Course Code	Course Name				Credits
J1BST121	**LINEAR ALGEBRA AND CALCULUS**				**3**
Regulation	2026	L: T:P:H:S	3:0:0: 0:4.5	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	Basic knowledge in single variable calculus and matrix operations				

COURSE OBJECTIVE	
1	To introduce the foundational principles of linear algebra and calculus, including systems of linear equations, the matrix eigenvalue problem, ordinary differential equations and series representations of functions.
2	To develop analytical and problem-solving skills for evaluating multiple integrals, solving second-order differential equations and constructing Taylor and Fourier series through structured study.
3	To enable the application of linear-algebraic and calculus-based techniques to model and solve real-world engineering problems using modern computational methods.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply Gauss elimination and eigenvalue methods to solve linear systems and reduce quadratic forms to canonical form.	K3
2	Solve homogeneous and non-homogeneous second-order ordinary differential equations using the methods of undetermined coefficients and variation of parameters	K3
3	Compute areas and volumes by evaluating double and triple integrals in Cartesian, polar and cylindrical coordinate systems.	K3
4	Construct Taylor, Maclaurin and Fourier series representations of functions for engineering analysis 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	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, Quadratic forms and their canonical forms. (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 homogenous ODEs (with constant coefficients) - General solution, Particular solution by the method of undetermined coefficients (Particular solutions for the functions $ke\gamma x$, kxn, $kcos\omega x$, $ksin\omega x$, $ke\alpha xcos\omega x$, $ke\alpha xsin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE (with constant coefficients), Solution by variation of parameters (Second Order). Solution of Euler-Cauchy Equations (second Order only) (Text 1: Relevant topics from sections 2.1, 2.2, 2.5,2.7, 2.10)	12
3	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 2: Relevant topics from section 14.1, 14.2, 14.3, 14.5, 14.6)	12
4	Taylor and Fourier series	Taylor series representation (without proof, assuming the possibility of power series expansion in appropriate domains), Maclaurin series representation, 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. (Text 1: Relevant topics from sections 11.1, 11.2, Text 2: Relevant topics from section 9.8)	10

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
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
2	Calculus	H. Anton, I.Biven,S.Davis	Wiley	12th edition,2024

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 Rorres	Wiley	11th edition, 2019
4	Bird's Higher Engineering Mathematics	John Bird	Taylor & Francis	9th edition, 2021
5	Higher Engineering Mathematics	B. V. Ramana	McGraw-Hill Education	39th edition, 2023
6	Signals and Systems	Simon Haykin, Barry Van Veen	Wiley	2nd edition, 2002

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/
	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, Diagonalization	3
	Part 4	Quadratic forms	Quadratic forms Transformation to Principal Axes. Conic Sections	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 kxn, $kcos\omega x$, $ksin\omega x$, $ke\alpha xcos\omega x$, $ke\alpha xsin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE(with constant coefficients),	3
	Part 4	Method of Variation of Parameters and Cauchy -Euler ODE	Solution by variation of parameters (Second Order) Solution of Euler-Cauchy Equations (second Order only)	3
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
4.Taylor and Fourier series (10 Hrs)	Part 1	Series representation of functions	Taylor series representation and Maclaurin series representation	2
	Part 2	Fourier series	Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions)	3
	Part 3	Half Range Cosine Series	Fourier Cosine Series	3
	Part 4	Half Range Sine Series	Fourier Sine Series	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	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	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	CO 1	WK2, WK3	PO1, PO2, PO5
2	Differential Equations Assignment	Prepare a graded report solving non-homogeneous and Euler-Cauchy ODEs by hand, with engineering-context examples and verification of results.	5 Hrs	2	CO 2	WK1, WK2, WK3	PO1, PO2, PO5, PO11
3	Integrals and Series Mini-Report	Submit a graded mini-report applying multiple integrals to area/volume problems and Fourier/Taylor series to function approximation, with plots and analysis.	5 Hrs	3,4	CO 3, CO 4	Wk1, WK2, WK3, WK4	PO1, PO2, 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	**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	Multiple Integrals	12	-	3	12				15
4	Taylor and Fourier series	10	-	3	12				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
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 CO2 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. AntireflectionDiffraction-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

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.	11th Edition, 2024
2	Engineering Physics	H K Malik, A.K. Singh,	McGraw Hill Education	2nd Edition, 2017
3	Optics	Ajoy Ghatak	Mc Graw Hill Education	8th Edition, 2024

REFERENCE

Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Physics	G Vijayakumari	Vikas Publications	8th Edition, 2014
2	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	7th Edition 2017
3	Engineering Physics	Aruldhas G.	PHI Pvt. Ltd	2nd Edition, 2015
4	Fiber Optic Communications	Gerd Keiser	Springer	5th Edition 2021
5	A Text Book of Engineering physics	I. Dominic, A. Nahari	OWL Publications	2nd Edition, 2016
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition 2017
7	Engineering Physics	Rakesh Dogra	Katson Books	1st 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 CO2 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	Teaching 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 Code	Course Name				Credits
J1ESP103	**ALGORITHMIC THINKING WITH PYTHON**				**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	NIL				

COURSE OBJECTIVE	
1	To develop problem-solving skills using structured programming techniques
2	To write, test, and debug Python programs using control structures and functions.
3	To handle data using data structures.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Utilize computing as a model for solving real-world problems.	K2
2	Apply problem-solving techniques to design algorithms and pseudocode for simple computational problems.	K3
3	Develop Python programs using variables, data types, operators, and control structures.	K3
4	Implement modular and recursive solutions using user-defined functions and utilize Python data structures	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	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 ,WK 2	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	**ental/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
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	4x 3	12
B	2 (Including Choice)	8	7	4 x 7	28
TOTAL MARKS					**40**

Course Code	Course Name				CREDITS
J1EST104	**ENGINEERING MECHANICS**				**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	Nil				

COURSE OBJECTIVE	
1	**Introduce fundamental principles and laws** of mechanics governing the behaviour of particles and rigid bodies under the action of forces.
2	**Develop the ability to analyse and solve problems** involving equilibrium of force systems, friction, centroid, and moment of inertia.
3	**Explain the concepts of** kinematics and kinetics of particles and rigid bodies under different types of motion.
4	**Apply the principles of** rotational motion and mechanical vibrations to analyse the motion and stability of engineering systems.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the fundamental principles of mechanics force systems, moments, and equilibrium of particles and rigid bodies.	K2
2	Apply equilibrium equations and laws of friction to analyze forces acting on connected and contact bodies.	K4
3	Determine the centroid and moment of inertia of simple and composite plane areas using standard theorems.	K3
4	Analyze the motion and stability of particles, rigid bodies, and engineering systems using the principles of kinematics, kinetics, rotational dynamics, and mechanical vibrations under various motion conditions.	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	2	2	-	-	-	-	-	-	3	2	2	-	-	-	-	-	-	-	-	3	2	2
2	3	3	3	2	-	-	-	-	-	3	3	2	2	-	-	-	-	-	-	-	3	3	2
3	2	3	3	2	2	-	-	-	-	3	2	2	2	-	-	-	-	-	-	-	2	3	2
4	2	2	3	3	2	2	-	-	-	3	3	2	3	2	-	-	-	-	-	-	3	3	2

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

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Fundamentals of Statics and Equilibrium, Friction**	Fundamentals of mechanics and its branches – force systems and rectangular components – resultants and conditions of equilibrium – system isolation and free body diagrams – moments, Avignon's theorem, and couples – resolution of a force into a force and couple – Fundamentals of friction: laws, coefficient, cone of friction, angle of friction and angle of repose – ladder and block friction – simple friction problems.	12
2	**Structural Mechanics- Trusses and beams Centroid, and Moment of Inertia**	Introduction to structural mechanics types of beams and loading – support reactions of cantilever and simply supported beams (point load and UDL only) – trusses and analysis of simple trusses using method of joints and method of sections – Centroid of areas and composite areas – concept of Pappus–Guldinus theorems – moment of inertia – parallel and perpendicular axis theorems – polar moment of inertia and radius of gyration – mass moment of inertia of ring and disc (derivation only).	11
3	**Kinematics and Kinetics of Particles and Rigid Bodies & Mechanical Vibrations**	Kinematics of rectilinear motion – equations of motion – kinetics and Alembert's principle – motion on horizontal and inclined surfaces – motion of connected bodies – Introductory concepts of work–energy and impulse–momentum (No problems required)– Mechanical Vibrations**:** Fundamentals of free vibrations, degree of freedom, simple harmonic motion, spring–mass systems, stiffness and natural frequency, time period, and numerical problems on single-degree-of-freedom systems.	11
4	**Curvilinear translation and Combined motion of translation and rotation**	Curvilinear translation and projectile motion – kinematics of rotational motion – equations of motion for a rigid body about a fixed axis – rotational kinetics under constant moment. Combined motion of translation and rotation – instantaneous centre – motion of connecting rod and crank in reciprocating machines.	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1.	Engineering Mechanics (Statics and Dynamics)	S. Timoshenko & D. H. Young	McGraw-Hill Education	2017
2	Engineering Mechanics	R. C. Hibbeler	Pearson Education	2022
REFERENCE				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Mechanics	S. S. Bhavikatti & K. G. Rajasekharappa	New Age International	2016
2	Vector Mechanics for Engineers – Statics and Dynamics	F. P. Beer & E. R. Johnston Jr.	McGraw-Hill Education	2018
3	Engineering Mechanics Statics	J. L. Meriam, L. G. Kraige	Wiley	2020

VIDEO LINKS	
1	https://onlinecourses.nptel.ac.in/noc23_me74
2	https://nptel.ac.in/courses/112106286
3	https://nptel.ac.in/courses/112103108
VIRTUAL LAB/SIMULATION TOOLS	
1	PhET simulation or Python/Scilab
2	https://vlab.amrita.edu/index.php?sub=1

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
1. Fundamentals of Statics and Equilibrium, Friction (12 Hrs)	Part 1	**Introduction to Mechanics and Force Systems**	Introduction to branches and laws of mechanics – concept of rigid body – characteristics of a force – principles of transmissibility and superposition – representation of force systems – resolution of forces into rectangular components – parallelogram law of forces – resultants of force systems in two dimensions.	3
	Part 2	**Equilibrium of Forces and Free-Body Diagrams**	Conditions of equilibrium for coplanar force systems – Lami's theorem – analytical equilibrium equations in 2D – system isolation and construction of Free-Body Diagrams (FBD) – applications to particles and rigid bodies under different loading conditions.	3
	Part 3	**Moments and Couples**	Concept of moment and principle of moments – Avignon's theorem – couple and its characteristics – moment of a couple – reduction of a force system to an equivalent force and couple – simple applications and numerical problems.	3
	Part 4	**Introduction to Friction and it's applications**	Definition and types of friction – laws of dry friction – limiting friction – coefficient, angle, and cone of friction – angle of repose – equilibrium of bodies on rough horizontal and inclined planes – ladder friction – simple contact friction problems.	3
2. Structural Mechanics, Centroid, and Moment of Inertia (11 Hrs)	Part 1	**Introduction to beams and support reactions**	Types of beams and supports – types of loads (point load and uniformly distributed load) – determination of support reactions for cantilever and simply supported beams under point loads and UDLs – simple numerical problems.	3
	Part 2	**Trusses and analysis of trusses**	Introduction to trusses- analysis of simple trusses- method of joints- method of sections.	2

	Part 3	**Centroid of Areas**	Concept and definition of centroid – centroid of simple geometrical figures – centroid of composite plane areas (no derivations) – Pappus–Guldinus theorems (conceptual treatment only) – simple problems on centroid of composite areas.	3
	Part 4	**Moment of Inertia**	Concept and definition – moment of inertia of plane areas – parallel and perpendicular axis theorems – polar moment of inertia and radius of gyration – mass moment of inertia of ring and disc (derivation only) – simple numerical problems involving plane areas and sections.	3
3. Kinematics and Kinetics of Particles and Rigid Bodies and Mechanical Vibrations (11 Hrs)	Part 1	**Kinematics of Particles**	Kinematics of rectilinear motion – displacement, velocity, and acceleration – equations of motion for constant acceleration – simple numerical problems.	2
	Part 2	**Kinetics of Particles and Rigid Bodies**	Concept of kinetics – Newton's second law of motion –Analysis of Lift motion- Alembert's principle – motion on horizontal and inclined surfaces – motion of connected bodies – simple numerical problems.	3
	Part 3	**Work–Energy, Impulse–Momentum and Mechanical Vibrations**	Introductory concepts of work–energy and impulse–momentum principles (no numerical problems) – basics of mechanical vibrations – types of vibrations – degree of freedom – simple harmonic motion – displacement, velocity, and acceleration in SHM.	3
	Part 4	**Spring–Mass Systems and Free Vibrations**	Spring–mass systems – stiffness – time period – natural frequency of free vibrations – effect of mass and stiffness on frequency – simple numerical problems on single-degree-of-freedom (SDOF) systems.	3
4. Curvilinear translation (11 Hrs)	Part 1	**Curvilinear Motion and Projectile Motion**	Curvilinear translation – position, velocity and acceleration in curvilinear motion – projectile motion and its applications – simple numerical problems.	3
	Part 2	**Kinematics and Kinetics of Rotational Motion**	Kinematics of rotational motion – angular displacement, angular velocity and angular acceleration – equations of rotational motion for a rigid body about a fixed axis – rotational kinetics under constant moment – simple numerical problems.	3
	Part 3	**Combined Translation and Rotation**	Combined motion of translation and rotation – rolling motion of rigid bodies – relationship between linear and angular motion – simple numerical problems.	2
	Part 4	**Instantaneous Centre and Applications**	Instantaneous centre of rotation – determination of velocity using instantaneous centre – motion of connecting rod and crank mechanism in reciprocating machines – engineering applications.	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	NPTEL Video Review	Watch NPTEL lectures on *Force Systems and Equilibrium* (IIT Madras) and summarize key concepts with examples.	6	1	CO1	WK1, WK3	PO1, PO2
2	Problem Solving Practice	Solve 10 numerical problems on Support Reactions, Free Body Diagrams, and Moments and Couples from standard textbooks or past exams.	6	1	CO2	WK2, WK3	PO2, PO3
3	Case Study – Friction in Machines	Study and prepare a short report on applications of friction in brakes, clutches, and belt drives.	6	2	CO2	WK3, WK4	PO1, PO6
4	Centroid and MOI Visualization	Use PhET simulation or Python/Scilab to visualize centroid and moment of inertia for composite sections.	6	2	CO3	WK3, WK4	PO5, PO2
5	Mini Research / Article Review	Review an engineering article on *vibration control in mechanical systems* and present a summary connecting it to course concepts.	6	3	CO5	WK4, WK6	PO11 , PO7

TERM WORK ACTIVITIES (15 Hrs)							
Sl.No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	Laboratory Demonstration / Simulation	Perform virtual lab experiments (IIT Delhi/Amrita VLABS) on *Equilibrium of Forces*, *Ladder Friction*, and *Beams with Loads*. Submit an observation sheet.	5	1, 2	CO1, CO2	WK3, WK4	PO4, PO5
2	Group Assignment	Prepare a group assignment on *Applications of Alembert's Principle* and *Lift Motion* using real-life case examples.	5	3	CO4	WK3, WK4	PO2, PO10
3	Mini Project / Model	Develop a simple working or 3D model (e.g., beam with loads, spring–mass system) or simulation using Python/MATLAB to demonstrate vibration principles.	5	3	CO5	WK4, WK6	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	**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	Fundamentals of Statics and Equilibrium	12	3	3	9				15
2	Friction, Centroid, and Moment of Inertia	11	3	3	9				15
3	Kinematics and Kinetics of Particles and Rigid Bodies and Mechanical Vibrations	11		3	12				15
4	Curvilinear translation	11	3	3	9				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
J1EST135	**INTRODUCTION TO MECHANICAL 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 understand fundamentals of thermodynamics
2	To apply the first and second laws of thermodynamics to engineering systems
3	To understand working of IC engines and refrigeration, and psychometric concepts
4	To understand different manufacturing process, gears and working of pumps

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Describe basic thermodynamic concepts and apply the first law of thermodynamics to analyse energy transfer	K2
2	Analyse entropy using the second law to evaluate engine performance.	K3
3	Understand working of IC engines, refrigeration system and psychometric concepts.	K2
4	Summarize different manufacturing processes and applications, and machining techniques.	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	-	-	3	-	-	3	-	-	-	3	1	-	-	-	-	-	-	-	-	2			
2	-	3	3	2	2	3	-	-	-	3	2	-	-	-	-	-	-	-	-	2			
3	-	2	3	-	-	3	-	-	-	3	2	-	-	-	-	-	-	-	-	2			
4	-	-	3	-	-	3	-	-	-	3	-	-	-	-	-	-	-	-	-	2			
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																							

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Thermodynamics fundamentals**	Thermodynamics and its applications–Basic Concepts Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic System and Control Volume, Surrounding, Boundaries, Types of Systems, Universe, Thermodynamic properties, Process, Cycle. Thermodynamic Equilibrium, Quasi – static Process State, Point and Path function. Zeroth Law of Thermodynamics, Measurement of Temperature, reference Points, Temperature Scales. Energy - Work - free expansion. Joule's Experiment-First law of Thermodynamics - Enthalpy, PMM1, Limitations of First Law.	15
2	**2nd Laws and Entropy**	Second Law of Thermodynamics, Heat Engine, Heat pump – Kelvin- Planck and Clausius Statements, Equivalence of two statements, Causes of Irreversibility, PMM2, Absolute Thermodynamic Temperature scale Clausius Inequality, Entropy, principle of increase of entropy, Entropy generation, Entropy and Disorder, isentropic process, Third law of thermodynamics.	15
3	**IC Engines and Refrigeration**	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.	15
4	**Manufacturing process and Machine Elements**	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, Milling machine, CNC machine, 3D printing. Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), List types of clutches and their use, Bearings and their classification (Journal bearing and ball bearing).	15

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Thermodynamics	P. K. Nag	McGraw Hill	2013
2	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1st Edition, 2013
3	Textbook of Basic Mechanical Engineering	R.K. Rajput	Laxmi Publications	3rd Edition, 2017
4	Fundamentals of Mechanical Engineering	G.S. Sawhney	PHI Learning Pvt. Ltd.	1st Edition, 2013
5	Fundamentals of Engineering Thermodynamics	E. Rathakrishnan	PHI	2005
6	Thermodynamics an Engineering Approach	Y. A. Cengel and M. A. Boles	McGraw Hill	2011
REFERENCE				
SLNo.	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	Fundamentals of Engineering Thermodynamics	Moran J., Shapiro N. M	Wiley	2006
4	Thermodynamics	Holman J. P.	McGraw Hill	2004
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc22_me65/preview			
2	https://www.youtube.com/watch?v=cj0-wSGGe6g			
3	https://archive.nptel.ac.in/courses/112/106/112106310/ https://www.youtube.com/watch?v=9GMBpZZtjXM&list=PLD8E646BAB3366BC8			
4	https://archive.nptel.ac.in/courses/112/106/112106310/ https://www.youtube.com/watch?v=sUDfpFD0xX4&list=PLD8E646BAB3366BC8&index=4			
5	https://archive.nptel.ac.in/courses/112/106/112106310/ https://www.youtube.com/watch?v=lvy8h-yWhRQ&list=PLD8E646BAB3366BC8&index=6			
VIRTUAL LAB/SIMULATION TOOLS				
1	Online Interactive Psychrometric Chart / Calculator			
2	Simulation Software (e.g., ABAQUS/ANSYS//MATLAB)			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Thermodynamics Fundamentals (15 Hrs)	Part 1	**Introduction to Thermodynamics**	Thermodynamics and it's applications– Basic Concepts Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic System and Control Volume, Surrounding, Boundaries, Types of Systems, Universe.	4
	Part 2	**Thermodynamic Properties, Equilibrium, and Point-Path Functions**	Thermodynamic properties, Process, Cycle. Thermodynamic Equilibrium, Quasi – static Process State, Point and Path function.	4
	Part 3	**Zeroth Law and Measurement of Temperature**	Zeroth Law of Thermodynamics, Measurement of Temperature, reference Points, Temperature Scales	3
	Part 4	**First law of Thermodynamics**	Energy - Work - free expansion. Joule's Experiment- First law of Thermodynamics - Enthalpy, PMM1, Limitations of First Law	4
2. 2nd Law and Entropy (15 Hrs)	Part 1	**Second law of Thermodynamics**	Second Law of Thermodynamics, Heat Engine, Heat pump – Kelvin- Planck and Clausius Statements, Equivalence of two statements,	4
	Part 2	**Irreversibility and Thermodynamic Temperature Scale**	Causes of Irreversibility, PMM2, Absolute Thermodynamic Temperature scale	3
	Part 3	**Clausius Inequality and Entropy**	Clausius Inequality, Entropy, principle of increase of entropy, Entropy generation,	4
	Part 4	**Entropy and disorder**	Entropy and Disorder, isentropic process, Third law of thermodynamics.	4
3. IC Engines and Refrigeration (15 Hrs)	Part 1	**Carnot, Otto, Diesel cycles**	Thermodynamic cycles -Carnot Cycle - Derivation of efficiency (problems on efficiency) Otto, Diesel cycles (no derivation of efficiency and problems).	4
	Part 2	**IC Engines**	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.	4
	Part 3	**Refrigeration**	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems);	4
	Part 4	**Psychometric analysis**	Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Psychrometric chart, Cooling and dehumidification.	3

4. Manufacturing process and design (15 Hrs)	Part 1	**Primary Manufacturing Process**	Sand Casting, Forging, Rolling, Extrusion.	4
	Part 2	**Metal Joining Processes**	Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications.	5
	Part 3	**Machining processes**	Description and operations performed on Lathe, Milling machine, CNC machine, 3D printing.	4
	Part 4	**Gear, clutch and bearing**	Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), List types of clutches and their use, Bearings and their classification (Journal bearing and ball bearing)..	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 or Manufacturing Processes focusing on recent innovations.	15 hrs	3, 4	3, 4	WK4, WK8	PO1, PO11
2	Research Paper Analysis	Review an IEEE or ASME paper on IC engine technology (e.g., alternative fuels or net-zero design) or sustainable manufacturing. Submit a 500-word summary and critical evaluation.	10 hrs	3, 4	4	WK5, WK8	PO1, PO7, PO11
1	Literature Review on Applications of Thermodynamics	Study and prepare a report on real-life applications of thermodynamic principles in power plants, refrigeration, and air conditioning systems.	10 hrs	1, 2	1, 2	WK3,WK4	PO1,PO6, PO11
5	Chart Preparation Carnot and Refrigeratic Cycles	Draw and compare Carnot, Rankine, and refrigeration cycles, highlighting efficiency and performance parameters.	10 hrs	3	3	WK3,WK4	PO1,PO11

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 lathe a centrifugal pump, or a gear train.	8 hrs	3, 4	4,5	WK3, WK6	PO1, PO8, PO11
2	Experiment on Zeroth Law of Thermodynamics	Verify the Zeroth Law using a temperature measurement setup and compare results on different temperature scales.	7	1	Co1	WK3, WK6	PO1, PO2, 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

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 Fundamentals	15	6	9					15
2	2nd Law and Entropy	15	6	9					15
3	IC Engines and Refrigeration	15	6	6	3				15
4	Manufacturing process and design	15	6	9					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)	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**

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 **Skills to be developed:** ● 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**	**WK**	**PO**
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 though 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**	**Weigh tage**	**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 CONTINUOS INTERNAL ASSESSMENT							
Sl. No.	**Evaluation Criteria**	**Weigh tage**	**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 Code	Course Name				Credits
J1BST221	**VECTOR CALCULUS, PARTIAL DERIVATIVES AND TRANSFORMS**				**3**
Regulation	2026	L: T:P:H:S	3:0:0: 0:4.5	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	Basic Knowledge of Integration and Differentiation				

COURSE OBJECTIVE	
1	To introduce the calculus of functions of several variables, partial derivatives and the theory of Laplace transforms
2	To develop analytical skills for evaluating gradients, directional derivatives, divergence, curl and line integrals of vector fields
3	To apply vector integral theorems and Laplace-transform techniques to engineering problems involving flux, work and differential equations.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
CO1	Apply partial differentiation, the chain rule and implicit differentiation to analyse functions of several variables and locate their maxima and minima	K3
CO2	Apply Laplace transforms, shifting theorems and the convolution theorem to solve linear differential equations	K3
CO3	Compute the gradient, directional derivative, divergence, curl and line integrals of scalar and vector fields	K3
CO4	Apply Green's, divergence and Stokes' theorems to evaluate line, surface and flux integrals in engineering problems	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	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 2: Relevant topics from sections 13.2, 13.3, 13.4, 13.5, 13.8)**	11
2	**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)**	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 2: 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 2: Relevant topics from section 15.4, 15.5, 15.6, 15.7,15.8)**	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Advanced Engineering Mathematics	Erwin Krey zig	John Wiley & Sons	10th edition, 2016
2	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	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://archive.nptel.ac.in/courses/111106139			
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

Laplace Transforms (12 Hrs)	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
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	Stokes theorem	Verification of Stokes theorem, using Stokes 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	**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 hrs	2	2	WK2 WK3	PO1, PO2, PO4
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
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	1	CO1	WK2 WK3 WK4	PO1, PO2, PO4
2	**Laplace Transform Problem.**	Submit a computational report by solving 5 problems on Laplace transforms, shifting theorems and convolution applied to differential equations.	5	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	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
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
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

CO	Knowledge Attitude Profile WK									Program Outcomes & Program Specific Outcomes 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 $CaC_2O_4 \cdot H_2O$ and polymers - DTA - Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4 \cdot H_2O$.	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

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 (KMnO4 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 - Electro less 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 $CaC_2O_4 \cdot H_2O$ and polymers. DTA - Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4 \cdot H_2O$.	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
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)	8	2	8x2	16
B	2 (Including Choice)	8	6	4 x 6	24
TOTAL MARKS					40

Course Code	Course Name				Credits
J1EST253	**INTRODUCTION TO ELECTRONICS ENGINEERING**				**4**
Regulation	2026	L: T:P:H:S	3:1:0: 0:5	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 introduce the fundamental concepts of electronic devices, including passive and active components, and analyze the characteristics and applications of diodes, BJTs, and basic power supply circuits.
2	To develop understanding of analog electronic systems, including transistor biasing, amplifiers, and Field Effect Transistors (JFET and MOSFET), along with their operating principles and characteristics.
3	To explain and analyze feedback mechanisms, oscillators, and operational amplifier circuits, and apply them in signal processing applications such as amplification, filtering, and waveform generation.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Understand the operation and characteristics of passive and active electronic devices including diodes, BJTs, and power supply circuits.	K2
2	Explain the working principles and characteristics of FETs (JFET and MOSFET) and analyze transistor biasing and amplifier configurations.	K2
3	Analyze feedback mechanisms and oscillator circuits, and evaluate their performance in terms of gain, stability, and frequency.	K3
4	Apply operational amplifier concepts in various configurations and design basic analog circuits for practical 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	2	–	2	–	–	–	–	3	2	–	–	2	2	–	–	–	–	–			
2	–	3	3	–	2	–	–	–	–	3	3	–	–	2	–	–	–	–	–	3			
3	–	3	3	–	3	–	–	–	–	3	3	3	–	3	2	–	2	2	2	3			
4	–	3	3	–	2	–	2	–	–	3	3	2	3	3	2	–	2	2	2	3			

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

SYLLABUS			
Module	**Title**	**Topics**	**Hours**
1	**Introduction to Electronic devices**	Introduction to Electronic devices: Passive and active components in electronics (Resistor, Capacitor, inductor, Diode, BJT, FET). Block diagram of DC power supply. Construction, working and V -I Characteristics of BJT, Input output characteristics of CE configuration, Comparison of CE, CB and CC configurations. Transistor as a switch, Transistor Biasing- Fixed Biasing and Voltage Divider biasing, Transistor as an amplifier (Circuit diagram, working, Frequency response and gain bandwidth product)	15
2	**Fundamentals of Analog Devices**	Introduction to Analog Electronics and its Applications Overview of analog signal behavior, basic electronic device roles in amplification, switching, and signal conditioning. Field Effect Transistors (FET): Construction, working principles, and characteristics of JFET and MOSFET -Enhancement and Depletion mode MOSFET operation -Transfer characteristics and device behavior in different biasing conditions.	15
3	**Feedback Systems and Oscillators**	Feedback Concepts: Principles of feedback in electronic circuits, Positive and negative feedback mechanisms and their effects on gain, stability, and bandwidth Oscillators: Barkhausen criterion for sustained oscillations, Comparison between LC and RC oscillator circuits, Hartley and Colpitts oscillator operation and circuit behavior (device-independent description), RC phase shift oscillator analysis and frequency determination.	15
4	**Operational Amplifiers and Applications**	Operational Amplifier Fundamentals: Block diagram, ideal vs. practical parameters, Frequency response and voltage transfer curve Configurations: inverting, non-inverting, voltage follower Applications: integrator, differentiator, comparator, Schmitt trigger, Sample & Hold, Instrumentation amplifier	15

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electronics and Linear Circuits	N N Bhargava D C, Kulshreshtha	McGraw Hill	2017
2	Microelectronic Circuits	Adel S. Sedra, Kenneth C. Smith	Oxford University Press	2021 (7th Edition)
3	Electronic Devices and Circuit Theory	Robert L. Boylestad, Louis Nashelsky	Pearson Education	2020 (11th Edition)
4	Op-Amps and Linear Integrated Circuits	Ramakant A. Gayakwad	Pearson Education	2018 (4th Edition)
REFERENCE				
SL. No.	Name of Book	Name of Author/s	Publisher	Year
1	Integrated Electronics: Analog and Digital Circuits and Systems	Jacob Millman, Christos C. Halkias	McGraw Hill Education	2017
2	Linear Integrated Circuits	D. Roy Choudhury, Shail B. Jain	New Age International	2018
3	Electronic Devices and Circuits	David A. Bell	Oxford University Press	2015
4	Analog Electronics	L.K. Maheshwari, M.M.S. Anand	PHI Learning Pvt. Ltd.	2019
5	Electronic Circuit Analysis	K. Lal Kishore	BSP Books Pvt. Ltd.	2020
VIDEO LINKS				
1	https://nptel.ac.in/courses/117101106 (NPTEL – Analog Circuits)			
2	https://www.youtube.com/playlist?list=PLbMVogVj5nJRdd1G38L_8GzxvcW11zMwN			
3	https://www.nptelprep.in/courses/108101094/materials			
VIRTUAL LAB/SIMULATION TOOLS				
1	LTSpice			
2	Multisim			
3	Proteus Design Suite			
4	Tinkercad Circuits			
5	Falstad Circuit Simulator			
6	MATLAB Simulink			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1. Introduction to Electronic devices	Part 1	Electronic Components and Power Supply	Introduction to Electronic devices: Passive and active components in electronics (Resistor, Capacitor, inductor, Diode, BJT, FET). Block diagram of DC power supply.	4
	Part 2	Transistor Characteristics and Configurations	Construction, working and V -I Characteristics of BJT, Input output characteristics of CE configuration, Comparison of CE, CB and CC configurations.	4
	Part 3	BJT: Switching and Biasing Techniques	Transistor as a switch, Transistor Biasing-Fixed Biasing and Voltage Divider biasing,	3
	Part 4	BJT Amplifier: Principles, Operation, and Performance	Transistor as an amplifier (Circuit diagram, working, Frequency response and gain bandwidth product)	4
2.Fundamentals of Analog Devices	Part 1	Introduction to Analog Systems	Introduction to Analog Electronics and its Applications. Overview of analog signal behavior,	3
	Part 2	Device Roles and Signal Processing	Basic electronic device roles in amplification, switching, and signal conditioning.	4
	Part 3	Field Effect Transistors (FET) & JFETs	Field Effect Transistors (FET): Construction, working principles, and characteristics of JFET	4
	Part 4	MOSFET Operation and Biasing	MOSFET -Enhancement and Depletion mode MOSFET operation -Transfer characteristics and device behavior in different biasing conditions.	4
3. Feedback Systems and Oscillators	Part 1	Feedback Concepts	Principles of feedback in electronic circuits, Positive and negative feedback mechanisms and their effects on gain, stability, and bandwidth	4
	Part 2	Introduction to Oscillators and types	Barkhausen criterion for sustained oscillations, Comparison between LC and RC oscillator circuits.	4
	Part 3	LC Oscillator Circuits	Hartley and Colpitts oscillator operation and circuit behavior (device-independent description).	4
	Part 4	RC Oscillator Circuit	RC phase shift oscillator analysis and frequency determination	3
4. Operational Amplifiers and Applications	Part 1	Operational Amplifier Fundamentals	Block diagram, ideal vs. practical parameters, Frequency response and voltage transfer curve	4
	Part 2	Basic Op-Amp Configurations:	Configurations: Inverting amplifier, non-inverting amplifier, voltage follower	3
	Part 3	Mathematical Applications	Applications: integrator, differentiator, Instrumentation amplifier	4
	Part 4	Comparison and Switching	Comparator, Schmitt trigger, Sample & Hold	4

SELF LEARNING ACTIVITIES (45 Hrs)							
Sl. No	**Activity**	**Description**	**Time (Hrs)**	**Module**	**CO**	**WK**	**PO**
1	Component Datasheet Analysis	Study datasheets of Diodes, BJTs, to understand characteristics, ratings, and application constraints.	5	1	CO1	WK2, WK3	PO1
2	Simulation of Amplifier Circuits	Use LTspice/Multisim to simulate BJT, MOSFET amplifier and observe gain & efficiency.	5	1	CO1	WK3, WK4	PO2, PO4
3	Comparative Study: FET vs MOSFET	Prepare a report comparing structure, input impedance, switching speed, and suitable applications.	5	2	CO2	WK3, WK5	PO1
4	Oscillator Design Challenge	Design & simulate Hartley or RC Phase Shift oscillators (device-independent approach). Evaluate frequency stability.	5	3	CO3	WK3, WK6	PO2, PO4
5	Op-Amp Configuration Practice	Implement inverting, non-inverting, voltage follower circuits and record gain & bandwidth.	5	3	CO3	WK4, WK8	PO3
6	Instrumentation Amplifier Case Study	Explore applications in biomedical/industrial sensing; analyze common-mode rejection and gain stability.	7	3	CO3	WK6, WK7	PO4
7	Basic Op-Amp Configurations and Mathematical Applications-Simulation	Simulate output waveforms; analyze resolution, conversion steps & speed.	8	4	CO4	WK2, WK4	PO1, PO4
8	Technical Presentation	Students present on any analog subsystem (e.g., oscillators,).	5	Mixed	CO4	WK8, WK9	PO4

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Analog Subsystem Design	In teams, design and simulate a Diode transistor characteristics of different configurations; perform load-line analysis and efficiency evaluation using simulation tools.	4	Module 1	CO1	WK3, WK4	PO3
2	Analog Signal Detection	Use an oscilloscope to view different Analog Signal Behaviors (Sine, Square, Triangle). Students identify peak-to-peak voltage and frequency.	4	Module 2	CO2	WK3, WK4	PO3
3	Oscillator Simulation / Practical Observation	Collaboratively build and test RC Phase Shift Oscillator; Simulate or observe oscillator circuits or analyze waveforms using software/tools.	4	Module 3	CO3	WK6, WK7	PO5
4	Op-Amp Application Prototyping	Develop and demonstrate Op-Amp based circuits such as Comparator, Integrator, Schmitt Trigger, and Instrumentation Amplifier. Record practical gain and response.	3	Module 4	CO4	WK4, WK6	PO1

RUBRICS FOR TERM WORK EVALUATION						
Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	**Poor (1)**
1	Design & Implementation	Circuit/system design is innovative, optimized, and fully functional	Design meets objectives with minor inefficiencies	Basic design works with limited optimization	Design incomplete or lacks functionality	No meaningful design attempted
2	Technical Accuracy	Circuit behaviour, calculations, and simulations are precise and error-free	Mostly accurate with minor conceptual or calculation errors	Some errors in logic or execution	Frequent inaccuracies or conceptual gaps	Lacks technical understanding
3	Team Collaboration	Active participation, clear role distribution, and effective teamwork	Good collaboration with minor coordination issues	Uneven participation or unclear roles	Minimal collaboration or conflict-prone teamwork	No evidence of teamwork
4	Documentation & Presentation	Report is well-structured, clear, includes diagrams, data, and insights	Structured report with minor lapses in clarity or formatting	Understandable but lacks depth	Poorly organized or missing key elements	No documentation submitted

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**40%**
Learning Activity (Self Learning, Term Work, Assignments,)	40%
Attendance	10 %
Internal Examination	50 %
Course Project	NA
End Semester Examination	**60%**
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	Introduction to Electronic devices	15	6	9					15
2	Fundamentals of Analog Devices	15	6	9					15
3	Feedback Systems and Oscillators	15	6	6	3				15
4	Operational Amplifiers and Applications	15	6	6	3				15
This shall be treated as a general guideline for students and faculty 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	8x 3	24
B	2 (Including Choice)	4	9	4 x 9	36
TOTAL MARKS					**60**

Course Code	Course Name				Credits
J1ESP104	**ENGINEERING GRAPHICS AND COMPUTER AIDED DRAWING**				**3**
Regulation	2026	L: T:P:H:S	2:0:2: 0:4	Notional Learning Hours/Semester	90
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TP	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 60 Marks	ESE: 40 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To learn the principles and techniques of dimensioning and preparing engineering drawings.
2	To develop the ability to accurately interpret and understand engineering drawings.
3	To learn the features of CAD software & conversion of 3D views & 2D views.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Understand the projection of points and lines located in different quadrants	K2
2	Prepare multi view orthographic projections of objects by visualizing them in different positions	K3
3	Plot sectional views and develop surfaces of a given object.	K3
4	Prepare pictorial drawings using the principles of isometric projection	K3
5	Sketch simple drawing using CAD tools.	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	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

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 panes.	2
	Part 3	Solid inclined to VP	Projection of solids with axis inclined to Vertical panes.	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
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		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.

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 benifits 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	Concert 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.NO.	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
J1MRT207	**TRANSDUCERS AND MEASUREMENTS**				**3**
Regulation	2026	L: T:P:H:S	3:0:0: 0:4.5	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	Nil				

COURSE OBJECTIVE	
1	Introduce the fundamental concepts of sensors and transducers, their classification, operating principles, and the role of electrical and digital transducers in measurement systems.
2	Develop an understanding of measurement systems and instrumentation, emphasizing characteristics, static and dynamic performance, error analysis, and calibration techniques.
3	Familiarize students with bridge circuits, oscilloscopes, and recording instruments, and enable them to apply these tools for accurate measurement, analysis, and signal interpretation in engineering applications.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Define and describe the basic concepts, types, and characteristics of sensors and transducers used for measurement.	K2
2	Explain the principles and working of electrical and digital transducers used in measurement applications.	K2
3	**Summarize** the functions, characteristics, and errors associated with measurement systems and instrumentation.	K2
	Explain the operation and applications of bridge circuits, oscilloscopes, and recording instruments used in measurement systems.	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	3	–	2	–	–	–	–	–	–	3	2	–	–	–	–	–	–	–	–	–	3	2	
2	–	2	3	–	–	2	–	–	–	3	2	–	–	2	–	–	–	–	–	–	3	3	
3	–	–	2	3	–	–	–	–	–	2	3	–	2	–	–	–	–	–	–	–	2	3	
4	–	–	2	–	–	3	–	–	–	2	–	2	–	3	–	–	–	–	2	–	2	3	

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

SYLLABUS			
Module	Title	Topics	Hours
1	**Introduction to Sensors and Transducers**	Definition of sensors and transducers –Mechanical devices as Primary Detectors-Pressure Sensitive Primary Devices-Temperature Detectors- Hydro Pneumatic Devices. Electric Transducers. Advantages of Electrical Transducers. Classification of Electrical Transducers- Primary and Secondary Transducers, Active and Passive Transducers, Analog and Digital Transducers. Electrical Phenomena Used in Transducers..	11
2	**Electrical and Digital Transducers**	Resistive Transducers- Potentiometers, Strain gauges-gauge factor Resistance Thermometers, Thermistors. Capacitance transducers - piezo electric transducers – Inductive transducers: LVDT characteristics-photoelectric sensors – Hall Effect transducers - measuring circuits-calibration- Optical transducers.. Digital Transducer. Shaft Encoder.	12
3	**Measurement Systems and Instrumentaion**	Measurements- Significance of Measurements- Methods of Measurement: Direct &Indirect Methods-Instruments-Mechanical, Electrical and Electronic instruments- Classification of Instruments Analog and Digital Modes of Operation-Functions of Instruments and Measurement Systems- Applications of Measurement Systems Elements of a Generalized Measurement System- Characteristics of Instruments and Measurement Systems: Measurement system Performance- Static Calibration-Static Characteristics- Errors in Measurements-True Value-Static Error- Static Correction -Scale Range and Scale Span- Error Calibration Curve- Reproducibility and Drift- Accuracy and Precision, Linearity. Hysteresis-type of errors classification of errors	11
4	**Bridge Circuits, Oscilloscopes, and Recording Instruments**	DC bridges: introduction, sources and detectors-General Equation Types of bridges: Wheatstone, Kelvin bridge AC bridges: introduction, sources and detectors-General equation. Maxwell's inductance and Maxwell's inductance -capacitance bridge. Cathode ray oscilloscopes: principles, construction and limitations Digital storage oscilloscopes: principles- Measurements using CRO s and DSOs- Recording instruments: Strip chart recorder, X-Y Plotter, LCD displays..	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL. NO	Name of Book	Name of Author/s	Publisher	Year
1.	A Course in Electronic Measurements and Instrumentation	A. K. Sawhney	Dhanpat Rai & Co	2015
2	Electronic Instrumentation and Measurements	David A Bell	Oxford University Press	2013
3	Electronic Instrument Design	Kim R Fowler	Oxford reprint	2015

REFERENCE				
SL. NO	Name of Book	Name of Author/s	Publisher	Year
1	Sensors and Transducers,	D. Patranabis,	PHI 2/e	2003
2	Electronic Instrumentation and Measurements	Kalsi HS	Mc Graw hill,4/e,	2019
3	Electrical Measurements and Measuring systems	Golding E W and Widdis F C	Wheeler &co	1993
VIDEO LINKS				
1	https://nptel.ac.in/courses/108105064			
2	https://nptel.ac.in/courses/108105063			
VIRTUAL LAB/SIMULATION TOOLS				
1	https://www.labcenter.com			
2	https://www.multisim.com			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
Introduction to Sensors and Transducers (11Hrs)	Part 1	Fundamentals of Sensors and Transducers	Definition and need for measurement – Concepts of sensors and transducers – Difference between sensor and transducer – Primary and secondary detectors.	**3**
	Part 2	Mechanical and Pressure Sensitive Devices	Mechanical devices as primary detectors – Pressure sensitive devices – Hydro-pneumatic devices – Temperature detectors and their characteristics.	3
	Part 3	Electrical Transducers	Electrical transducers – Working principle – Advantages of electrical transducers – Basic conversion principles.	3
	Part 4	Classification and Applications	Classification of transducers: Primary/Secondary, Active/Passive, Analog/Digital – Electrical phenomena used in transducers – Practical applications.	2
Electrical and Digital Transducers (12 Hrs)	Part 1	Resistive and Strain Gauge Transducers	Resistive transducers – Potentiometers – Strain gauges – Gauge factor and measurement setup.	3
	Part 2	Temperature and Capacitive Sensors	Resistance thermometers – Thermistors – Capacitive transducers – Principles and applications.	3
	Part 3	Inductive and Piezoelectric Transducers	Inductive transducers – LVDT characteristics – Piezoelectric effect – Working.	3
	Part 4	Optical, Hall Effect and Digital Transducers	Photoelectric sensors – Hall Effect transducers – Optical transducers – Digital shaft encoder – Measuring circuits and calibration.	3

Measurement Systems and Instrumentation (11 Hrs)	Part 1	Introduction to Measurement Systems	Definition and significance of measurements – Direct and indirect measurement methods – Classification of instruments (Mechanical, Electrical, Electronic).	3
	Part 2	Measurement System Components	Analog and digital modes of operation – Functions and applications of measurement systems – Elements of a generalized measurement system.	3
	Part 3	Characteristics of Instruments	Static and dynamic characteristics – Performance terms – Static calibration – Reproducibility and drift.	3
	Part 4	Errors and Calibration	Errors in measurement – Types and sources of errors – Accuracy, precision, linearity, hysteresis – Calibration curve and correction.	2
Bridge Circuits, Oscilloscopes, and Recording Instruments (11 Hrs)	Part 1	DC and AC Bridge Fundamentals	Bridge principles – Sources and detectors – General equations – Wheatstone bridge and Kelvin bridge – Applications.	3
	Part 2	AC Bridge Measurements	Maxwell's inductance and inductance–capacitance bridges – Schering bridge – Wien bridge – Calibration and balancing.	3
	Part 3	Oscilloscopes	Cathode Ray Oscilloscope (CRO): principle, construction, and operation – CRO measurements – Digital Storage Oscilloscope (DSO) features and usage.	3
	Part 4	Recording Instruments	Recording instruments: Strip chart recorder – X–Y plotter – LCD display systems – Basic signal recording and analysis.	2

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Study on Types of Sensors	Watch NPTEL video lectures or online resources on basic sensor and transducer classifications. Prepare a short summary highlighting the difference between active and passive transducers.	7	Module 1	CO1	WK1	PO1, PO2
2	Comparative Study of Temperature Sensors	Research various temperature sensors (RTD, thermistor, thermocouple). Compare their characteristics, range, and accuracy in a tabular format.	6	Module 2	CO2	WK2	PO1, PO2
3	Error Identification Case Study	Analyze a real-world measurement setup (e.g., temperature or pressure measurement system) and identify possible sources of error. Suggest ways to minimize them.	6	Module 3	CO3	WK4	PO2, PO4

4	Video-based Learning – CRO and DSO Applications	Watch demonstrations on CRO and DSO measurements (YouTube/NPTEL). Note key procedures for measuring amplitude, frequency, and phase difference.	5	Module 4	CO4	WK5	PO1, PO5
5	Short Report on Modern Measurement Systems	Prepare a brief report (2–3 pages) on modern trends in sensor technology — MEMS, IoT sensors, and smart instrumentation.	6	All Modules	CO1–CO4	WK6	PO5, PO10

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	**Transducer Identification and Specification Study**	Identify different types of sensors and transducers (resistive, capacitive, inductive, piezoelectric). Collect data sheets and compare specifications such as range, sensitivity, and accuracy. Prepare a short report.	3	Module 1	CO1	WK1	PO1, PO2
2	**Simulation of Electrical Transducers**	Use any virtual lab or simulation software (NI Multisim, Proteus, or Virtual Labs) to demonstrate the working of an LVDT and strain gauge. Record output characteristics and discuss performance.	3	Module 2	CO2	WK2	PO2, PO5
3	**Measurement and Error Analysis**	Perform a simple measurement experiment (temperature, displacement, or voltage). Record readings, identify possible errors, and compute accuracy and precision.	3	Module 3	CO3	WK3	PO2, PO4
4	**Bridge Circuit Demonstration**	Design and test a Wheatstone or Kelvin bridge using resistors in a breadboard/simulation tool. Calculate unknown resistance and verify balancing conditions.	3	Module 4	CO4	WK4	PO1, PO5
5	**Mini Project / Report on Measurement Instrumentation**	Prepare a mini report (2–3 pages) or small project on any modern measurement system (e.g., smart sensors, IoT-based data acquisition, or digital oscilloscope application). Present findings in class.	3	All Modules	CO1–CO4	WK5	PO5, 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, demonstrates originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
3	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
4	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	Introduction to Sensors and Transducers	11	6	9					15
2	Electrical and Digital Transducers	12	3	12					15
3	Measurement Systems and Instrumentation	11	6	9					15
4	Bridge Circuits, Oscilloscopes, and Recording Instruments	11	3	12					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
J1ESL127	**ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP**				1
Regulation	2026	L: T:P:H:S	0:0:2: 0:1	Notional Learning Hours	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: 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 - "-"

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=PLBBGwIiUvNPCVfQCxGk9halPCPSKoof-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**	**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 END SEMESTER EXAMINATION							
Sl. No	Criteria	Weightage	Excellen (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 CONTINUOS INTERNAL ASESSMENT							
Sl. No	Evaluation Criteria	Weighage	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**