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
J1BSP122	**PHYSICS FOR ELECTRICAL SCIENCE**				**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, Semiconductor Theory and Modern Physics				

COURSE OBJECTIVE	
1	To provide students with a solid background in the fundamentals of Physics and to impart this knowledge in Electrical 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 comprehended knowledge about laser and fibre optics in various engineering applications	**K3**
2	Apply the concepts of superconductivity and the basic theory of dielectrics in solving engineering problems	**K3**
3	Apply the fundamentals of Semiconductor Physics to determine carrier concentration and utilize the energy band structure and current–voltage characteristics of intrinsic and extrinsic semiconductors.	**K3**
4	Apply the principles of semiconductor material behaviour to explain the operation and performance of semiconductor and photonic devices.	**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	3	-	2	-	-	-	3	2	-	-	2	-	-	-	-	2	2	-	-	-
2	3	2	2	3	-	-	-	-	-	3	2	-	-	-	-	2	-	-	-	2	-	-	-
3	3	2	3	3	-	2	-	-	-	3	3	-	-	2	-	-	-	-	-	2	-	-	-
4	3	2	3	3	-	2	-	-	-	3	2	-	-	2	-	-	-	-	-	2	-	-	-
5	3	2	2	2	-	2	-	2	2	2	2	-	3	2	-	-	2	2	-	2	-	-	-

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

SYLLABUS			
Module	Title	Topics	Hours
1	**Laser & Fiber Optics**	Optical processes - Absorption, Spontaneous emission and stimulated emission, Properties of laser, 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, Semiconductor Laser (Qualitative), Applications of laser. Optical fiber-Principle of propagation of light, Types of fibers- Step index and Graded index fibers, Numerical aperture – Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	9
2	**Superconductivity & Dielectrics**	Super conductivity, Transition temperature, Critical field, Meissner effect, Type I and Type II Super conductors, Applications of superconductors. Dielectric constant, Polarization, Permittivity- relative permittivity, Relation between polarization and dielectric constant, Types of Polarization, Internal fields in liquids and solids, Clausius Mossotti Relation, Dielectric loss(qualitative), Dielectric breakdown (qualitative)	9
3	**Semiconductor Physics**	Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band, Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative) Formation of p-n junction, Fermi level in semiconductors- intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction - Forward and reverse biased p-n junctions, V-I Characteristics of p-n junction	9
4	**Semiconductor Devices**	Semiconductor devices - Rectifiers- Full wave and Half wave, Zener diode - V-I characteristics - Zener breakdown and Avalanche breakdown, Tunnel diode - V-I characteristics, Applications of Zener and Tunnel diodes. Photonic devices (qualitative) - Photo detectors (Junction and PIN photodiodes), Applications, Solar cells- V-I Characteristics, Efficiency, Stringing of Solar cells to solar panel, Light Emitting Diode, Applications of LED	9

LIST OF EXPERIMENTS (24 hours)		
Instructions • Minimum 10 Experiments		
Sl. No.	**Experiment**	**CO**
1	Diode characteristics	CO4, CO5
2	Zener diode – V I characteristics	CO4, CO5
3	Half wave rectifier	CO4, CO5
4	Characteristics of LED	CO4, CO5
5	Solar Cell – V I and Intensity Characteristics	CO4, CO5
6	Laser – Determination of wavelength using diffraction grating	CO1, CO5
7	Laser- To measure the wavelength using a millimetre scale as a grating	CO1, CO5
8	CRO -Measurement of frequency and amplitude of wave forms	CO5
9	Photo diode - V-I Characteristics	CO4, CO5
10	Numerical aperture of optical fiber	CO1,CO5
11	Tunnel diode –V-I characteristics	CO4, CO5
12	Voltage regulation using a Zener diode	CO4, CO5
13	Full wave rectifier	CO4, CO5
14	Determination of band gap energy of a semiconductor	CO3, CO5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl. No.	**Name of Book**	**Name of Author/s**	**Publisher**	**Edition and Year**
1	Concepts of Modern Physics	Arthur Beiser	Tata McGraw Hill Publications	6th Edition, 2003
2	Engineering Physics	H K Malik , A.K. Singh,	McGraw Hill	2nd Edition, 2017
3	A Textbook of Engineering Physics	MN Avadhanulu, P G Kshirsagar, TVS Arun murthy	S. Chand	11th Edition, 2018

REFERENCE				
Sl. No.	**Name of Book**	**Name of Author/s**	**Publisher**	**Edition and Year**
1	Semiconductor Devices Fundamentals	Robert F Pierret	Pearson Education	1995
2	Advanced Semiconductor Fundamental	Robert F Pierret	Pearson Education	2nd Edition, 2002
3	Solid State Electronic Devices	Ben G Streetman and Sanjay Kumar Banerjee	Pearson Education 6/e	2010
4	Solid State Physics	S.O. Pillai	New age international publishers	10th Edition, 2022
5	Introduction to Solid State Physics	Charles Kittel	Wiley India Edition	2019
6	Advanced Engineering Physics	Premlet B	Phasor Books	10th Edition ,2017
7	A Text Book of Engineering Physics	I. Dominic and. A. Nahari,	Owl Books Publishers	Revised Edition, 2025
VIDEO LINKS (NPTEL, SWAYAM…)				
1	https://nptel.ac.in/courses/108106181			
2	https://nptel.ac.in/courses/108108112			
3	https://nptel.ac.in/courses/115103108			
4	https://nptel.ac.in/courses/115102124			
5	https://ocw.mit.edu/courses/6-007-electromagnetic-energy-from-motors-to-lasers-spring-2011/			
VIRTUAL LAB/SIMULATION TOOLS				
1	Amrita Virtual Labs — Physics (https://vlab.amrita.edu/)			
2	PhET Interactive Simulations (semiconductor and optics)			
3	Basic Electronics Virtual Laboratory (https://be-iitkgp.vlabs.ac.in)			

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	**Part**	**Part Name**	**Topics Covered**	**Hours**
1.Laser & Fiber Optics	Part 1	**Lasers and Optical Amplification**	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	**Types and Applications of Lasers**	Construction and working of Ruby laser, Semiconductor Laser (Qualitative), Applications of laser.	2
	Part 3	**Fundamentals of Optical Fibers**	Optical fiber-Principle of propagation of light, Types of fibers-Step index and Graded index fibers	2
	Part 4	**Optical Fiber Parameters and Applications**	Numerical aperture –Derivation, Applications of optical fibers - Fiber optic communication system (block diagram)	3
2.Superconductivity & Dielectrics	Part 1	**Superconductivity & Key Properties**	Super conductivity, Transition temperature, Critical field, Meissner effect,	2
	Part 2	**Superconductor Types & Applications**	Type I and Type II Super conductors, High temperature superconductors (qualitative), Applications of superconductors.	2
	Part 3	**Dielectric Properties of Materials**	Dielectric constant, Polarization, Permittivity- relative permittivity, Relation between polarization and dielectric constant, Types of Polarization	3
	Part 4	**Behavior of Dielectrics in Electric Fields**	Internal fields in liquids and solids, Dielectric loss(qualitative), Dielectric breakdown (qualitative)	2
3.Semiconductor Physics	Part 1	**Intrinsic semiconductor**	Intrinsic semiconductor, Derivation of density of electrons in conduction band and density of holes in valence band	2
	Part 2	**Carrier Concentration & Extrinsic Semiconductors**	Intrinsic carrier concentration, Variation of Intrinsic carrier concentration with temperature, Extrinsic semiconductor (qualitative)	3
	Part 3	**P-N Junction & Energy Bands**	Formation of p-n junction, Fermi level in semiconductors-intrinsic and extrinsic, Energy band diagram of p-n junction - Qualitative description of charge flow across a p-n junction	2
	Part 4	**P-N Junction Bias & I-V Characteristics**	Forward and reverse biased p-n junctions, Diode equation (Derivation), V-I Characteristics of p-n junction	2

4.Semiconductor Devices	Part 1	**Rectifiers & Zener Diode**	Semiconductor devices - Rectifiers- Full wave and Half wave	2
	Part 2	**Tunnel Diode & Semiconductor Laser**	Zener diode - V-I characteristics - Zener breakdown and Avalanche breakdown, Tunnel diode - V-I characteristics, Applications of Zener and Tunnel diodes.	2
	Part 3	**Photonic devices – LED & Photodetectors**	Photonic devices (qualitative) - Photo detectors (Junction and PIN photodiodes), Applications	2
	Part 4	**Solar cell**	Solar cells- V-I Characteristics, Efficiency, Stringing of Solar cells to solar panel, Light Emitting Diode, Applications of LED	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	**Survey of Modern Laser and Fiber-Optic Applications**	Study technical articles on industrial, medical and communication applications of lasers and optical fibers, and prepare a short documented summary.	5	1	CO1	WK1, WK4, WK8	PO1, PO11
2	**Superconductivity Research**	Collect recent advancements and applications (MRI, maglev trains, quantum computing). Prepare a short presentation.	5	3	CO2	WK3 WK5 WK7	PO1, PO3
3	**Semiconductor Theory Exploration**	Study intrinsic and extrinsic semiconductors, carrier concentration, and Fermi level variation using NPTEL videos.	5	1	CO3	WK1 WK2 WK3	PO1, PO3
4	**Device Application Study**	Research practical uses of Zener diode and Tunnel diode in modern electronics (voltage regulation, high-speed circuits).	5	2	CO3	WK3 WK4 WK6	PO1, PO3
5	**Solar Energy Study**	Prepare a mini report on the working of solar panels, focusing on solar cell efficiency and connections.	5	2	CO4	WK4 WK6 WK7	PO1, PO3
6	**Laboratory Correlation Report**	Relate any two physics lab experiments (e.g., diode and laser) to theoretical principles learned in class.	5	1–4	CO5	WK3 WK5 WK6 WK9	PO1, PO3, PO5

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Semiconductor Device Characterization Report	Prepare a report comparing V–I characteristics of diode, Zener, and Tunnel diode with simulation/lab results.	10 Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2 PO11
2	Laser and Fiber Optics Experiment Correlation	Record observations for laser wavelength determination and fiber NA experiment; interpret data and create comparison chart.	10 Hrs	3,4	CO3, CO4	WK2, WK4, WK6	PO2, PO4, PO5
3	Semiconductor Application Mini Poject	Design a mini circuit using Zener or LED for a given application (voltage regulator, indicator circuit, etc.) with working explanation.	10 Hrs	4	CO4	WK4, WK6, WK8	PO4, PO5, PO9

RUBRICS FOR TERM WORK EVALUATION						
Sl. No.	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	**Understanding of Concept**	Demonstrates complete and accurate grasp of underlying concepts and design relations.	Demonstrates good understanding with minor conceptual gaps.	Demonstrates basic understanding of essential ideas.	Demonstrates partial understanding; several concepts unclear.	Little or no conceptual understanding evident.
2	**Implementation & Coding**	Design/implementation is fully correct, clean, and well-organised.	Implementation works with minor deviations or minor cosmetic issues.	Implementation partially works; some sections require correction.	Implementation incomplete or requires substantial guidance.	Implementation not attempted or non-functional.
3	**Analysis & Interpretation**	Results are analysed in depth with quantitative comparison to theory and clear insights.	Analysis is correct with minor interpretation gaps.	Basic analysis; limited quantitative comparison.	Analysis incomplete or inconsistent.	No valid analysis or interpretation.

4	**Report & Presentation**	Report is comprehensive, well-structured, with plots, calculations, references and clear conclusions.	Report is clear with only minor omissions in structure or referencing.	Report covers required content but lacks polish or detail.	Report poorly organised or missing major sections.	Report incomplete or not submitted.
5	**Teamwork & Engagement**	Actively leads/collaborates; shows initiative, ownership and professional conduct.	Collaborates well with occasional guidance.	Contributes adequately to assigned tasks.	Limited engagement; reactive participation only.	Minimal or no contribution.

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 thoroughly prepared with pre-lab work complete.	Mostly prepared with minor gaps in pre-lab work.	Prepared with noticeable gaps; partial pre-lab work.	Minimal preparation; pre-lab work largely missing.	No preparation evident.
2	**Experimental Skills & Performance**	40%	Conducts experiment expertly, follows procedure precisely and records accurate data.	Conducts experiment with minor procedural deviations and largely accurate data.	Conducts experiment with moderate accuracy; some procedure issues.	Significant procedural or accuracy errors; needs assistance.	Cannot perform experiment.
3	**Analysis, Interpretation & Documentation**	30%	Detailed analysis with correct inferences; record is complete and well-presented.	Correct analysis with minor inference gaps; record clear with small omissions.	Basic analysis with limited inference; record adequate.	Weak analysis; record incomplete or disorganised.	No valid analysis; record missing or unusable.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30%
Learning Activity (Self Learning, Term Work, Assignments)	10 %
Attendance	10 %
Internal Examination	50 %
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	Laser & Fiber Optics	9	2	5	3	-	-	-	**10**
2	Superconductivity & Dielectrics	9	-	7	3	-	-	-	**10**
3	Semiconductor Physics	9	2	5	3	-	-	-	**10**
4	Semiconductor Devices	9	-	5	5	-	-	-	**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 Example 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

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	**Problem Solving Strategies**	Compare two everyday problems (e.g., finding a lost item vs. planning a trip) and identify which strategy (Trial & Error, Heuristic, Means-Ends, Backtracking) best applies.	3	1	CO1	WK1 WK2	PO1, PO2
2	**Problem Solving Process**	Take a real-world scenario (e.g., calculating electricity bill, student grade analysis, or bus fare system). Break it down into: • Understanding the problem • Formulating a model • Developing an algorithm • Writing a Python program • Testing and evaluating the solution	3	1	CO1	WK2 , WK4	PO1, PO2
3	**Algorithm and Flowchart Practice**	Design algorithms and draw flowcharts for basic computational problems (e.g., area, factorial, largest of three numbers) using online tools like draw.io.	4	2	CO2	WK1 , WK3	PO1, PO2
4	**Pseudocode Development**	Write structured pseudocode for real-world problems such as grading systems or ATM transactions, emphasizing sequencing, selection, and iteration.	3	2	CO2	WK1 , WK3	PO1, PO2
5	**Exploring Python Basics**	Practice Python fundamentals — data types, variables, operators, expressions, input/output, and type conversion — through simple coding exercises.	4	3	CO3	WK2 , WK3	PO1, PO5
6	**Debugging and Control Structures**	Develop and test Python programs using conditional and looping constructs; identify and fix syntax and logic errors.	4	3	CO3	WK2 , WK6	PO1, PO5

7	**Function-based Problem Solving**	Write user-defined and recursive functions to solve problems like factorial, palindrome, and Fibonacci sequence, emphasizing modularity and reusability.	5	4	CO4	WK3, WK6	PO1, PO2, PO5
8	**Algorithm to Python Implementation**	Select a real-world problem (e.g., billing or student marks analysis). Develop the algorithm, flowchart, and pseudocode, then implement the solution in Python.	4	4	CO4	WK3, WK6, WK8	PO2, PO3, PO5

TERM WORK ACTIVITIES (30 Hrs)							
Sl.No.	**Activity**	**Description**	**Time**	**Module**	**CO**	**WK**	**PO**
1	**Problem Solving Strategies**	Apply Trial & Error, Heuristics, Means-Ends Analysis, and Backtracking to a puzzle/problem and record outcomes.	4	1	CO1	WK1, WK2	PO1, PO2
2	**Problem Solving Process**	Model a real-world problem (e.g., grade analysis, electricity bill) into steps: understanding → model → algorithm.	3	1	CO1	WK1, WK4	PO1, PO2
3	**Algorithm Design**	Prepare algorithms for basic computational problems (e.g., area calculation, sum of numbers, temperature conversion) using standard notation tools.	4	2	CO2	WK1, WK3	PO1, PO2
4	**Pseudocode Writing and Representation**	Write well-structured pseudocode for real-world processes involving sequencing, selection, and repetition (e.g., ATM withdrawal, grading system).	3	2	CO2	WK1, WK3	PO1, PO2
5	**Python Fundamentals Practice**	Develop programs to perform input/output operations, work with variables, data types, operators, and expressions. Test for correct syntax and logic.	4	3	CO3	WK2, WK3	PO1, PO5
6	**Control Structures Implementation**	Implement programs using decision-making and looping constructs (if-else, for, while) with validation-based examples and user inputs.	4	3	CO3	WK2, WK6	PO1, PO5
7	**Function-Based Problem Solving**	Design and implement Python programs using user-defined and recursive functions for problems such as factorial, Fibonacci, and prime number checks.	3	4	CO4	WK3, WK6	PO1, PO2, PO5
8	**Data Structures and Modular Programming**	Work with sequence data types (list, tuple, and 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	**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

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 analyse 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	Analyse 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, Varignon'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 D'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 – Varignon'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- D'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 D'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
J1EST115	INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING				4
Regulation	2026	L: T:P:H:S	4:0:0: 0:6	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode			Theory
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To describe the fundamental principles of electrical and magnetic circuits.
2	To explain the analysis of DC and AC electrical circuits.
3	To explain the basic principles and operation of electronic components and circuits used in simple electronic systems.
4	To introduce the fundamentals of digital electronics and communication systems and familiarize students with emerging technologies such as ZigBee, WiMAX, PAN, 5G, 6G, and IoT.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits	K3
2	Apply the principles of electromagnetic induction and AC systems to analyze circuits and calculate voltage, current, power, and power factor in single-phase and three-phase circuits.	K3
3	Explain and analyze the basic functions of passive and active electronic components and examine the operation and characteristics of BJTs, FETs, and operational amplifiers in simple electronic circuits.	K4
4	Apply the principle of digital electronics and communication systems to analyze the functioning and applications of wired and wireless technologies such as AM, FM, GSM, Bluetooth, ZigBee, WiMAX, PAN, 3G–6G, and IoT.	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	3	-	-	-	-	-	-	3	2	-	-	-	-	-	-	-	-	-	3	-	-
2	-	3	3	3	-	-	-	-	-	3	3	-	2	-	-	-	-	-	-	-	3	2	-
3	3	1	3	2	-	2	-	-	-	3	3	-	-	2	-	-	-	2	-	2	3	-	-
4	3	-	3	-	-	-	-	-	-	3	2	-	-	2	-	-	-	2	-	2	3	-	-

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

SYLLABUS			
Module	Title	Topics	Hours
1	**DC Electric Circuits and Magnetic Circuits**	**Elementary Concepts of DC Electric Circuits:** Current and Voltage Division Rule - Ohms Law and Kirchhoff's laws - Capacitors & Inductors: V-I relations and Energy stored - numerical problems. **Star-delta Conversion and Source Transformation:** Star-delta conversion (resistive networks only - derivation not required) - numerical problems. Voltage and Current Sources - Source Transformation - numerical problems. **Analysis of DC Electric Circuits:** Mesh current method - matrix representation - solution of network equations - numerical problems. Node voltage methods - matrix representation - solution of network equations by matrix methods, numerical problems. **Elementary Concepts of Magnetic Circuits:** Basic Terminology of Magnetic Circuits - MMF - field strength - flux density - reluctance,(numerical problems). Comparison between electric and magnetic circuits	15
2	**AC Circuits**	**Electromagnetic Induction:** Faraday's laws, Lenz's law, statically induced and dynamically induced emf, Self-inductance and mutual inductance, coefficient of coupling (numerical problems not needed) **Alternating Current Fundamentals:** Generation of alternating voltages, Representation of sinusoidal waveforms: frequency - period - average value - RMS value and form factor - numerical problems. Phasor representation of sinusoidal quantities, Complex Forms - Trigonometric, Rectangular and Polar forms. **Analysis of Simple AC Circuits:** Purely resistive, inductive & capacitive circuits - numerical problems. RL, RC and RLC series circuits - concept of impedance - power factor - active, reactive and apparent power, Voltage, Impedance and Power Triangle - numerical problems. **Three Phase AC Systems:** Generation of three phase voltages, Advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents, computation of three phase power (balanced only) - numerical problems	15
3	**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). Operational amplifiers (Op Amps): The Op-Amp - Block diagram, Schematic Symbol and 741 IC Pin diagram.	13
4	**Digital Electronics and communication systems**	Modern Electronics and its applications: General block diagram of a Communication system, Concept of AM and FM, Block diagram of AM and FM super-heterodyne receiver. Basic concepts of Wired communication, Introduction to Wireless Communication, Evolution, Wireless LAN, Bluetooth, Zig-Bee and Personal Area Networks. Broadband Wireless Access-WiMax Technology, Wireless spectrum allocation and Standards. Block diagram of GSM, Comparison of 3G, 4G, 5G and 6G communication technologies. Number Systems- Decimal, Binary, Octal and hexadecimal, and their conversions. Logic gates, Boolean algebra and rules of simplification Introduction to IoT and its applications.	17

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electrical Engineering	D P Kothari and I J Magrath	Tata McGraw Hill	4th Edition 2019
2	Schaum's Outline of Basic Electrical Engineering	J. .J. Cathey and Syed A. Nasar	Tata McGraw Hill	3rd Edition 2010
3	Basic Electrical Engineering	V. K. Mehta & Rohit Mehta	S. Chand	6th Edition 2012
4	Basic Electronics and Linear Circuits	N N Bhargava D C, Kulshreshtha	McGraw Hill	2017
5	Electronic Communication Systems	Kennedy and Davis	McGraw Hill	2017
6	Basic Electrical and Electronics Engineering	S. K. Bhattacharya	Pearson	2012
7	Digital Fundamentals	Thomas L. Floyd	Pearson Education	2020
8	Introduction to Internet of Things (IoT)	Raj Kamal	McGraw Hill	2021
9	Basic Electronics and Linear Circuits	N N Bhargava D C, Kulshreshtha	McGraw Hill	2017
REFERENCE				
Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Basic Electrical Engineering	D. C. Kulshreshtha	Tata McGraw Hill	2nd Edition 2019
2	Electrical Engineering Fundamentals	Del Toro V.	Pearson Education	2nd Edition 2019
3	Basic Electrical Engineering	T. K. Nag Sarkar, M. S. Sophia	Oxford Higher Education	3rd Edition 2017
4	Electronics: A Systems Approach	Neil Storey	Pearson	2017
5	Electronic Devices and Circuit Theory	Robert L. Boylston	Pearson	2015
6	Principles of Electronic Communication Systems	Frenzel, L. E	MGH	2016
7	Electronic Devices and Circuits	David A. Bell	Oxford University Press	5th Ed., 2017
8	Principles of Electronic Communication Systems	Louis E. Frenzel	McGraw Hill	5th Ed., 2023
9	Fundamentals of Digital Circuits	A. Anand Kumar	PHI Learning	2019
10	Basics of Internet of Things (IoT)	Arsheen Bahga, Vijay Madisetti	Universities Press	2020

VIDEO LINKS		
1	Basic Electrical Technology, IIT Kheradpir - https://nptel.ac.in/courses/108105053	
2	Fundamentals of Electrical Engineering, IIT Kheradpir - https://nptel.ac.in/courses/108105112	
3	Introduction to Electrical Engineering , IIT Delhi https://youtube.com/playlist?list=PLp6ek2hDcoNCc3IgSGVjIsiMhM_Ll9FEn	
4	Basic Electrical Technology: http://www.digimat.in/nptel/courses/video/108108076/108108076.html	
5	NOC:Basic Electric Circuits: http://www.digimat.in/nptel/courses/video/108104139/108104139.html	
6	NOC:Introduction to Electrical Engineering: http://www.digimat.in/nptel/courses/video/108102185/108102185.html	
7	NOC:Network Analysis: http://www.digimat.in/nptel/courses/video/108105159/108105159.html	
8	Digital Circuits (NPTEL) - https://nptel.ac.in/courses/108105132	
9	Analog Circuits- NPTEL – Analog Electronic Circuits (IIT Kharagpur) - https://nptel.ac.in/courses/108105158	
10	IoT Basics- NPTEL – Introduction to Internet of Things (IIT Kharagpur) https://nptel.ac.in/courses/106105166	
11	MOSFET and Amplifier Basics, Electronics Tutorials – Transistor & MOSFET Explained (YouTube) https://www.youtube.com/@ElectronicsTutorials	
VIRTUAL LAB/SIMULATION TOOLS		
1	Virtual Labs: https://bee-iitk.vlabs.ac.in/ https://bes-iitr.vlabs.ac.in/ https://vlab.amrita.edu/index.php?sub=1&brch=75	To perform experiments on Kirchhoff's rules, measurement of voltage, current, power and power factor, study of series RLC circuit.
2	MultisimLive https://www.multisim.com	Create Circuits and Simulate with the Power of SPICE
3	Circuit Lab - Circuit Simulation and Schematics https://www.circuitlab.com/	Interactive browser-based tool for real-time electronic circuit visualization.
4	Virtual Labs – IIT Bombay - https://www.vlab.co.in/	To perform experiments on diode and transistor characteristics, rectifiers, and filters.
5	TINA-TI / Multisim Simulation	To simulate and analyze analog and digital electronic circuits.
6	Falstad Circuit Simulator	Interactive browser-based tool for real-time electronic circuit visualization.
7	NI Multisim / Multisim Live	For both analog and digital circuit simulation; useful for logic gate verification, Boolean simplification, and waveform analysis.
8	Proteus Design Suite	For digital circuit implementation, simulation, and verification of logic and sequential circuits.
9	Tinker CAD Circuits (Autodesk)	For basic IoT and embedded system demonstrations using virtual Arduino-based circuits and sensors.

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
1. DC Electric Circuits and Magnetic Circuits (15 Hrs)	Part 1	Elementary Concepts of DC Electric Circuits	Current and Voltage Division Rule - Ohms Law and Kirchhoff's laws - Capacitors & Inductors: V-I relations and Energy stored - Numerical problems.	3
	Part 2	Star-delta Conversion and Source Transformation	Star-delta conversion (resistive networks only - derivation not required) - numerical problems. Voltage and Current Sources - Source Transformation - numerical problems.	3
	Part 3	Analysis of DC Electric Circuits	Mesh current method - matrix representation - solution of network equations - numerical problems. Node voltage methods - matrix representation - solution of network equations by matrix methods - numerical problems.	6
	Part 4	Elementary Concepts of Magnetic Circuits	Basic Terminology of Magnetic Circuits - MMF - field strength - flux density - reluctance, Comparison between electric and magnetic circuits.	2
2. AC Circuits (15 Hrs)	Part 1	Electromagnetic Induction	Faraday's laws, Lenz's law, statically induced and dynamically induced emf, Self-inductance and mutual inductance, coefficient of coupling (numerical problems not needed)	2
	Part 2	Alternating Current Fundamentals	Generation of alternating voltages, Representation of sinusoidal waveforms: frequency – period - average value - RMS value and form factor - numerical problems. Phasor representation of sinusoidal quantities, Complex Forms - Trigonometric, Rectangular and Polar forms.	4
	Part 3	Analysis of Simple AC Circuits	Purely resistive, inductive & capacitive circuits - numerical problems. RL, RC and RLC series circuits - concept of impedance - power factor - active, reactive and apparent power, Voltage, Impedance and Power Triangle - numerical problems.	6
	Part 4	Three Phase AC Systems	Generation of three phase voltages, advantages of three phase systems, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents, computation of three phase power (balanced only) - numerical problems	3

3.Inroduction to Electronic devices (13 Hrs)	Part 1	Electronic Components and Power Supply	Passive and active components: Resistors, Capacitors, Inductors, Diodes, BJTs, FETs. Block diagram of a DC power supply.	3
	Part 2	Transistor Characteristics and Configurations	Construction, working, and V–I characteristics of BJT. Input and output characteristics of CE configuration. Comparison of CE, CB, and CC configurations.	3
	Part 3	Applications of Transistor	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).	5
	Part 4	Operational Amplifiers (Op-Amps)	Operational amplifiers (Op Amps): The Op-Amp - Block diagram, Schematic Symbol and 741 IC Pin diagram.	2
4. Digital Electronics and communication systems (17 Hrs)	Part 1	Communication Systems Fundamentals	General block diagram of a Communication system, Concept of AM and FM, Block diagram of AM and FM super-heterodyne receiver.	3
	Part 2	Wired and Wireless Communication	Basic concepts of Wired communication, Introduction to Wireless Communication, Evolution, Wireless LAN, Bluetooth, Zig-Bee and Personal Area Networks. Broadband Wireless Access-WiMax Technology, Wireless spectrum allocation and Standards.	5
	Part 3	Cellular and Advanced Communication Systems	Block diagram of GSM, Comparison of 3G, 4G, 5G and 6G communication technologies. Introduction to IoT and its applications.	4
	Part 4	Digital Electronics Fundamentals	Number Systems- Decimal, Binary, Octal and hexadecimal, and their conversions. Logic gates, Boolean algebra and rules of simplification.	5

SELF LEARNING ACTIVITIES (36 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Simulation/ Virtual Lab	Simulation tutorials on Ohm's Law and KCL/KVL using software like Multisim, PSpice, Falstad or any other Circuit Simulator.	4 Hrs	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
2	Solution of Matrix	Write MATLAB/Octave/Scilab code to solve mesh or nodal equations using matrix methods.	4 Hrs	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
3	Simulation/ Virtual Lab	Simulate RLC series circuits in Multisim/MATLAB and study phase difference between voltage and current.	4 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5

4	Technical Video Presentation	Watch video simulations of 1-pahse and 3-phase generation, rotation of phasors.	2 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5
5	Self Study/ Simulation	To plot/simulate the graphical representation of various electrical parameters (voltage, current and power) for different AC circuits.	4 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5
6	Exploratory Virtual Lab Study	Independently explore online virtual labs (IITB, Falstad, or TINA-TI) to observe the behavior of basic electronic components such as diodes, transistors, and operational amplifiers. Record key observations related to voltage/current characteristics and performance trends. *(Focus: concept familiarization, no formal evaluation)*	6 Hrs	1	CO3	WK3	PO1, PO2
7	Mini Project / Case Study	Undertake a small simulation-based study demonstrating any one digital or communication concept — for example, logic gate operations, AM modulation, or a simple IoT application concept. Submit a short summary of objectives, circuit/simulation results, and observations. *(Focus: creative application and self-driven learning)*	5 Hrs	2	CO4	WK5, WK6	PO2, PO3, PO4
8	Technical Review & Presentation	Prepare a concise report or presentation on emerging technologies such as ZigBee, WiMAX, PAN, 5G, 6G, or IoT, highlighting their key features and relevance in modern communication systems. *(Focus: independent research and communication skills)*	4 Hrs	2	CO4	WK6, WK7	PO4, PO10

TERM WORK ACTIVITIES (30 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Hardware Experiment	Build a simple DC resistive network using resistors and measure voltages/currents using a multimeter to verify KVL/KCL.	6 Hrs	1	CO1	WK1, WK2, WK3	PO1, PO2, PO5
2	Hardware Experiment	Demonstrate electromagnetic induction using a coil, magnet, and galvanometer.	1 Hrs	2	CO2	WK1, WK3, WK4	PO1, PO2, PO5
3	Hardware Experiment	Use a function generator and oscilloscope to measure amplitude, frequency, and RMS of AC signals.	3 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5, PO9

4	Hardware Experiment	Demonstrate star and delta connections using a 3-phase resistive load bank; measure line, phase voltages/currents and also power consumption.	2 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5, PO9
5	Analog Circuit Simulation and Verification	Simulate and verify the performance of analog circuits such as half-wave, full-wave rectifiers, filters, and transistor amplifiers using Multisim or TINA-TI. Compare simulated waveforms with theoretical predictions and submit a lab report. *(Focus: structured analysis and performance evaluation)*	5	1	CO3	WK3, WK4	PO1, PO2
6	Digital Circuit Implementation	Design and simulate basic digital logic circuits and Boolean expressions using logic gates. Verify truth tables and timing responses through software simulation. *(Focus: formal design verification and documentation)*	5	2	CO4	WK5	PO1, PO3
7	Communication System Simulation	Simulate the block diagram of a basic AM or FM transmitter-receiver, or a GSM model, using TINA-TI or equivalent tool. Analyze input/output waveforms and modulation behavior. *(Focus: applied understanding and result interpretation)*	5	2	CO4	WK6, WK7	PO2, PO3, 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 & Simulation	Correct, optimized, and complete implementation with proper documentation.	Implementation mostly correct; minor optimization issues.	Partial implementation with minor errors.	Incomplete or contains major functional errors.	No valid implementation attempted.
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 %

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN					
No: of Sections in the Question paper			2 (Each Sections has the following Question Pattern with Part A and Part B)		
Part	**No. of Questions/Module**	**Total No. of Questions**	**Max. marks/ Question**	**Part Summary**	**Total Marks**
A	2 (No choice)	4	3	4 x 3	12
B	2 (Including Choice)	4	9	2 x 9	18
TOTAL MARKS					**30**

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	DC Electric Circuits and Magnetic Circuits	15	3	3	9				15
2	AC Circuits	15	3	3	9				15
3	Introduction to Electronic Devices	13	6	9					15
4	Digital Electronics & Communication Systems	17	3	6	6				15
This shall be treated as a general guideline for students and teachers for distribution of marks.									

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
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, and 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, colour 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 Ki Cad, 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 (Ki Cad / 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, and 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, DE soldering 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 Ki Cad 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
3	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 Proof 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	Tinkercad 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 Ki Cad/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 as table) 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**	**Weigh tage**	**Excellent (100%)**	**Good (80%)**	**Satisfac tory (60%)**	**Needs Improveme nt (40%)**	**Poor (10%)**
1	Understanding & Conceptual Clarity	40%	Demonstrates complete understanding of concepts; applies theory correctly; shows deep comprehension	Good understandi ng; minor conceptual gaps; mostly correct application	Basic understa nding; some confusio n; limited applicati on	Weak understanding ; major gaps; incorrect application	No understan ding; unable to explain concepts
2	Experimental/Pr ogramming Skills	30%	Flawless execution; optimal approach; error-free; efficient solution; exceeds requirements	Good execution; minor errors; effective approach; meets requiremen ts	Basic executio n; several errors; simple approac h; partially meets require ments	Poor execution; major errors; inefficient approach; barely meets requirements	Unable to execute; non-functional ; does not meet requireme nts
3	Analysis, Interpretation, and Documentation.	30%	Professional quality; comprehensive ; accurate results; well-structured; exceeds expectations	Good quality; mostly accurate; clear structure; meets expectation s	Accepta ble quality; some inaccura cies; basic structure ; minimal expectat ions met	Poor quality; many inaccuracies; weak structure; below expectations	Unaccept able quality; incorrect; no proper structure

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

RUBRICS FOR CONTINUOS INTERNAL ASESSMENT							
Sl. No.	**Evaluation Criteria**	**Weightage**	**Excellent (100%)**	**Good (80%)**	**Satisfactory (60%)**	**Needs Improvement (40%)**	**Poor (10%)**
1	Preparation & Pre-lab Work	20%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understands	Partially completed, some confusion	Minimal effort, weak comprehension	No prep, unable to explain
2	Experimental/Programming Skills	20%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	10%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretation	Minimal interpretation, errors	No analysis

4	Attendance and Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted
5	Viva	10%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer
6	Internal Lab Examination	30%	Marks Scored by the student can be proportionally added to the Assessment based on the weightage.				

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

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
J1BSP212	**CHEMISTRY FOR ENGINEERS**				**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 impart the fundamental principles of electrochemistry, corrosion and energy-conversion systems used in modern electrical and electronic devices.
2	To familiarise students with engineering materials - nanomaterials, conducting polymers and organic electronic materials - and their role in contemporary electronics
3	To develop the ability to apply spectroscopic and analytical techniques to characterise materials and to address environmental chemistry challenges (water, waste, climate).

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply electrochemical principles to analyze electrochemical cells, energy storage and conversion devices, and corrosion protection techniques for engineering applications.	K3
2	Apply the principles of nanomaterials, advanced polymers, and functional electronic materials to select appropriate materials for emerging engineering applications.	K3
3	Apply spectroscopic and analytical techniques (UV-Vis, IR, XRD, SEM) to characterise materials.	K3
4	Apply water quality assessment, treatment, and sewage management principles to address engineering problems for societal well-being.	K3
5	Apply environmental-chemistry principles to evaluate waste-treatment processes and to discuss climate-change indicators and Sustainable Development Goals.	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	3	2	2	2	-	-	-	3	2	2	2	2	2	-	-	2	-	1			
2	3	2	3	2	-	2	-	-	-	3	2	2	2	2	-	-	-	2	-	1			
3	3	2	3	2	-	3	-	2	-	3	2	2	3	3	-	-	-	2	-	1			
4	3	2	3	2	3	2	2	-	2	3	2	2	2	2	3	-	2	2	-	2			
5	2	2	2	-	3	-	3	3	2	2	-	-	-	-	-	3	1	-	-	-			
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) - Photoelectrochemical 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 - Electroless plating of copper.	10
2	**Materials for Electronic Applications**	**Nano Materials** - Classification based on Dimension & Materials - Synthesis - Sol gel and Chemical Reduction - Applications of nanomaterials - Carbon Nanotubes - Fullerenes - Graphene - Carbon Quantum Dots - Structure, properties & application. **Polymers** - Fire Retardant Polymers - Halogenated & Non-halogenated polymers - Conducting polymers - Classification - Polyaniline & Polypyrene - synthesis, properties and applications. **Organic electronic materials and devices** - Construction, working and applications of Organic Light Emitting Diode (OLED) & Quantum Dot LED (QLED) - Materials used in Quantum computing Technology - Super capacitors - Spintronics.	8
3	**Molecular Spectroscopy and Analytical Techniques**	**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 **Vibrational Spectroscopy** - Principle - Number of vibrational modes - Vibrational modes of CO_2 and H_2O - Applications **X-ray Diffraction (XRD)** - Principle and applications in determining crystal structure and phase identification. **Scanning Electron Microscope (SEM)** - Principle, instrumentation and Applications.	9

4	**Environmental Chemistry**	**Water characteristics** - Hardness - Types of hardness - Temporary and Permanent - Disadvantages of hard water - Degree of hardness (Numericals) **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. **Waste Management** - Sewage water treatment - Primary, Secondary and Tertiary - Flow diagram - Trickling filter and UASB process. E Waste - Methods of disposal - Recycle, recovery and reuse. **Chemistry of climate change** - Greenhouse Gases- 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	3,5
12	Determination of calorific value using Bomb calorimeter	3,5
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, Kamaluddin, 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 edn., 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**	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) - Photoelectrochemical cell - DSSC (Dye sensitised solar cell).	3
	Part 4	**Corrosion and Corrosion Control Methods**	Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection - Electroplating of copper - Electroless plating of copper.	2
2.Materials for Electronic Applications	Part 1	**Classification and Synthesis of Nanomaterials**	Classification of nanomaterials based on Dimension & Materials - Synthesis - Sol gel and Chemical Reduction - Applications of nanomaterials.	2
	Part 2	**Carbon-Based Nanomaterials and Applications**	Carbon Nanotubes - Fullerenes - Graphene - Carbon Quantum Dots - Structure, properties & application.	2
	Part 3	**Functional Polymers**	Polymers - Fire Retardant Polymers - Halogenated & Non-halogenated polymers - Conducting polymers - Classification - Polyaniline & Polypyrrole - synthesis, properties and applications.	2
	Part 4	**Electronic Materials and Devices**	Organic electronic materials and devices - Construction, working and applications of Organic Light Emitting Diode (OLED) & Quantum Dot LED (QLED) - Materials used in Quantum computing Technology - Super capacitors - Spintronics.	2
3.Molecular Spectroscopy and Analytical Techniques	Part 1	**Fundamentals of Spectroscopy and Molecular energy levels**	Spectroscopy - Types of spectra - Molecular energy levels – Beer Lambert's law – Numerical problems	2
	Part 2	**Molecular Electronic Spectroscopy**	Electronic Spectroscopy – Principle, Types of electronic transitions – Role of conjugation in absorption maxima – Instrumentation - Applications.	3
	Part 3	**Vibrational Spectroscopy**	Vibrational Spectroscopy – Principle - Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications.	2
	Part 4	**Characterization Techniques**	X-ray Diffraction (XRD) – Principle and applications in determining crystal structure and phase identification. SEM - Principle, instrumentation, and Applications.	2

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 (Numericals).	2
	Part 2	**Water Softening Methods**	Ion exchange process - principle, procedure and advantages. Reverse osmosis – principle, process and advantages.	2
	Part 3	**Water Disinfection and Wastewater 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	**E - Waste Management and Climate Chemistry**	E Waste - Methods of disposal – Recycle, recovery and reuse - Chemistry of climate change- Greenhouse Gases - Ozone Depletion - Sustainable Development - An introduction to Sustainable Development Goals.	2

SELF LEARNING ACTIVITIES (30 Hrs)

Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	**Battery / Fuel-Cell Case Study**	Pick a real-world battery (e.g., Li-ion in an EV) or Fuel cell application; Write a structured 2-page report on operating principle, performance, and sustainability concerns.	6 Hrs	1	CO1	WK1 WK3 WK5 WK7	PO1 PO6 PO PO11
2	**Nanomaterials Survey**	Survey a recent journal/review article on graphene OR conducting polymers; produce a note on synthesis, properties, and electronic-engineering applications.	6 Hrs	2	CO2	WK1 WK3 WK8	PO1 PO2 PO9 PO11
3	**Spectra Interpretation Practice**	Take labelled IR and UV-Vis spectra from a public database; identify functional groups / transitions; submit annotated worksheets.	6 Hrs	3	CO3	WK1 WK2 WK3	PO1 PO4 PO5
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 Hrs	4	CO4	WK1 WK3 WK5 WK7	PO1 PO6 PO8 PO11
5	**Climate Change Awareness Activity**	Make a 1-page infographic showing greenhouse gases and their impact on climate change.	6 Hrs	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 corrosion	Study corrosion failures in engineering structures (bridges, pipelines, ships, automobiles, or offshore structures) and recommend suitable corrosion prevention methods.	8 Hrs	1	CO1	WK1 WK2 WK3	PO1 PO2 PO5
2	Concept-Based Quiz on Material Characterization Techniques	Students will prepare and conduct a 20–25 question concept-based quiz covering spectroscopy, XRD, SEM and nano materials	8 Hrs	2, 3	CO2, CO3	WK1 WK2 WK3	PO1 PO2 PO4 PO5 PO9
3	Environment / Sustainability Presentation	Prepare a short group presentation or poster on Climate change / Sustainable Development Goals (SDGs). Emphasize chemistry's role in sustainability.	8 Hrs	4	CO5	WK1 WK2 WK3 WK5 WK7 WK8 WK9	PO1 PO7 PO8 PO11
4	Mini Project: Water and Wastewater Analysis	Estimate hardness, chloride, or DO values of given water samples (or simulated data). Create a comparative table of methods (EDTA, Mohr, Winkler).	6 Hrs	4	CO4	WK1 , WK4 , WK7	PO1 PO7

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**	**Weigh tage**	**Excellent (5)**	**Good (4)**	**Satisfactor y (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 preparatio n; understan ds most objectives and procedure s.	Partial pre-lab work done; limited understandi ng 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 experime nt 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%	Analyze, Interpret and Document results correctly	Minor interpretat ion issues.	Some errors in analysis; interpretati on superficial.	Major errors in calculations; misinterprets results. Errors in Documentatio n	No meaningful analysis/int erpretation.

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	Materials for Electronic Applications	8	3	5	2				10
3	Molecular Spectroscopy and Analytical Techniques	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
J1EST263	**FUNDAMENTALS OF MECHANICAL AND CIVIL ENGINEERING**				**4**
Regulation	2026	L: T:P:H:S	4:0:0: 0:6	Notional Learning Hours/Semester	120
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))					
Course Type	TC	Course delivery Mode		Theory + Practical	
Scheme of Evaluation		CIE: 40 Marks	ESE: 60 Marks	Duration of ESE: 2 Hrs 30 Min.	
Pre-requisite	NIL				

COURSE OBJECTIVE	
1	Understand thermodynamic principles and cycles governing energy conversion systems used in electrical power generation.
2	Understand refrigeration cycles and psychrometric concepts relevant to electrical cooling and HVAC applications
3	To provide fundamental knowledge of Civil Engineering concepts, building components, construction materials, and services, enabling electrical engineering students to understand, interpret, and apply basic civil principles in the planning, installation, and estimation of electrical infrastructure works.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the principles of electromechanical energy conversion and thermodynamic cycles relevant to power generation and refrigeration systems.	K2
2	Apply psychrometric and fluid mechanics concepts to analyze HVAC systems and the operation of pumps and turbines in electrical applications.	K3
3	Summarize manufacturing, metal joining, and machining processes relevant to electrical and electronic component fabrication.	K2
4	Explain the role of Civil Engineering in electrical infrastructure development and demonstrate understanding of building components, materials, and basic building regulations relevant to electrical systems.	K3
5	Explain the basic structural components of buildings, modern construction materials, and essential building services, and interpret their relevance in planning and estimating works associated with electrical installations.	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	-	-	-	3	3	-	-	-	-	-	-	-	-	-	2	1	-
2	-	2	3	-	-	2	-	-	-	3	3	-	-	2	2	-	-	-	-	-	2	2	1
3	-	-	3	-	2	3	-	-	1	3	-	-	-	2	2	1	1	1	-	-	2	1	-
4	3	2	3	2	1	-	1	-	1	3	3	-	-	-	1	-	1	3	1	-	2	1	1
5	3	2	3	2	1	-	1	-	1	3	3	-	-	-	1	-	1	3	1	-	2	1	1
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																								

SYLLABUS			
Module	Title	Topics	Hours
1	**Thermodynamics, IC Engines and Refrigeration**	General introduction to Mechanical Engineering: Thermodynamic cycles - Carnot Cycle -Derivation of efficiency, Otto, Diesel cycles (no derivation of efficiency and problems). IC Engines: CI & SI Engines, working of 2-Stroke & 4-Stroke engines. Listing the parts of IC Engines. Concept of CRDI, MPFI and hybrid engines. Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Psychrometric chart, Cooling and dehumidification, Layout of central air conditioning systems.	12
2	**Fluid Machinery, Machine Elements, and Manufacturing Technology**	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump, and Pelton turbine. Different types of gears and its applications (spur, helical, bevel, worm and worm wheel), Clutches - function and their types (basics only). Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: Description with sketches of Arc Welding, Soldering and Brazing and their applications, CNC machining, 3D printing	13
3	**Introduction to buildings, building regulations, construction materials**	Role of Civil Engineers in nation building and sustainable development; Major disciplines and scope of Civil Engineering, Relevance of Civil Engineering to Electrical Engineers **Introduction to buildings:** Selection of site for a residential building; Load bearing and non-load bearing structures, components of a residential building and their functions (Brief introduction) **Relevance of NBC, KBR and CRZ:** Types of buildings as per NBC (In brief), Building area terminology, Drawing documents required for building permit as per KBR (Brief introduction only). **Introduction to Surveying:** Principles, Classification-based on instruments, based on purpose, based on method; accuracy and precision; Levelling: Principle, level line, horizontal line, datum, Simple levelling; Theodolite: Parts and working principle; Modern surveying: Total Station,	

		GNSS, GIS, GPS, Remote Sensing, Drones, and LiDAR – Principles and Applications. **Introduction to construction materials: Cement:** Ordinary Portland cement,, properties, uses, grades; **Aggregates:** qualities, classification; **Sand:** qualities, types; **Cement concrete:** ingredients, grades, processes, slump test, compression test; **Steel:** types, structural steel sections, uses, types of reinforcing bars; **Reinforced concrete**: properties and uses; **Bricks and stones:** classification, tests, qualities; **Timber products:** properties and uses of plywood, fibre board, particle board	
4	**Introduction to structural components, modern materials, basic infrastructure services and quantity surveying**	**Introduction to structural components: Foundations:** Bearing capacity of soil (definition only); shallow and deep foundations-types (brief discussion); **Brick masonry:** Terms; Bonds-header, stretcher, English, Flemish(elevation and plan of one & one and a half brick wall only); **Roofs and floors**: Types, material used; **Plastering & Pointing:** purpose. **Introduction to Modern materials**: Architectural glass, ceramics, plastics, composites, geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, prefabricated components (brief overview). **Basic infrastructure services:** MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings. **Introduction to quantity surveying:** Basic concept of quantity estimation and bill of quantities.	12

LIST OF EXPERIMENTS (20 Hours)		
Instructions • Minimum 10 Experiments are mandatory • Students should maintain a record of the lab experiments		
Sl. No.	**Experiment**	**CO**
MECHANICAL ENGINEERING (Minimum of 5 Experiments to be done)		
1	To identify various automobile parts and understand the working principle of an Internal Combustion (IC) engine through demonstration.	1
2	To recognize different types of hydraulic machines and comprehend the operating principles of hydraulic pumps and turbines through practical demonstrations.	2
3	To perform the process of pattern making or die selection and carry out sand casting to produce a simple component.	3
4	To forge metals by hand or machine, and to observe the differences in hardness of the materials before and after forging.	3
5	To join metal pieces using electric arc welding and practice making proper welded joints (butt, lap, and T-joints).	3
6	To study the working of CNC machines and understand how they perform automatic machining operations to produce accurate components.	3
7	To understand the basics of 3D printing — slicing a CAD model and observing the additive manufacturing process.	3

CIVIL ENGINEERING (Minimum of 5 Experiments to be done)		
1	a. Setting out practice. b. Transfer the level from one point to another using a water level.	
2	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.	
3	Draft a plan for 1BHK residential building using the given dimensions.	
4	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.	
5	Conduct field tests on cement and bricks.	
6	Determine the compressive strength of bricks and concrete cubes, timber parallel and perpendicular to the grain.	
7	Determine height of object whose base is inaccessible using Total Station.	
8	Determine the distance, gradient, distance, difference, height between accessible stations using Total Station.	

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1st Edition, 2013
2	Textbook of Basic Mechanical Engineering	R.K. Rajput	Laxmi Publications	3rd Edition, 2017
3	Fundamentals of Mechanical Engineering	G.S. Sawhney	PHI Learning Pvt. Ltd.	1st Edition, 2013
4	Materials for Civil and Construction Engineering	Mamlouk, M.S., Zaniewski, J. P	Pearson Publishers	2017
5	Building Construction, Volume1	Mckay, W.B., Mckay, J. K.,	Pearson India Education Services	
6	Construction Technology	Chudley, R	Longman group, England Course Plan	4th edn, 2007

REFERENCE

SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Automotive Engineering Fundamentals	Richard Stone and Jeffrey K. Ball	SAE International	1st Edition, 2014
2	Elements of Mechanical Engineering	K.P. Roy, S.K. Hajra Choudhury,	A.K. Hajra Choudhury Media Promoters & Publishers Pvt. Ltd.	Revised Edition, 2012
3	Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing	Ian Gibson, David W. Rosen, and Brent Stucker	Springer	2nd Edition, 2015

4	Building Construction	Punmia. B.C.	Laxmi Publications	2016
5	Engineering Materials	Rangwala S.C.	Charotar Publishers	2017
6	Basic Civil Engineering	Shibu Nalpat	Nalpat Publishers	2024
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc22_me65/preview			
2	https://www.youtube.com/watch?v=cj0-wSGGe6g			
3	https://www.youtube.com/watch?v=MKc6plBumYA			
4	https://onlinecourses.nptel.ac.in/noc22_ce42/preview - Introduction to civil engineering profession			
5	https://nptel.ac.in/courses/105102088 - Building materials and Construction			
6	https://onlinecourses.nptel.ac.in/noc22_me65/preview			
VIRTUAL LAB/SIMULATION TOOLS				
1	Online Interactive Psychrometric Chart / Calculator			
2	V-Lab (Virtual Lab) Manufacturing Processes			
3	https://cs-iitd.vlabs.ac.in/exp/cube-test/			
4	https://ms-nitk.vlabs.ac.in/exp/slump-test/			

COURSE CONTENTS AND LECTURE SCHEDULE (50 HOURS)

Module	Part	Part Name	Topics Covered	Hours
1.Thermodynamics, IC Engines and Refrigeration (12 Hrs)	Part 1	**Thermodynamics Fundamentals**	General introduction to Mechanical Engineering: Thermodynamic cycles - Carnot Cycle -Derivation of efficiency, Otto, Diesel cycles (no derivation of efficiency and problems).	3
	Part 2	**IC Engine Principles and Types**	IC Engines: CI & SI Engines, working of 2-Stroke & 4-Stroke engines. Listing the parts of IC Engines	3
	Part 3	**Advanced IC Engine Concepts**	Concept of CRDI, MPFI and hybrid engines.	3
	Part 4	**Refrigeration and Psychometrics**	Refrigeration: Unit of refrigeration, reversed Carnot cycle, COP, vapour compression cycle (only description and no problems); Definitions of dry, wet & dew point temperatures, specific humidity and relative humidity, Psychrometric chart, Cooling and dehumidification, Layout of central air conditioning systems.	3

2. Fluid Machinery, Machine Elements, and Manufacturing Technology (13 Hrs.)	Part 1	**Fluid Machinery**	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump, and Pelton turbine.	4
	Part 2	**Machine Elements**	Different types of gears and its applications (spur, helical, bevel, worm and worm wheel), Clutches - function and their types (basics only).	3
	Part 3	**Manufacturing Processes**	Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion, CNC machining, 3D printing	3
	Part 4	**Metal Joining Processes**	Metal Joining Processes: Description with sketches of Arc Welding, Soldering and Brazing and their applications,	3
3. Introduction to Civil engineering (15 Hrs)	Part 1	**Introduction to building and building regulations**	Role of Civil Engineers in nation building and sustainable development; Major disciplines and scope of Civil Engineering, Relevance of Civil Engineering to Electrical Engineers **Introduction to buildings:** Selection of sites for a residential building; Load bearing and non-load bearing structures, components of a residential building and their functions (Brief introduction) **Relevance of NBC, KBR and CRZ:** Types of buildings as per NBC (In brief), Building area terminology, drawing documents required for building permit as per KBR (Brief introduction only)	4
	Part 2	**Introduction to surveying**	**Surveying:** Principles, Classification-based on instruments, based on purpose, based on method; accuracy and precision; **Levelling:** Principle, level line, horizontal line, datum, Simple levelling; **Theodolite:** Parts and working principle **Modern surveying:** Total Station, GNSS, GIS, GPS, Remote Sensing, Drones, and LiDAR – Principles and Applications	4
	Part 3	**Introduction to construction materials**	**Cement:** Ordinary Portland cement, properties, uses, grades; **Aggregates:** qualities, classification; **Sand:** qualities, types; **Cement concrete:** ingredients, grades, processes, slump test, compression test; **Steel:** types, structural steel sections, uses, types of reinforcing bars; **Reinforced concrete**: properties and uses; **Bricks and stones:** classification, tests, qualities; **Timber products:** properties and uses of plywood, fibre board, particle board	5
4.	Part 1	**Introduction to structural components**	**Foundations:** Bearing capacity of soil (definition only); shallow and deep foundations-types (brief discussion) **Brick masonry:** Terms; Bonds-header, stretcher, English, Flemish (elevation and plan of one & one and a half brick wall only) **Roofs and floors**: Types, material used **Plastering & Pointing:** purpose	4

	Part 2	**Introduction to Modern materials**	**Modern materials**: Architectural glass, ceramics, plastics, composites, geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, prefabricated components (brief overview)	4
	Part 3	**Basic infrastructure services and introduction to quantity surveying**	**Basic infrastructure services:** MEP, HVAC, elevators, escalators and ramps (Civil Engineering aspects only), fire safety for buildings. **Introduction to quantity surveying:** Basic concept of quantity estimation and bill of quantities.	4

SELF LEARNING ACTIVITIES (20 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	**Research Report**	Prepare a brief report on Hybrid Engine technology or Central Air Conditioning System layout, focusing on recent innovations.	10 hrs.	1	1,2	WK4, WK8	PO8, PO12
2	**Civil Engineering in Media**	Students shall watch a documentary or read about two major infrastructure projects—one from India and one from abroad—focusing on the role of electrical systems in construction, power distribution, and sustainability. They shall prepare a short, illustrated report and present key insights on how electrical engineering integrates with large-scale civil infrastructure.	10 hrs.	3,4	3,4	WK1, WK3, WK4, WK6, WK8	PO1, PO6, PO9

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	**Mechanical System Model**	In a group of 3-4, create a detailed sketch or simple 3D model (using free CAD tool or physical materials) of any one key component: a 4-stroke engine system, a centrifugal pump, or a gear train.	10 hrs	1,2	1,2	WK3, WK6	PO1, PO8
2	**Field Visit and utility plan**	Students shall visit a completed multistoried building to study how civil layouts support electrical installations and utility services. They shall prepare site and utility plans showing key electrical components, service routes, and related civil features using manual drafting or CAD. The activity helps understand the coordination between civil and electrical systems in building design.	10 hrs	3,4	3,4	WK1, WK3, WK4, WK6	PO1, PO2, PO4, PO6, PO9, PO11
3	**Field work**	Preparation of Bill of Quantities (BOQ) for Civil Works related to Electrical Installation	10 hrs	4	3,4	WK1, WK2 WK3, WK4, WK6	PO1, PO2, PO4, PO6, PO9, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.No	**Evaluation Criteria**	**Excellent (5)**	**Good (4)**	**Satisfactory (3)**	**Needs Improvement (2)**	**Poor (1)**
1	Completeness	All tasksdone with extra depth, innovative additions	Altasks complete, 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 conceptua l gaps	Incorrect or no implemen tation
3	Documentation & Presentation	Well-structured, clear, professional	Structured but with small lapses	Understanda ble but lacks clarity	Poorly structured	No document ation

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 withpre-labwork completed; demonstrates clear understandin g of objectivesan d procedure.	Minor gaps inpre-lab preparatio n; understan ds most objectives and procedures .	Partial pre-lab work done; limited understandin g of objectives.	Minimal preparation; weak understanding of experiment.	No preparation; unable to explain objectives/pr oce dure.
2	Experiment al Skills & Performanc e	40%	Performs experiment independentl y 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 e ven with help
3	Analysis, Interpretati on and Documentati on	30%	Analyze, Interpret and Document results correctly	Minor interpretat ion n issues.	Some errors in analysis; interpretation superficial.	Major errors in calculations; misinterprets results. Errors in Documentation	No meaningful analysis/int erpret ation.

ASSESSMENT PATTERN	
Assessment	**Weightage**
Continuous Internal Assessment	**60%**
Lab Evaluation	30 %
Learning Activity (Self Learning, Term Work, Assignments,)	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	**Thermodynamics, IC Engines and Refrigeration**	12	3	4	3	-	-	-	10
2	**Fluid Machinery, Machine Elements, and Manufacturing Technology**	13	3	4	3	-	-	-	10
3	**Introduction to buildings, building regulations, construction materials**	13	3	4	3	-	-	-	10
4	**Introduction to structural components, modern materials, basic infrastructure services and quantity surveying**	12	3	4	3	-	-	-	10
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	1 (No choice)	4	3	4x 3	12
B	2 (Including Choice)	4	7	4 x 7	28
TOTAL MARKS					**40**

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
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 analyse, 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 rolestorming 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	L	9	I/G	2		CO4
11.3	identify errors in English language usage 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.	**24**	Basic practical engineering skills	**3**

	11. Union and valves connection practice in pipes. 12. Foot valve fitting practice. 13. Water pump seal and bearing changing practice			
2	Language Lab sessions	-	Language Skills	**4**

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.No.	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.No.	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	Ramesh 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, • Concerns, • Areas in which he/she hesitates to take advice, • Goals/Expectations, from the point of view of the following assumed roles • their parent/guardian/mentor their friend/sibling/cousin **<u>Skills to be developed:</u>** • Goal setting - Identification of skills and setting goal • Self-awareness • Discussion in groups Group work- Compiling of ideas Mind mapping	3
	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 their 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 hat 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.No.	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.No.	**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
J1EET207	**MEASUREMENTS AND INSTRUMENTATION**				**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	To introduce the fundamental principles, functional elements, and performance characteristics of electrical and electronic measurement systems.
2	To explain the working principles and applications of various instruments used for measuring electrical, magnetic, and energy quantities.
3	To familiarize students with different types of transducers, their characteristics, and the basics of data acquisition and display systems.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the knowledge of functional elements, measurement errors, operating torques, and damping methods to explain the construction and operation of moving coil and moving iron instruments, and solve problems related to range extension using shunts and multipliers.	K3
2	Apply appropriate methods and measuring instruments to determine resistance, inductance, capacitance, and magnetic quantities using bridges and meters.	K3
3	Apply the principles of wattmeters, energy meters, and instrument transformers for the measurement and analysis of electrical quantities.	K3
4	Apply the principles of transducers and data acquisition systems to measure physical and electrical parameters	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	-	-	-	-	-	3	2	-	-	2	-	-	-	-	-	-	3	1	1
2	-	2	3	2	-	-	-	-	-	3	3	-	-	2	-	-	-	-	-	-	3	2	1
3	-	2	3	2	-	2	-	-	-	3	3	-	-	2	-	-	-	-	-	-	3	2	1
4	-	-	2	3	-	2	-	2	-	3	3	-	2	3	-	-	-	-	-	-	2	3	2
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - "-"																								

SYLLABUS			
Module	Title	Topics	Hours
1	**Fundamentals of Measurement Systems**	Introduction to Measuring Instruments: Functional elements of measurement systems - Block Schematic and operation of building blocks, Need for measurement systems, Static and dynamic characteristics of measuring instruments, Types of measuring instruments, Types of errors. Operating Forces and Torques: Concept of deflecting, controlling, and damping torques. Methods of control – gravity control and spring control. Methods of damping – air friction, fluid friction, and eddy current damping. Ammeters and Voltmeters: Moving coil and moving iron instruments – constructional details and operating principles only. Range extension using shunts and multipliers (include simple numerical problems).	11
2	**Measurement of Electrical and Magnetic Quantities**	Measurement of Resistance: Measurement of insulation resistance – loss of charge method. Measurement of earth resistance – fall of potential method and earth tester. DC Bridges: Wheatstone bridge, Kelvin double bridge. AC Bridges: Maxwell bridge, Schering bridge, and Wien's bridge. Magnetic Measurements: Measurement of flux and permeability - Flux meter, determination of B–H curve, hysteresis loop (method of reversal).	11
3	**Measurement of Power and Energy**	Measurement of power: Dynamometer type wattmeter construction and working - 3-phase power measurement - three wattmeter method and two wattmeter methods (Include simple problems of two wattmeter method). Measurement of energy: Induction type 1-phase energy meter, Two Element Energy Meter- construction and working. Digital Energy meters -Time of Day (TOD) and Smart metering (description only). Instrument Transformers -CT and PT- Principle of Operation (Concepts only) - Extension of range using instrument transformers.	11
4	**Transducers and Data Acquisition Systems**	Transducer: Definition, Classification based on the principle of operation, Factors influencing the selection of transducers. Characteristics and choice of transducers. Advantages of Electrical transducers, Resistive transducers (strain gauges), inductive transducer (LVDT), Photoelectric transducers and Thermal transducers (Thermocouples, RTDs, and thermistors). Data Acquisition Systems: Principles of Digital Data Acquisition systems (Basic Principles only), PMU, CRO and DSO (Block Schematic and Description Only), Virtual Instrumentation Systems (Block schematic and Description only).	12

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1.	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawhney	Dhanpat Rai & Co.	2023
2	A Course in Electrical and Electronic Measurement and Instrumentation	J. B. Gupta	S. K. Kataria & Sons	14th Ed., 2014
3	Electronic Instrumentation	H. S. Kalsi	McGraw Hill	2019
4	Principles of Electrical Measurement	S. Tumansky	Taylor & Francis	2006
REFERENCE				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Modern Electronic Instrumentation and Measurement Techniques	Albert D. Helfrick, William D. Cooper	Prentice Hall of India	2016
2	Doebelin's Measurement Systems	E. O. Doebelin, D. N. Manik	McGraw Hill Education	7th Ed., 2019
3	Electrical and Electronics Measurements and Instrumentation	P. Purkait et al.	McGraw Hill Education	2013
VIDEO LINKS				
1	"Electrical Measurement and Electronic Instruments" – NPTEL nptel.ac.in/courses/108105153			
2	NPTEL – Industrial Instrumentation – NPTEL nptel.ac.in/courses/108105064?utm			
VIRTUAL LAB/SIMULATION TOOLS				
1	**Virtual Labs – IIT Bombay** (https://elms-iitr.vlabs.ac.in/)	Experiments on bridges, meters, and transducers.		
2	NI ELVIS / Proteus	Virtual lab tools for sensor simulation.		
3	**Falstad Circuit Simulator** (falstad.com/circuit)	Quick visual analysis of AC/DC circuits and measurements.		
4	LabVIEW	NI's graphical programming platform for virtual instrumentation, data acquisition, and sensor interfacing.		

COURSE CONTENTS AND LECTURE SCHEDULE				
Module	Part	Part Name	Topics Covered	Hours
Fundamentals of Measurement Systems (11 Hrs)	Part 1	Introduction to Measuring Instruments	Functional elements of measurement systems - Block Schematic and brief operation of building blocks, Need for measurement systems, Static and dynamic characteristics of measuring instruments, Types of measuring instruments, Types of errors.	3
	Part 2	Operating Forces and Torques	Concept of deflecting, controlling, and damping torques. Methods of control – gravity control and spring control. Methods of damping – air friction, fluid friction, and eddy current damping.	4
	Part 3	Ammeters and Voltmeters	Moving coil and moving iron instruments – constructional details and operating principles only. Range extension using shunts and multipliers (include simple numerical problems).	4
Measurement of Electrical and Magnetic Quantities (11 Hrs)	Part 1	Measurement of Resistance	Measurement of insulation resistance – loss of charge method. Measurement of earth resistance – fall of potential method and earth tester.	3
	Part 2	DC Bridges & AC Bridges	Wheatstone bridge and Kelvin double bridge, Maxwell bridge, Schering bridge, and Wien's bridge – theory, phasor diagram, and balance conditions.	5
	Part 3	Magnetic Measurements	Measurement of flux and permeability - Flux meter, determination of B–H curve, hysteresis loop (method of reversal).	3
Measurement of Power and Energy (11 Hrs)	Part 1	Measurement of Power	Dynamometer type wattmeter construction and working - 3-phase power measurement - three wattmeter method and two wattmeter methods (Include simple problems of two wattmeter method).	4
	Part 2	Measurement of Energy	Measurement of energy: Induction type 1-phase energy meter, Two Element Energy Meter-construction and working. Digital Energy meters - Time of Day (TOD) and Smart metering (description only).	4
	Part 3	Instrument Transformers	CT and PT- Principle of Operation (Concepts only) - Extension of range using instrument transformers.	3
Transducers and Data Acquisition Systems (12 Hrs)	Part 1	Transducers: Classification and Selection	Transducer: Definition, Classification based on the principle of operation, Factors influencing the selection of transducers. Characteristics and choice of transducers. Advantages of Electrical transducers,	3
	Part 2	Resistive, Inductive, Photoelectric and Thermal Transducers	Resistive transducers (strain gauges), inductive transducers (LVDT), Photoelectric transducers and Thermal transducers (thermocouples, RTDs, and thermistors).	5
	Part 3	Data Acquisition and Display Systems	Data Acquisition Systems: Principles of Digital Data Acquisition systems (Basic Principles only), PMU, CRO and DSO (Block Schematic and Description Only), Virtual Instrumentation Systems (Block schematic and Description only).	4

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl. No	Activity	Description	Time	Module	CO	WK	PO
1	Measurement Standards and Basics	Watch NPTEL lecture *"Introduction to Measurement and Instrument Characteristics"* (IIT Kharagpur). Write a short note on accuracy, precision, and sensitivity.	5 Hrs	1	CO1	WK1, WK2	PO1, PO2
2	PMMC and MI Instruments Study	Observe construction and operation from NPTEL videos. Draw neat diagrams, label parts, and state one application each.	5 Hrs	1	CO1	WK3	PO1, PO5
3	Bridge Circuits (Virtual Lab – IIT Bombay)	Perform simple Wheatstone & Maxwell bridge experiments using Virtual Labs. Verify balance condition and record readings.	5 Hrs	2	CO2	WK3, WK6	PO2, PO5
4	Power and Energy Measurement (NPTEL)	Watch *"Dynamometer Type Wattmeter"* and *"Induction Energy Meter"* videos. Write half-page summaries on working principles.	5 Hrs	3	CO3	WK3, WK4	PO1, PO2
5	Transducers and Sensors Study	Study *"Sensors and Transducers"* (IIT Delhi). Prepare a comparison chart of resistive, inductive, and thermal transducers with one use each.	5 Hrs	4	CO4	WK4, WK6	PO1, PO5
6	Shunt/Multiplier Design and Damping Characteristics Study	Study instrument damping methods, solve quantitative design problems for meter range extension using shunts and multipliers, and submit a report.	5 Hrs	1	CO1	WK1, WK3, WK4	PO1, PO2, PO5

TERM WORK ACTIVITIES (15 Hrs)							
Sl. No.	**Activity**	**Description**	**Time (Hrs)**	**Module**	**CO**	**WK**	**PO**
1	Measurement Systems Report	Solve and document a set of instrument-characteristic and bridge-measurement problems with neat circuit diagrams.	5 Hrs	1, 2	CO1, CO2	WK1, WK3, WK4	PO1, PO2, PO5
2	Error and Calibration Exercise (Analytical)	Calculate absolute, relative, and percentage errors using given instrument data; draw a simple calibration curve.	5 Hrs	1	CO1	WK2, WK3	PO2
3	Study of Measurement Standards and Instrument Symbols	Prepare a chart showing BIS/ISO symbols, standard quantities, and corresponding measuring devices.	5 Hrs	1	CO1	WK1	PO1

RUBRICS FOR TERM WORK EVALUATION						
Sl. No	Evaluation Criteria	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Understanding of Concept	Demonstrates complete understanding of principles and theory.	Clear understanding with minor errors.	Adequate but lacks depth	Partial understanding	Very limited understanding
2	Implementation / Simulation	Circuit/system implemented correctly with proper documentation.	Mostly correct; minor issues.	Functional with some errors.	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Detailed analysis and result validation.	Clear verification with some analytical depth.	Limited analysis; lacks comparisons.	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	Average teamwork.	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 Measurement Systems	11	3	9	3				15
2	Measurement of Electrical and Magnetic Quantities	11	3	3	9				15
3	Measurement of Power and Energy	11	3	9	3				15
4	Instrumentation and Data Acquisition Systems	12	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
J1ESL248	**INFORMATION TECHNOLOGY 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: 0	Duration of ESE: 2 Hr 30 Min.	
Pre-requisite	Nil				

COURSE OBJECTIVE	
1	To develop a foundational understanding of computer systems, including hardware components, operating systems, and basic networking concepts..
2	To equip students with practical skills in Linux/Unix environments, including command-line operations, shell scripting, and system-level interactions.
3	To enable learners to design and develop basic web applications, using HTML, CSS, and JavaScript, along with version control tools for project management.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Experiment with fundamental computer hardware components and demonstrate their iteraction with system software.	K3
2	Apply Linux/Unix command-line operations and develop basic shell scripts for system-level tasks.	K3
3	Perform network configuration and troubleshooting using standard networking tools and commands	K3
4	Develop basic web pages and interactive elements using HTML, CSS, and JavaScript.	K3
5	Utilize development tools and version control systems (Git/Bitbucket) for managing and deploying simple projects.	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	2										2		
2	2	3	2			2				3	2										2		
3	2	3	2			2				3	2	2									2		
4	2	3	2	2		2				3	3	2									2	2	
5	2	3	2	2		2				3	3	2									2	2	2

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

SYLLABUS			
Module	Title	Topics	Hours
1	**Computer Hardware & Operating Systems**	Computer hardware components, peripherals, boot process, installation of Linux and Windows OS, basic Unix/Linux commands	6
2	**Networking Fundamentals & Configuration**	Networking hardware (RJ45, UTP, fibre, switch, router, WAP, modem), networking commands (ipconfig, ping, traceroute, ssh, ftp), network setup and configuration	6
3	**Network Analysis & System Tools**	Network traffic analysis using Wireshark/Packet Tracer, shell programming in Linux (bash), basic LaTeX usage	9
4	**Web Development & Version Control**	HTML, CSS, JavaScript, form validation, image slider, deploying web pages, development environments (VS Code, Sublime), Git/Bitbucket	9

LIST OF EXPERIMENTS (30 Hours)

Instructions

- Lab experiments must be implemented in corresponding programming languages
- Minimum 10 Experiments are mandatory
- Suitable Data/ Datasets can be used whenever required
- Students should maintain a record of the lab experiments.

Sl. No.	Experiment	CO
1	Practice Computer Hardware – Familiarization CPU Box, Motherboard, CPU & Chip-set, Interface cards, Card slots, Hard disk, Cables, SMPS, NIC, Various ports, etc. Computer Peripherals - I/O Devices. Storage devices, Interface cards – Buses – Firmware	CO1
2	Familiarization of Boot process	CO1
3	Familiarizing installation of Linux and Windows operating systems	CO1
4	Familiarizing basic Unix/Linux commands - ls, mkdir, cp, mv, grep, rmdir, chmod, useradd, passwd, history, dmesg, CPU info, uname, du, time, write, fdisk	CO2
5	Familiarizing networking hardware - RJ45, UTP, fibre, switch, NIC, router, Wireless Access Point (WAP), modem	CO3
6	Familiarizing basic networking commands - ipconfig, ping, traceroute, lookup, ssh, scp, telnet, ftp	CO3
7	View network traffic using Wireshark/Packet tracer	CO3
8	Familiarizing the steps how to configure and establishing a network connecting	CO3
9	Shell programming in Linux(bash)	CO2
10	Create a web page and deploy on a local web server.	CO4
11	Use JavaScript to validate forms.	CO4
12	Create an image slider using HTML, CSS, and JavaScript. Allow users to navigate between images using previous and next buttons.	CO4
13	Familiarisation of LaTeX - Basic only	CO5
14	Familiarisation of Development Environments - Visual studio code, Sublime Text, Atom	CO5
15	Introducing Repositories - Git / Bitbucket	CO5

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Invitation to Computer Science	G. Michael Schneider, Judith Gersting	Cengage	2/e, 2020
2	LINUX for Developers: Jumpstart Your Linux Programming Skills	William Rothwell	Pearson	1/e, 2018
3	HTML, CSS, and JavaScript - All in One, Sams Teach Yourself	Julie C. Meloni, Jennifer Kyrnin	Pearson	1/e, 2018
REFERENCE				
SL. No	Name of Book	Name of Author/s	Publisher	Year
1	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin, Greg Gagne	Wiley	2018
2	Computer Networking: A Top-Down Approach	James F. Kurose, Keith W. Ross	Pearson	2021
3	HTML and CSS: Design and Build Websites	Jon Duckett	Wiley	2011
VIDEO LINKS				
1	https://overthewire.org/wargames/bandit/			
2	https://www.w3schools.com/			
SIMULATION TOOLS				
1	Wireshark, Packet Tracer			

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 CONTINUOS INTERNAL ASESSMENT							
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.				

RUBRICS FOR END SEMESTER EXAMINATION							
Sl. No.	Criteria	Weigh tage	Excellent (5)	Good (4)	Satisfactor y (3)	Needs Improvement (2)	Poor (1)
1	Experimental Preparation	20%	Clear plan, correct setup, uses resources wisely	Mostly clear, few oversights	Basic preparatio n	Disorganized, unprepared	No attempt
2	Problem Solving/Executi on	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 correctnes s	Mostly incorrect	No output
4	Inference/Interpr etation (Viva Voce)	20%	All results correctly interpreted, strong insights	Good understand ing	Basic interpretat ion	Minimal/incor rect	No inferenc e
5	Record Submission	10%	Outstanding understanding, all questions answered	Good responses, minor errors	Satisfactor y, basic answers	Poor knowledge, incomplete	Does not submit

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