including caffeine -Hallucinogens - Tobacco -Volatile solvents.	1

4.First aid and sports injuries (3 Hrs)	Part 1	First Aid	First aid and principles of First Aid: Primary survey: ABC (Airway, Breathing, Circulation). Qualities of a Good First Aider	1
	Part 2	Different first aid measures	First aid measures for: - Cuts and scrapes - Bruises - Sprains - Strains - Fractures - Burns - Nosebleeds. First Aid Procedures: Cardiopulmonary Resuscitation (CPR) - Heimlich Maneuver - Applying a sling	1
	Part 3	Sports injuries: Classification	Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain	1

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. NO	Activity	Description	Time	Module	CO	WK	PO
1	NPTEL video analysis and submission of case study	Submission of a case study in the topic of Exercise in children and adolescents or Role of Exercise in disease management	6	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
2	Dietary Analysis and Nutrition Journal	Maintain a 7-day food diary and analyze macronutrient and micronutrient intake using online tools; submit a written report on dietary habits and suggested improvements.	6	2	CO2	WK4, WK6	PO1, PO6, PO8
3	Yoga and Mindfulness Practice Log	Practice a set of yogic asanas and pranayama regularly for 4 weeks; maintain a reflective journal documenting postures practiced, duration, and health benefits observed.	6	3	CO3	WK3, WK6	PO6, PO7, PO8
4	First Aid Scenario Simulation Report	Study and document appropriate responses to 5 first-aid emergency scenarios including CPR, choking, fractures, burns, and bleeding; prepare a structured emergency response guide.	6	4	CO4	WK2, WK5	PO6, PO9
5	Personal Fitness Assessment and Exercise Program Design	Measure individual fitness components (resting heart rate, flexibility, muscular endurance); evaluate results against norms and design a 6-week personalized exercise program using FITT principles.	6	1	CO1	WK1, WK3	PO1, PO2, PO9

TERM WORK ACTIVITIES (15 Hrs)							
Sl.NO	Activity	Description	Time	Module	CO	WK	PO
1	Physical Fitness Testing and Report	Conduct standard fitness tests (sit-and-reach, push-up test, 3-minute step test); record results, compare against age-based norms, and submit a written fitness report with recommendations.	5	1	CO1	WK2 , WK4	PO4, PO9
2	Yoga Asana and Pranayama Demonstration	Demonstrate a sequence of 5 yogic asanas (one from each category: sitting, standing, lying) and one pranayama technique; explain the health benefits of each posture demonstrated.	5	3	CO3	WK3 , WK6	PO6, PO9
3	First Aid and CPR Practical Demonstration	Demonstrate the primary survey (ABC), CPR on a training manikin, Heimlich maneuver, wound dressing for cuts and burns, and application of a sling; assessed by instructor using a standardized checklist.	5	4	CO4	WK2 , WK5	PO6, PO9

RUBRICS FOR TERM WORK EVALUATION						
Sl.N O.	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Subject Knowledge and Accuracy	Demonstrates thorough and accurate understanding of all concepts with no errors.	Shows good understanding with only minor errors.	Shows adequate understanding with some conceptual errors.	Shows limited understanding with several notable errors.	Little or no understanding of the subject evident.
2	Practical Skill Performance	Demonstrates all required practical skills correctly and with confidence.	Performs most practical skills correctly with minor lapses.	Performs skills adequately but with noticeable inconsistencies.	Struggles with most practical skills; requires repeated guidance.	Unable to perform practical skills correctly.
3	Record Report Quality	Comprehensive, well-organized report with thorough data analysis and clear conclusions.	Clear, well-structured report with adequate detail and logical conclusions.	Satisfactory report with basic information but limited analysis.	Incomplete report with minimal information and poor structure.	Very poor or no report submitted.

4	Participation and Engagement	Consistently active and enthusiastic participation in all practical activities.	Regular participation with only occasional lapses in engagement.	Participates adequately when required; moderate engagement.	Rarely participates; frequently needs encouragement from instructor.	Does not participate in activities even when prompted.
5	Attendance and Punctuality	Attends all practical sessions on time with no absences.	Attends most sessions; rarely late with no unexcused absences.	Acceptable attendance with a few minor absences or instances of tardiness.	Poor attendance; frequently absent or consistently late.	Very poor attendance; misses most practical sessions.

ASSESSMENT PATTERN	
Assessment	Weightage
Attendance	10 %
Case Study/Micro project/Presentation	40 %
Activity evaluation	50 %
Total	100 Marks

Course Code	Course Name				Credits
JIMET207	MATERIAL SCIENCE AND ENGINEERING				3
Regulation	2026	L: T:P:H:S	2:1:0: 0:3.5	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Engineering Physics, Engineering Chemistry, Engineering Mechanics				

COURSE OBJECTIVE	
1	To understand the structure, bonding, and crystal geometry of engineering materials and their influence on mechanical, thermal, and electrical properties.
2	To study crystal imperfections, diffusion, phase diagrams, and heat treatment processes for controlling material microstructure and performance.
3	To analyze mechanical behaviour and failure mechanisms such as fatigue, creep, and fracture, and to explore various strengthening methods.
4	To familiarize with modern and sustainable materials including polymers, ceramics, composites, and nanomaterials for advanced engineering applications.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the structure, bonding, and crystallography of engineering materials and their influence on properties.	K2
2	Interpret and analyse microstructures using phase diagrams and diffusion principles.	K3
3	Apply heat treatment and strengthening mechanisms to improve material performance.	K3
4	Evaluate mechanical behaviour and failure mechanisms such as fatigue, creep, and fracture.	K4
5	Identify and compare modern materials including composites, ceramics, polymers, and nanomaterials for industrial applications.	K3

COURSE ARTICULATION MATRIX

CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	—	—	—	—	—	3	2	2	—	—	—	—	—	—	—	—	3	2	—
2	2	3	3	3	2	—	—	—	—	2	3	3	2	—	—	—	—	—	—	—	3	3	2
3	2	3	3	2	2	—	—	—	—	2	3	3	2	2	—	—	—	—	—	—	3	3	2
4	2	3	3	3	2	2	—	—	—	2	3	3	3	2	2	—	—	—	2	—	2	3	3
5	3	3	2	2	2	2	3	—	2	3	2	3	2	3	3	3	2	2	3	2	2	3	3

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”

SYLLABUS

Module	Title	Topics	Hours
1	Atomic Structure and Crystallography	Structure of atoms – Primary and secondary bonding – Correlation between bonding and material properties – Crystal structures: SC, BCC, FCC, HCP; coordination number and atomic packing factor – Miller indices, planes and directions – Crystal systems and lattices – Slip and twinning – Schmid’s law and critical resolved shear stress – Grain size and Hall–Petch relation – Introduction to amorphous and nanocrystalline materials.	11
2	Crystal Imperfections, Diffusion and Material Characterization	Types of crystal imperfections – point, line, and surface defects – Burgers vector, dislocation motion, dislocation density – Strengthening mechanisms via dislocation interactions – Diffusion in solids: Fick’s laws, diffusion mechanisms, temperature dependence, and applications – Metallographic specimen preparation and etching – X-ray diffraction, SEM, and TEM – Structure–property correlation in metals.	11
3	Phase Diagrams and Heat Treatment	Alloy formation and solid solutions – Hume–Rothery rules – Binary phase diagrams: isomorphous, eutectic, peritectic systems – Iron–Carbon equilibrium diagram: microstructure and properties – Phase transformations and TTT/CCT diagrams – Heat treatment processes: annealing, normalizing, hardening, tempering, spheroidizing, case hardening – Surface hardening techniques (carburizing, nitriding, induction, flame) – Hardenability and Jominy end-quench test.	11
4	Mechanical Behavior and Modern Engineering Materials	Stress–strain behaviour of materials – Elastic and plastic deformation – Strengthening mechanisms: work hardening, solid solution, precipitation, grain size – Fracture: ductile and brittle, fracture toughness – Fatigue: S–N curve, factors affecting fatigue life – Creep: stages and prevention – Ferrous and non-ferrous alloys (steel, cast iron, aluminium, copper, titanium) – Polymers, ceramics, composites, superalloys, maraging steels, shape-memory alloys, nanomaterials – Sustainable and recyclable materials for modern engineering applications.	12

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL. No	Name of Book	Name of Author/s	Publisher	Year
1.	Materials Science and Engineering: An Introduction	William D. Callister & David G. Rethwisch	Wiley	2020
2	Introduction to Physical Metallurgy	S. H. Avner	McGraw Hill Education	2019
3	Engineering Metallurgy, Part I – Applied Physical Metallurgy	R. A. Higgins	Elsevier/ELBS	2018

REFERENCE

Sl. No	Name of Book	Name of Author/s	Publisher	Year
1	Mechanical Metallurgy	George E. Dieter	Tata McGraw Hill	2017
2	Physical Metallurgy Principles	Robert E. Reed-Hill & Reza Abbas Chian	Cengage Learning	2018
3	Materials Science and Engineering	V. Raghavan	Prentice Hall India	2016
4	Mechanical Behavior of Materials	Marc A. Meyers & Krishan K. Chawla	Cambridge University Press	2020
5	Elements of Materials Science and Engineering	Lawrence H. Van Vlack	Pearson Education	2014

VIDEO LINKS

1	Introduction to materials science and engineering https://nptel.ac.in/courses/113102080
2	Materials Science and Engineering https://onlinecourses.nptel.ac.in/noc24_mm12
3	Phase Diagrams in Materials Science and Engineering https://onlinecourses.nptel.ac.in/noc25_mm25

VIRTUAL LAB/SIMULATION TOOLS

1	Virtual Metallography Lab (NPTEL / IIT Bombay) -Online simulation tools to study metallographic specimen preparation, polishing, etching, and microstructure observation for steels, cast irons, and non-ferrous alloys.
2	ANSYS / Abaqus (FEA Tools) - Finite Element Analysis (FEA) software for modelling and simulating mechanical behaviour of metals under various loading conditions — includes stress–strain analysis, deformation, and failure prediction.
3	JMatPro / Thermo-Calc (Phase Diagram Simulation Tools) -Used for simulating phase equilibria, solidification behavior, and thermophysical properties of alloys and materials. Enables visualization of Fe–C and multicomponent phase diagrams.

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
1: Atomic Structure and Crystallography (15 Hrs)	Part 1	Atomic Structure and Bonding	Structure of atoms – Primary and secondary bonding – Correlation between bonding and material properties – Significance of metallic, ionic, and covalent bonds.	3
	Part 2	Crystallography and Crystal Systems	Crystal structures: SC, BCC, FCC, HCP – Coordination number and atomic packing factor – Miller indices, planes and directions – Crystal systems and lattices.	3
	Part 3	Deformation and Grain Effects	Slip and twinning – Schmid's law and critical resolved shear stress – Grain size and Hall-Petch relation – Effect of grain size and boundaries on properties.	3
	Part 4	Advanced Structures	Introduction to amorphous, nanocrystalline, and crystalline materials – Structure–property relationship.	2
2: Crystal Imperfections, Diffusion and Material Characterization (15 Hrs)	Part 1	Crystal Imperfections	Types of crystal imperfections – Point, line, and surface defects – Burgers vector, dislocation motion, dislocation density.	3
	Part 2	Diffusion in Solids	Diffusion mechanisms – Fick's laws, temperature dependence – Applications of diffusion in engineering materials.	3
	Part 3	Strengthening and Defect Interaction	Strengthening mechanisms via dislocation interactions – Role of grain boundaries and solid solution strengthening.	3
	Part 4	Material Characterization	Metallographic specimen preparation and etching – XRD, SEM, TEM – Structure–property correlation in metals.	2
3: Phase Diagrams and Heat Treatment (15 Hrs)	Part 1	Alloy Formation and Phase Diagrams	Alloy formation and solid solutions – Hume-Rothery rules – Binary phase diagrams: isomorphous, eutectic, peritectic systems.	3
	Part 2	Iron–Carbon System	Iron–Carbon equilibrium diagram: microstructure and properties – Significance of austenite, ferrite, cementite, pearlite, and martensite.	3
	Part 3	Phase Transformations and Heat Treatment	Phase transformations and TTT/CCT diagrams – Heat treatment processes: annealing, normalizing, hardening, tempering, spheroidizing, case hardening.	3
	Part 4	Surface Modification	Surface hardening techniques (carburizing, nitriding, induction, flame) – Hardenability and Jominy end-quench test.	2
4: Mechanical Behavior and Modern	Part 1	Mechanical Behavior	Stress–strain behavior of materials – Elastic and plastic deformation – Fracture: ductile and brittle, fracture toughness.	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Research Paper Review	Review a recent research paper (from Elsevier/ Springer/ ScienceDirect) related to alloy development, nanomaterials, or heat treatment. Prepare a one-page summary on objectives, methodology, and findings.	8	2,3	CO2, CO3	WK2, WK4	PO2, PO4
2	Industrial Visit	Visit a metallurgical, foundry, or materials testing industry to understand real-time processes like casting, forging, or heat treatment. Submit a report highlighting key observations and technologies used.	10	3,4	CO3, CO4	WK4, WK6	PO4, PO6
3	Case Studies on Material Applications	Analyze 2–3 engineering case studies involving material selection (e.g., aerospace alloys, automotive steels, composites). Discuss reasons for selection and performance.	6	1,4	CO1, CO5	WK3, WK5	PO3, PO5
4	Report on Recyclability & Sustainability	Prepare a report on the recycling and sustainability of metals, polymers, or composites in modern industries. Highlight challenges and eco-friendly practices.	6	4	CO5	WK7	PO7, PO11

RUBRICS FOR SELF LEARNING ACTIVITIES EVALUATION							
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Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Relevance and Depth of Study	Demonstrates excellent understanding of the topic with in-depth analysis and strong linkage to material science concepts.	Shows good understanding with relevant content and moderate analysis.	Basic content coverage; limited analytical depth.	Minimal relevance or shallow discussion of topic.	Content irrelevant or copied; lacks understanding.
2	Application and Innovation	Applies knowledge creatively to real-world or industrial contexts; demonstrates originality.	Shows good application of theory with some innovative ideas.	Demonstrates basic understanding with limited application.	Minimal application of theoretical knowledge.	No attempt to apply theory; purely descriptive.
3	Report Quality and Documentation	Report is well-structured, formatted, and error-free; includes references and clear conclusions.	Report organized with minor errors; adequate referencing.	Report satisfactory but lacks clarity or detail in some areas.	Report incomplete or poorly formatted; missing references.	Report missing, disorganized, or plagiarized.
4	Presentation and Communication Skills	Presents findings confidently and clearly with logical flow and visual support.	Communicates ideas effectively with minor gaps.	Communicates basic information with some difficulty.	Lacks clarity, organization, or confidence in presentation.	No presentation or unable to communicate ideas.
5	Self-Initiative and Reflection	Shows high self-motivation, initiative, and critical reflection on learning outcomes.	Demonstrates good effort and self-learning attitude.	Displays moderate initiative and reflection.	Minimal self-effort or reliance on guidance.	No evidence of self-effort or reflection.

TERM WORK ACTIVITIES (15 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Preparation of Metallographic Specimen	Polishing, etching, and observing microstructures of mild steel, brass, and cast iron using an optical microscope.	4	II	CO2	WK4	PO1, PO4, PO5
2	Heat Treatment Experiments	Perform annealing, normalizing, hardening, and tempering on steel specimens. Study hardness variations and microstructural changes.	5	III	CO3	WK4	PO1, PO4, PO5
3	Jominy End Quench Test (Hardenability Test)	Conduct hardenability testing and plot hardness vs. distance curve. Discuss results based on cooling rates and microstructure.	3	III	CO3	WK4	PO4, PO5
4	Mini Case Study on Material Failure	Analyze a failed component (gear, shaft, or beam). Identify cause of failure (fatigue, creep, or fracture) and suggest preventive measures.	3	IV	CO4	WK2	PO2, PO3, PO6

RUBRICS FOR TERM WORK EVALUATION

Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept / Theory	Demonstrates deep understanding of underlying concepts; connects theory to application effectively.	Shows good conceptual clarity with minor gaps.	Basic understanding of concepts; occasional confusion.	Limited conceptual understanding; difficulty in applying theory.	Lacks understanding of basic concepts.
2	Practical / Experimental Skills	Performs experiments systematically with accuracy and safety; records and interprets data correctly.	Executes experiments with good precision and minimal errors.	Completes experiments with assistance; acceptable accuracy.	Frequent errors or needs guidance in execution.	Unable to perform experiments independently.
3	Data Analysis and Interpretation	Analyzes results logically; correlates outcomes with theory; presents graphs and calculations accurately.	Analyzes and interprets data with few inconsistencies.	Partial or basic data analysis with limited interpretation.	Data analysis incomplete or inaccurate.	No attempt or incorrect data analysis.

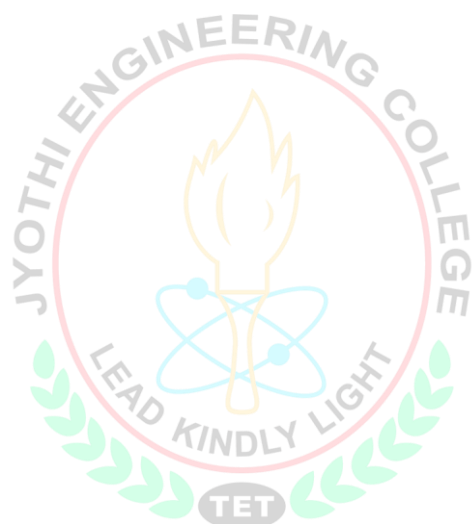
Assessment	
Internal	Term Work, Assignments, Module Test,
Total	

Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Mark
			R	U	A	An	E	C	
1	Atomic Structure and Crystallography	11	4	7					11
2	Crystal Imperfections, Diffusion and Material Characterization	11	2	5	4				11
3	Phase Diagrams and Heat Treatment	11	2	5	4				11
4	Mechanical Behavior and Modern Engineering Materials	12	2	2	3	5			12

This shall be treated as a general guideline for students and teachers for distribution of marks.

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN

No: of Sections in the Question paper		2			
Part	No. of Questions/Module	Total No. of Questions	Max. marks/ Question	Part Summary	Total Marks
A	2 (No choice)	8	3	8 x 3	24
B	2 (Including Choice)	8	9	4 x 9	36
TOTAL MARKS					60



(AUTONOMOUS)
 CREATING TECHNOLOGY
 LEADERS OF TOMORROW
 ESTD 2002

Course Code	Course Name					Credits
J1ESL127	ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP					1
Regulation	2026	L: T:P:H:S	0:0:2: 0:1	Notional Learning Hours		30
<i>(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))</i>						
Course Type	PL	Course delivery Mode			Practical	
Scheme of Evaluation		CIE: 100 Marks		ESE: 0	Maximum:100 Marks	
Pre-requisite	NIL					

COURSE OBJECTIVE	
1	Familiarize students with electrical safety practices, wiring accessories, protective devices, and the identification, symbols, and testing of basic electronic components.
2	Develop hands-on skills in domestic wiring, electrical measurement, earthing, battery handling, soldering, and PCB fabrication.
3	Apply circuit-assembly and EDA-tool techniques to construct, test, and analyse simple electrical and electronic circuits.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Demonstrate electrical safety procedures and identify cables, switches, fuses, and protective devices (MCB, ELCB, MCCB) with their ratings.	K3
2	Make use of protective devices, batteries, and earthing schemes by identifying their specifications and power-distribution arrangements.	K3
3	Construct domestic wiring circuits and measure electrical quantities using rheostats, transformers, and a CRO.	K3
4	Identify electronic components and interpret circuit diagrams and datasheets using BIS/IEEE symbols.	K3
5	Apply testing instruments and tools to test resistors, capacitors, diodes, transistors, and JFETs.	K3
6	Construct and test electronic circuits on PCB/breadboard using soldering, SMT, and EDA tools.	K4

COURSE ARTICULATION MATRIX																							
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes													
	WK									PO											PSO		
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	1	-	-	-	-	2	1	1	-	2	1	1	2	2	2	-	1	-	-	1	2	1	2
2	1	-	-	-	1	2	1	1	-	2	1	1	2	2	2	-	1	-	-	1	3	1	2
3	1	2	-	-	-	2	-	1	-	2	2	1	2	3	1	-	1	-	-	1	3	2	1
4	1	-	-	-	-	2	-	1	-	2	1	1	2	2	-	-	1	1	-	1	2	2	1
5	1	2	-	-	-	2	-	2	-	2	2	1	2	3	-	-	1	-	-	1	2	3	1
6	1	-	-	-	-	2	-	2	-	2	2	2	2	3	-	-	2	1	-	2	2	3	2
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																							

Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"

SYLLABUS			
Module	Title	Topics	Hours
1	Electrical Safety and Wiring	Precautionary steps for electrical shocks, identification of cables, switches, fuses, MCB, ELCB, MCCB, wiring circuits (single lamp, two lamps, two-way switches, power distribution), transformer operation, voltage measurement using CRO	7
2	Electrical Measurement, Battery and Earthing Systems	Familiarisation of rheostats, measurement of potential across resistance elements, relative potential in DC circuits. Battery specifications (Lead acid, Li Ion, NiCd), types of earthing and ground enhancing materials	8
3	Basic Electronics and Circuit Fundamentals	Electronics Component Familiarisation: Identification, symbols, color coding, packaging. Circuit Diagram and Tools: Drawing electronic circuits, interpreting datasheets, using tools. Electronic Component Testing: Testing resistors, capacitors, diodes, transistors, JFET using multimeter	7
4	PCB Design, Assembly, and Advanced Techniques	PCB and Soldering Techniques: Types, design, fabrication, soldering, crimping. Circuit Assembly and Testing: Assembly on PCB/breadboard, use of power supply, rectifier, filters, ICs. Advanced Techniques: Surface Mount Technology, EDA tools like KiCad, Xcircuit	8

LIST OF EXPERIMENTS (36 Hours)		
Instructions - Lab experiments must be implemented on a hardware bench using standard wiring accessories, electronic components, soldering equipment and EDA tools (KiCad / Xcircuit). - Minimum 12 experiments are mandatory. - Additional experiments may be conducted as demonstrations or for advanced learning. - Students should maintain a record of the lab experiments including aim, apparatus/setup, procedure, observations, results, and inference for each experiment.		
Sl. No.	Experiment	CO
1	A) Demonstrate the precautionary steps adopted in case of Electrical shocks. B) Identify different types of cables, wires, switches, fuses, fuse carriers. C) Identify MCB, ELCB and MCCB, familiarize the ratings.	1, 2
2	Wiring a single lamp controlled by Single switch	3
3	Wiring a two-lamp controlled by two switches	3
4	Wiring of light/fan circuit using two-way switches. (Staircase wiring)	3
5	Wiring of a simple light circuit for light/ fan point (PVC conduit wiring) and a 6A plug socket with individual control.	3
6	Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter.	2, 3
7	Familiarisation of step up and step-down transformers, (use low voltage transformers) Measurement and representation of voltage and waveform to scale in graph sheet with the help of CRO	3

8	A) Familiarisation of rheostats, B) Measurement of potential across resistance elements and introducing the concept of relative potential using a DC circuit.	3
9	A) Identify battery specifications using different types of batteries. (Lead acid, Li Ion, NiCd etc.) B) Familiarize different types of earthing (Pipe, Plate Earthing, Mat Schemes) and ground enhancing materials (GEM).	2
10	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol and cost of - Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sink etc.)	4
11	Drawing of electronic circuit diagrams using BIS/IEEE symbols and Interpret data sheets of discrete components and IC's	4
12	Familiarization/Application of testing instruments and commonly used tools - (Multimeter, Function generator, Power supply, CRO, DSO, Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers, Crimping tool, Hot air soldering and de-soldering station)	5
13	Testing of electronic components using multimeter - Resistor, Capacitor, Diode, Transistor and JFET.	5
14	Familiarization of Printed circuit boards (PCB) - Types, Single sided, Double sided, PTH, Processing methods. Design and fabrication of a single sided PCB for a simple circuit.	6
15	Inter-connection methods and soldering practice. Bread board, Wrapping, Crimping, Soldering - types - selection of materials and safety precautions. Soldering practice in connectors and general-purpose PCB, Crimping	6
16	Assembling electronic circuit/system on general purpose PCB, test and show the functioning (Any two) - Fixed voltage power supply with transformer, Rectifier diode, Capacitor filter, Zener/IC regulator, square wave generation using IC 555 timer in IC base.	6
17	Assembling electronic circuits using SMT (Surface Mount Technology) stations.	6
18	Introduction to EDA tool (such as KiCad or Xcircuit)	6

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1.	Electrical Design Estimating and Costing	K B Raina and S K Bhattacharya	New Age International Publishers	2024
2	Basic Electrical Engineering	D P Kothari and I J Nagrath	Tata McGraw Hill	2019
	Basic Electronics and Linear Circuits	N N Bhargava, D C Kulshreshtha and S C Gupta	McGraw Hill	2017
REFERENCE				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Electrical Systems Design	M K Giridharan	IK International Publishing House Pvt. Ltd	2022

VIDEO LINKS	
1	https://www.youtube.com/watch?v=kGDQkbNsC9w
2	https://www.youtube.com/shorts/Epc50HsiM84
3	https://www.youtube.com/watch?v=xDLAO8ajndk
4	https://www.youtube.com/watch?v=cJkevV7l22k
5	https://www.youtube.com/watch?v=OKfzXLrvOmw&list=PLBBGwLiUvNPCVfQCxGk9halPCPSKoof-u&index=9
6	NPTEL - Basic Electronics by Prof. T. S. Natarajan, IIT Madras: https://nptel.ac.in/courses/122106025 (https://youtu.be/w8Dq8blTmSA)
7	NPTEL - Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software: https://onlinecourses.nptel.ac.in/noc25_ee163/preview (https://www.youtube.com/watch?v=HOpaW2Ungcc&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5&index=11)
8	PCB Substrate and layers: https://www.youtube.com/watch?v=itiOpVqSi0A&list=PLp6ek2hDcoNAUpqc3DUj4U5hcipc2idZ5&index=32
9	Oscilloscope: https://youtu.be/0FVzYLEDsA8
SIMULATION TOOLS	
1	Falstad Circuit Simulator: https://www.falstad.com/circuit/
2	Tinker cad Circuits: https://www.tinkercad.com/circuits
3	KiCad's SPICE: https://www.kicad.org/discover/spice/

SELF LEARNING ACTIVITIES (12 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Electrical Safety Standards	Study IS 732 wiring practices and BIS guidelines on domestic electrical safety; review case studies on electrical accident prevention.	1	1	1,2	1,7	1,6,7
2	Battery Technology Survey	Explore datasheets and emerging battery chemistries (Li-ion, NiCd, solid-state) and compare specifications, life cycle, and safe disposal practices.	1	2	2	2,8	1,4,11
3	EDA Tools Self-Study	Watch NPTEL tutorials on PCB design with KiCad/XCircuit and practise drawing a simple schematic and its PCB layout.	1	3,4	4,6	2,6,8	1,5,11

TERM WORK ACTIVITIES (12 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Battery Technology Comparison	Compare Lead Acid, Li-ion, NiMH, and NiCd batteries based on specifications, applications, advantages, and environmental impact	1	2	2	2,5,6	2,7
2	PCB Fabrication Deliverable	Fabricate and solder a single-sided PCB for a simple circuit (e.g., IC 555 astable) and verify its functioning; submit a fabrication report.	2 Hr	4	5,6	6,8	1,3,5

RUBRICS FOR TERM WORK EVALUATION							
Sl. No	Evaluation Criteria	Weight age	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehension	Good understanding; minor conceptual gaps; mostly correct application	Basic understanding; some confusion; limited application	Weak understanding; major gaps; incorrect application	No understanding; unable to explain concepts
2	Experimental /Programming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requirements	Basic execution; several errors; simple approach; partially meets requirements	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional; does not meet requirements
3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensive; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectations	Acceptable quality; some inaccuracies; basic structure; minimal expectations met	Poor quality; many inaccuracies; weak structure; below expectations	Unacceptable quality; incorrect; no proper structure

RUBRICS FOR END SEMESTER EXAMINATION

Sl. No	Criteria	Weight age	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Experimental Preparation	20%	Clear plan, correct setup, uses resources wisely	Mostly clear, few oversights	Basic preparation	Disorganized, unprepared	No attempt
2	Problem Solving/Execution	30%	Independently solves, correct methodology	Minor help, approach mostly right	Needs guidance, some mistakes	High dependency, errors	Unable to attempt
3	Output Quality	20%	Results fully correct, well interpreted	Results mostly correct	Partial correctness	Mostly incorrect	No output
4	Inference/Interpretation (Viva Voce)	20%	All results correctly interpreted, strong insights	Good understanding	Basic interpretation	Minimal/incorrect	No inference
5	Record Submission	10%	Outstanding understanding, all questions answered	Good responses, minor errors	Satisfactory, basic answers	Poor knowledge, incomplete	Does not submit

RUBRICS FOR CONTINUOUS INTERNAL ASSESSMENT

Sl. No	Evaluation Criteria	Weightage	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Preparation & Pre-lab Work	20%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understands	Partially completed, some confusion	Minimal effort, weak comprehension	No prep, unable to explain
2	Experimental/Programming Skills	20%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	10%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretation	Minimal interpretation, errors	No analysis
4	Attendance and Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted

5	Viva	10%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer
6	Internal Lab Examination	30%	Marks Scored by the student can be proportionally added to the Assessment based on the weightage.				

ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	50%
Lab Evaluation	50 %
Learning Activity (Self Learning, Term Work)	10%
Attendance	10 %
Internal Examination	30 %
Course Project	NA
End Semester Examination	40%
Total	100

