

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:	
1	Apply Gauss elimination and eigenvalue methods to solve linear systems and reduce quadratic forms to canonical form.
2	Solve homogeneous and non-homogeneous second-order ordinary differential equations using the methods of undetermined coefficients and variation of parameters
3	Compute areas and volumes by evaluating double and triple integrals in Cartesian, polar and cylindrical coordinate systems.
4	Construct Taylor, Maclaurin and Fourier series representations of functions for engineering analysis applications.

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 $k\gamma x$, kx^n, $k\cos\omega x$, $k\sin\omega x$, $k\alpha x\cos\omega x$, $k\alpha x\sin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE (with constant coefficients), Solution by variation of parameters (Second Order). 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.	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.	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	Hou rs
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 $k\epsilon^{\gamma x}$)	3
	Part 3	Initial value Problem	Particular solution by the method of undetermined coefficients (Particular solutions for the functions kx^n , $k\cos\omega x$, $k\sin\omega x$, $k\epsilon^{ax}\cos\omega x$, $k\epsilon^{ax}\sin\omega x$), Initial value Problem for Non-Homogeneous Second order linear ODE (with constant coefficients),	3
	Part 4	Method of Variation of Parameters 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.	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	CO 1	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	CO 2	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	CO 3	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	CO 4	WK2, WK3	PO1, PO2, , PO5, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Verification of Linear System Solutions using Determinant and Rank Conditions	Students will manually verify consistency of different linear systems using determinant and rank criteria. Compare the theoretical results with numerical verification using a calculator or Python (optional). Prepare a tabular summary showing consistent/inconsistent systems.	5 Hrs	1	CO1	WK2, WK3	PO1, PO2, PO5
2	Differential Equations Assignment	Prepare a graded report solving non-homogeneous and Euler-Cauchy ODEs by hand, with engineering-context examples and verification of results.	5 Hrs	2	CO2	WK1, WK2, WK3	PO1, PO2, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	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
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN

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

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

COURSE OBJECTIVE

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

COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

SYLLABUS

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

LEADERS OF TOMORROW

LIST OF EXPERIMENTS (24 hours)

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

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

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

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

REFERENCE

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

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

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

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

SELF LEARNING ACTIVITIES (30 Hrs)

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

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

TERM WORK ACTIVITIES (30 Hrs)

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

RUBRICS FOR TERM WORK EVALUATION

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

LAB EVALUATION RUBRICS

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

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

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

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

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

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

LIST OF EXPERIMENTS (24 Hours)

Instructions

- Lab experiments must be implemented in Python
- Minimum 12 Experiments are mandatory
- Each student should maintain a record with Aim, algorithm, code, and output.
- Programs should follow proper indentation and coding standards.
- Continuous evaluation will be based on performance, timely submission, and viva.

Sl. No.	Experiment	CO
1*	Basic Input and Output Operations – Read the name, address, email, and phone number of a person through the keyboard and print the details.	1
2	Temperature Conversion – Convert temperature values between Celsius and Fahrenheit.	2
3*	Mathematical Calculations – Write programs to find the area and perimeter of a circle and a rectangle. Write a program to calculate compound interest when principal, rate, and number of periods are given.	2
4*	Simple Arithmetic Calculator – Develop a simple desktop calculator using Python that performs five basic arithmetic operations.	3
5*	Decision Making Programs – Write Python programs to check whether a number is odd/even, check leap year, and find the largest among three numbers.	3,4
6*	Grading System – Display the grade of a student corresponding to the marks entered.	4
7*	Number Operations – Write programs to find the sum of n natural numbers, and check whether a number is an Armstrong number or palindrome.	4
8*	Loops and Iterations – Generate Fibonacci sequence using a while loop and display all prime numbers in a given interval.	4
9	Pattern Generation – Implement Floyd's triangle using nested loops.	4
10*	Functions and Validation – Write a Python program to: a) validate a password using a function with specific criteria (length, case, digit, special character). b) Check whether a given mobile number is valid or not using a function.	4
11*	Recursion – Write a Python program to find the factorial of a number using a recursive function.	4
12*	List Manipulation – Input two lists, merge them such that even numbers appear first (sorted), followed by odd numbers (sorted). Write a Python program to check whether a string is a palindrome or not.	4
13*	Counting and Searching in Lists – Write a python program to Count positive, negative, and zero values; find words starting with vowels in a list.	4
14*	Dictionary Operations – Perform various dictionary manipulations such as displaying student marks, finding highest marks, counting pass students, and modifying entries.	4
15	Tuple Operations – Write a Python program to perform operations on a tuple of marks — find highest, lowest, average, count above 75, create new tuple, and check for specific value.	4

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL.	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.	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. Necaie	Wiley	3/e, 2024
3	Python Programming: An Introduction to Computer Science	J. Zelle	Franklin, Beedle & Associates Inc.	2010s
5	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, Jupyter Notebook)
3	Google Colab

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

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	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	CO 1	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	CO 1	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	CO 2	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	CO 2	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	CO 3	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	CO 3	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	CO 4	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	CO 4	WK3, WK6, WK8	PO2, PO3, PO5

TERM WORK ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Problem Solving Strategies	Apply Trial & Error, Heuristics, Means-Ends Analysis, and Backtracking to a puzzle/problem and record outcomes.	4	1	CO1	WK1, WK2	PO1, PO2
2	Problem Solving Process	Model a real-world problem (e.g., grade analysis, electricity bill) into steps: understanding → model → algorithm.	3	1	CO1	WK1, WK4	PO1, PO2
3	Algorithm Design	Prepare algorithms for basic computational problems (e.g., area calculation, sum of numbers, temperature conversion) using standard notation tools.	4	2	CO2	WK1, WK3	PO1, PO2
4	Pseudocode Writing and Representation	Write well-structured pseudocode for real-world processes involving sequencing, selection, and repetition (e.g., ATM withdrawal, grading system).	3	2	CO2	WK1, WK3	PO1, PO2
5	Python Fundamentals Practice	Develop programs to perform input/output operations, work with variables, data types, operators, and expressions. Test for correct syntax and logic.	4	3	CO3	WK2, WK3	PO1, PO5
6	Control Structures Implementation	Implement programs using decision-making and looping constructs (if-else, for, while) with validation-based examples and user inputs.	4	3	CO3	WK2, WK6	PO1, PO5
7	Function-Based Problem Solving	Design and implement Python programs using user-defined and recursive functions for problems such as factorial, Fibonacci, and prime number checks.	3	4	CO4	WK3, WK6	PO1, PO2, PO5
8	Data Structures and Modular Programming	Work with sequence data types (list, tuple, dictionary) and apply modularization concepts using function calls for reusable code.	5	4	CO4	WK3, WK6	PO2, PO5

RUBRICS FOR TERM WORK EVALUATION						
Sl .	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.	Criteria	Weight age	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

(AUTONOMOUS)
 CREATING TECHNOLOGY
 LEADING GROWTH
 ESTD 2002

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

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

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

COURSE ARTICULATION MATRIX																									
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes															
	WK									PO											PSO				
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3		
1	3	2	2	-	-	-	-	-	-	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	
2	3	3	3	2	-	-	-	-	-	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	
3	2	3	3	2	2	-	-	-	-	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	
4	2	2	3	3	2	2	-	-	-	3	3	2	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.	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.	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. Fundamental s 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.	Activity	Description	Time	Module	CO	WK	PO
1	NPTEL Video Review	Watch NPTEL lectures on <i>Force Systems and Equilibrium</i> (IIT Madras) and summarize key concepts with examples.	6	1	CO1	WK, 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	WK, 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	WK, 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	WK, WK4	PO5, PO2
5	Mini Research / Article Review	Review an engineering article on <i>vibration control in mechanical systems</i> and present a summary connecting it to course concepts.	6	3	CO5	WK, WK6	PO1, PO7

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Laboratory Demonstration / Simulation	Perform virtual lab experiments (IIT Delhi/Amrita VLABS) on <i>Equilibrium of Forces, Ladder Friction, and Beams with Loads</i> . Submit an observation sheet.	5	1, 2	CO1, CO2	WK, WK4	PO4, PO5
2	Group Assignment	Prepare a group assignment on <i>Applications of D'Alembert's Principle and Lift Motion</i> using real-life case examples.	5	3	CO4	WK, 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	WK, WK6	PO3, PO5, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	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	11	3	3	9				15
2	Friction, Centroid, and Moment of Inertia	12	3	3	9				15
3	Kinematics and Kinetics of Particles and Rigid Bodies	11		3	12				15
4	Rotational Motion and Mechanical Vibrations	11	3	3	9				15
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

END SEMESTER EXAMINATION (ESE) QUESTION PAPER PATTERN

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

Course Code	Course Name					Credits
J1EST145	ENGINEERING SCIENCE FOR CONSTRUCTION					4
Regulation	2026	L: T:P:H:S	4:0: 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	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 fundamentals of Civil Engineering, its disciplines, scope, and types of structures and buildings.
2	To provide knowledge on conventional and modern construction materials, their properties, uses, and basic testing methods along with foundation concepts.
3	To develop an understanding of sustainability principles, green buildings, and the use of eco-friendly and recycled materials in construction.
4	To familiarize students with green building systems, infrastructure services, life cycle analysis, and circular economy concepts in civil engineering.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the scope of Civil Engineering, types of structures, building components, and relevant building regulations (NBC, KBR, CRZ).	K2
2	Identify and describe construction materials, their properties, uses, and perform basic field tests along with understanding foundation types.	K2
3	Apply the concepts of sustainability and sustainable development in civil engineering practices.	K2
4	Analyze the importance of green buildings, SDGs, and sustainable infrastructure, including energy, water, and material efficiency.	K2
5	Understand and evaluate green building rating systems, infrastructure services, life cycle analysis, and circular economy principles.	K2

COURSE ARTICULATION MATRIX

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

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

SYLLABUS

Module	Title	Topics	Hours
1	Introduction to Civil Engineering	General Introduction to Civil Engineering: Major disciplines and scope of Civil Engineering, and type of buildings. Types of Civil Engineering Structures: Residential, commercial, transportation, hydraulic, coastal, retaining, water supply and waste management facilities. Role of Civil Engineers in nation building and sustainable development. Residential Planning and NBC Classification: Types of buildings as per NBC, Load bearing and non-load bearing structures, components of a residential building and their functions (concept only), Selection of site for a residential building Relevance of NBC, KBR and CRZ : Relevance of NBC, KBR & CRZ norms (brief discussion of relevance only Building Area Definitions: Built up area, Plinth area, Carpet area and Floor area ratio as per KBR	15
2	Construction Materials and Foundations	Conventional materials and modern materials: Types, properties and uses of brick, stone, timber, iron, steel, cement, sand, cement mortar and concrete; Field tests on brick, cement and concrete. Modern construction materials: Modern materials: Architectural glass, ceramics, plastics, composites, SCMs,	15

		geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, , (brief overview) Foundations: Bearing capacity of soil (definition only); shallow and deep foundations-types (brief discussion only)	
3	Sustainability in Civil Engineering	Concept of sustainability and sustainable development: Environmental, social, and economic pillars of sustainability. Environmental problems caused by unsustainable practices (pollution, waste, resource depletion). Sustainable Development Goals (SDGs) and their relevance to civil engineering. Sustainable Infrastructure importance (roads, buildings, water systems) (2hrs). Green buildings: Basic principles of sustainable design, Sustainable construction Materials, energy and water efficiency and waste management. Green Materials Sustainable and locally available materials: Mud as a Building material, Cross Laminated Timber, Stone as a building Material, Straw bale, Laterite Quarry Waste Alternate building materials, Benefits of using eco-friendly construction materials. Use of waste and recycled materials (fly ash, GGBS, recycled aggregates)., bamboo, Construction and Demolition waste, reclaimed wood, recycled glass, rubber, plastic, Hemp Crete	15
4	Green Building Systems and Sustainable Infrastructure in Civil Engineering	Green Building Rating Systems: Overview of green building rating system, LEED, GRIHA, IGBC; key parameters considered in rating, benefits. Carbon footprint: Sources, types of carbon foot, basic calculation, print, environmental impact, overview on carbon foot prints in buildings, reduction strategies, benefits, case studies Net-Zero Energy Buildings (NZEB): principles, components, renewable energy integration, energy balance concept Infrastructure services: Civil Engineering aspects of MEP, HVAC, Elevators, escalators, ramps and fire safety. Life Cycle Analysis (LCA): Introduction to the stages of LCA, concepts, Application, Case studies. Circular Economy: Principle, benefits, and challenges	15

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

SL .	Name of Book	Name of Author/s	Publisher	Year
1.	Engineering Materials (Material Science)	Rangwala S C	Charotar Publishing House Pvt Limited	43rd Edition 2019
2	Sustainability Engineering: Concepts, Design and Case studies.	David T. Allen and David R. Shonnard	Prentice Hall	2012

REFERENCE

SL .	Name of Book	Name of Author/s	Publisher	Year
1	Sustainable Building Technologies	K. S. Jagadish	I.K International Publishing House Pvt.Ltd	
2	Sustainable Construction Materials	Shashabk Gupta, Adithya Sharma, Dr. Nidhi Shukla, Dr. Prinka Tripathi, Gr. Gourav Kumar Singh	SAAR Publications	2024

VIDEO LINKS

1	Introduction to Civil Engineering Profession - Course -Introduction to Civil Engineering Profession_NPTEL
2	nptel.ac.in/courses/105102088 - Civil Engineering - Building materials and Construction,
3	nptel.ac.in/courses/105102195 - Sustainable Materials and Green Buildings
4	nptel.ac.in/courses/105106053 - Modern Construction Materials

COURSE CONTENTS AND LECTURE SCHEDULE

Module	Part	Part Name	Topics Covered	Hours
Fundamentals of Civil Engineering and Building Planning	Part 1	Introduction to Civil Engineering	Major disciplines and scope of Civil Engineering, and type of buildings. Types of Civil Engineering Structures: Residential, commercial, transportation, hydraulic, coastal, retaining, water supply and waste management facilities.Role of Civil Engineers in nation building and sustainable development.	6
	Part 2	Residential planning and building Concepts	Types of buildings as per NBC,Load bearing and non-load bearing structures, components of a residential building and their functions (concept only), Selection of site for a residential building	4

	Part 3	Building Regulation and Area Definitions	Relevance of NBC, KBR & CRZ norms (brief discussion of relevance only Building Area Definitions: Built up area, Plinth area, Carpet area and Floor area ratio as per KBR	5
Construction Materials and Foundation Engineering Basics	Part 1	Building Materials – Types, Properties and Applications	Types, properties and uses of brick, stone, timber, iron, steel, cement, sand, cement mortar and concrete;	5
	Part 2	Material Testing and Modern Materials	Field tests on brick, cement and concrete. Modern materials: Architectural glass, ceramics, plastics, composites, SCMs, geopolymers, recycled aggregates, thermal and acoustic insulating materials, waterproofing materials, , (brief overview)	5
	Part 3	Basic Concepts of Foundation Engineering	Bearing capacity of soil (definition and concept only); shallow and deep foundations-types (brief discussion only)	5
Sustainability in Civil Engineering	Part 1	Sustainability and Sustainable Development Framework	Environmental, social, and economic pillars of sustainability. Environmental problems caused by unsustainable practices (pollution, waste, resource depletion).	5
	Part 2	Green Buildings and Sustainable Design Principles	Sustainable Development Goals (SDGs) and their relevance to civil engineering. Sustainable Infrastructure importance (roads, buildings, water systems) Green buildings: Basic principles of sustainable design, Sustainable construction Materials, energy and water efficiency and waste management.	5
	Part 3	Sustainable and Alternative Construction Material	Sustainable and locally available materials: Mud as a Building material, Cross Laminated Timber, Stone as a building Material, Strawbale, Laterite Quarry Waste Alternate building materials, Benefits of using eco-friendly construction materials. Use of waste and recycled materials (fly ash, GGBS, recycled aggregates)., bamboo, Construction and Demolition waste, reclaimed wood, recycled glass, rubber, plastic, Hempcrete	5

Sustainable and smart infrastructure	Part 1	Green Building Rating Systems and Energy Efficiency	Green Building Rating Systems: Overview of green building rating system, LEED, GRIHA, IGBC; key parameters considered in rating, benefits. Carbon footprint: Sources, types of carbon foot , basic calculation, print, environmental impact, overview on carbon foot prints in buildings, reduction strategies, benefits, case studies	5
	Part 2	Net-Zero Energy Buildings & Infrastructure Services	Net-Zero Energy Buildings (NZEB): principles, components, renewable energy integration, energy balance concept Civil Engineering aspects of MEP, HVAC, Elevators, escalators, ramps and fire safety.	5
	Part 3	Life Cycle Assessment and Circular Economy: Concepts and Applications	Life Cycle Analysis (LCA): Introduction to the stages of LCA, concepts , Application, Case studies. Circular Economy: Principle, benefits, and challenges	5

SELF LEARNING ACTIVITIES (45 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Construction Material collection	Collect samples of conventional modern and sustainable construction materials for civil infrastructure and prepare a comparative chart.	15	2,3	CO1	WK, WK, WK8	PO1, PO2, PO9, PO11
2	Portfolio	Prepare a sketch portfolio showing different types of foundations, roofs, and floors with short notes on their uses and materials	15	2	CO2	WK, WK7	PO1, PO8, PO11
3	Poster presentation	Prepare a poster with clear hand-drawn sketches along with relevant pictures of each foundation type, like Shallow foundations and Deep foundations.	15	2	CO3	WK, WK, WK6	PO1, PO2, PO3, PO5, PO6
4	Field Experience	Collect information about different materials-low cost and ecofriendly which can be used for construction.	15	3	CO4	WK, WK, WK, WK9	PO1, PO2, PO6, PO7, PO11
5	Green Building	Case Study of a Green Building-prepare a PPT and present	15	4	CO1, CO2, CO3, CO4	WK8, WK9	PO1, PO8, PO9, PO11

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Site Visit and Report on a Building Under Construction	Visit a multi-storied building site under construction within your locality. Observe the ongoing construction activities, materials used, and structural components. Prepare a report with geo-tagged photographs, illustrating your observations.	15hrs	1,2	CO1, CO 2	WK1, WK4, WK5, WK6, WK7	PO1, PO2, PO6, PO7, PO8, PO9, PO11
2	Green Building Sustainable Design Activity	Students shall select a building or infrastructure project and study its sustainable features such as energy efficiency, water conservation, and material usage. They will analyze the project based on a green building rating system like LEED, GRIHA, or IGBC. Students shall also propose improvements to reduce carbon footprint and enhance sustainability. Finally, they will prepare a short report with neat sketches or diagrams explaining their findings.	15hrs	3,4	CO3, CO 4 CO 5	WK1, WK4, WK5, WK6, WK7	PO1, PO2, PO6, PO7, PO8, PO9, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	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	Introduction to Civil Engineering	10	3	12					15
2	Construction Materials and Foundations	12	3	12					15
3	Sustainability in Civil Engineering	12	3	6	6				15
4	Green Building Systems and Sustainable Infrastructure in Civil Engineering	11	3	6	6				15

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 analyze, interpret & effectively summarize textual, audio & visual content	K6
5	Develop the ability to create effective presentations through audio-visual mediums with the use of technology tools and initiate effective use of social media platforms & tech forums for content delivery and discussions	K6
6	Initiate profile-building exercises in line with the professional requirements, and start networking with professionals/academicians	K6

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

SYLLABUS
Table 1. Activities: 76 Marks

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

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

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

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

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

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

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

(AUTONOMOUS)
 CREATING TECHNOLOGY
 LEADERS OF TOMORROW
 ESTD 2002

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

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

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

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

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

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

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

Course Code	Course Name				Credits
J1ESL147	ENGINEERING WORKSHOP				1
Regulation	2026	L: T:P:H:S	0:0:2:0:1	Notional Learning Hours/Semester	30
(L: Lecture, T: Tutorial, P: Practical, H: Project: S: Self Learning and Term work (SL&TW))					
Course Type	PL	Course delivery Mode		Practical	
Scheme of Evaluation		CIE: 100 Marks	ESE: Nil	Duration of ESE: NA	
Pre-requisite	NA				

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

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

COURSE ARTICULATION MATRIX

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

SYLLABUS

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

6	Material Testing and Evaluation	Testing of basic construction materials for strength and quality. Conducting compressive strength tests on bricks and concrete cubes. Testing timber specimens parallel and perpendicular to the grain. Comparison of test results with standard specifications to evaluate material performance.	3
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LIST OF EXPERIMENTS (20 Hours)		
Instructions • Minimum 6 Experiments are mandatory from each session • Students should maintain a record of the lab experiments.		
Sl. No.	Experiment	CO
PART A		
1	To measure lengths, angles, and radii using tools such as Vernier Callipers, Micrometres, Height Gauge, Depth Gauge, and Bevel Protractor. Study small mechanical parts including bearings, seals, O-rings, circlips, and keys.	CO1
2	To perform the process of pattern making or die selection and carry out sand casting or die casting to produce a simple component.	CO1
3	To forge metals by hand and machine, and to observe the differences in hardness of the materials before and after forging.	CO1
4	To join metal pieces using electric arc welding and practice making proper welded joints (butt, lap, and T-joints).	CO1
5	To identify various automobile parts and understand the working principle of an Internal Combustion (IC) engine through demonstration.	CO2
6	To study the working of conventional machining machines such as the Lathe, Shaping & Slotting Machine, Milling Machine, Drilling Machine, and Grinding Machine through demonstration and understand their parts, operations, and applications.	CO2
7	To study the working of CNC machines and understand how they perform automatic machining operations to produce accurate components.	CO3
8	To understand the basics of 3D printing — slicing a CAD model and observing the additive manufacturing process.	CO3
9	To study the working of an industrial robot and practice basic operations such as pick-and-place using robotic end effectors.	CO3
PART B		
1	a. Identification and use of masonry tools. b. Identification of various types of pipe fittings and their uses.	CO4
2	a. Setting out of a two roomed building using thread, and tape. b. Transfer the level from one point to another using a water level.	CO5
3	a. Estimate the quantity of bricks required for a given brick masonry wall. b. Calculate the material quantities required for a specified volume and mortar mix ratio. c. Calculate the material quantities required for a specified volume and concrete mix ratio.	CO4,CO5

4	Construct 1 ½ - brick thick masonry wall using a. English bond and b. Flemish bond.	CO5
5	Draw line sketch and plan of 1BHK residential building using the given dimensions.	CO6
6	a. Determine the built-up area, plot area, and calculate Floor Area Ratio (FAR) for the given building. b. Prepare a site plan and utility plan for the given plot.	CO6
7	Conduct field tests on a. cement and b. Bricks.	CO6
8	Determine the compressive strength of a. bricks and b. Concrete cubes.	CO6
9	Modelling of a Small-Scale Rainwater Harvesting System.	CO6

TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Elements of Workshop Technology Vol-1- Manufacturing Processes	S K Hajra Choudhury A K Hajra Choudhury Nirjhar Roy	MPP Media Promoters and Publishers	2008
2	Mechanical Workshop Practice	K C John	PHI Learning	Edition 2 2010
3	Workshops: Engineering Practice Laboratory Manual	P. Kannaiah	Scitech Publications	2021
4	Essentials of Civil Engineering	S. C. Charotar	Publishing House	2012
5	Building Construction, Volumes 1 to 4	W. B. McKay, J. K. McKay	Pearson India Education Services	
6	Introduction to building services	E. F. Curd, C. A. Howard	Macmillan	1996
REFERENCE				
Sl.	Name of Book	Name of Author/s	Publisher	Year
1	Workshop Technology, Vol. I	S. K. Hajra Choudhury, A. K. Hajra Choudhury, Nirjhar Roy	Media Promoters & Publishers Pvt. Ltd.	2019
2	Workshop Practice	B. S. Raghuwanshi	Dhanpat Rai Publications	2018
3	The Civil Engineering Handbook	Chen W.F, Liew J Y R	CRC (Taylor and Francis), Canada	2002

VIDEO LINKS	
1	https://nptel.ac.in/courses/112107219 Fundamentals of Manufacturing Processes
2	https://nptel.ac.in/courses/112104195 Manufacturing Process Technology -Part I
3	https://onlinecourses.nptel.ac.in/noc22_ce42/preview Introduction to the civil engineering profession
4	https://nptel.ac.in/courses/105102088 Building materials and Construction
VIRTUAL LAB/SIMULATION TOOLS	
1	CNC Simulator
2	Robot Studio
3	Virtual Concrete Lab

SELF LEARNING ACTIVITIES (4 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Manufacturing Processes Study	Virtual measurement practice and study of foundry, smithy, and welding operations.	2	1	CO1–CO2	WK1 WK2	PO1, PO2, PO6, PO7
2	Modern Machining & Robotics	Study of machine tools, CNC/3D printing simulation, and industrial robot applications.	2	2-3	CO3	WK2, WK3	PO1, PO2, PO5
3	Manual Planning & Utility Layout of one's own house	Students shall prepare a manual sketch of their own house plan including room layout, dimensions, setbacks, and orientation, along with a simple water supply & drainage (utility) layout. Submit the sheet with proper symbols and legend.	2	4	CO4	WK1, WK2, WK4	PO1, PO2, PO3, PO7

4	Area Calculation & FAR Analysis for Residential Plot	Students shall collect the plot dimensions of their own residence or a nearby house, calculate plinth area, built-up area, permissible & achieved FAR, and prepare a comparison sheet with local bye-law requirements (setbacks, coverage, height limits).	2	4	CO5	WK2, WK4, WK5	PO1, PO2, PO3, PO6, PO7
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TERM WORK ACTIVITIES (6Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Conventional Manufacturing Practice	Perform measurement using Vernier Calliper, Micrometre, and Bevel Protractor. Prepare brief reports on foundry, smithy, and welding processes with observations.	3	1	CO1	WK2, WK3	PO1, PO2, PO6, PO7
2	Modern Machining and Robotics Study	Prepare a summary of machine tool demonstrations, CNC & 3D printing simulations, and industrial robot applications with process documentation.	3	2-3	CO2–CO3	WK3	PO1, PO2, PO5
3	Site Visit Observation Report	Visit a completed multi-storeyed building and document key observations including building footprint, setbacks, circulation, orientation, access, and service locations (water tank, septic tank, drainage lines, electrical entry, parking). Submit notes with photos.	3	6	CO6	WK2, WK3	PO1, PO7
4	Building Site & Utility Plan Preparation	From the site visit, prepare the Site Plan and Utility Plans (water supply, drainage, rainwater harvesting/ network) using manual drafting or CAD. Include labels, symbols, and scale. Submit final sheets.	3	5	CO6	WK3, WK4	PO2, PO5

RUBRICS FOR TERM WORK EVALUATION

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

RUBRICS FOR CONTINUOUS ASSESSMENT

Sl .	Evaluation Criteria	Weightage	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Preparation & Pre-lab Work	25%	Fully prepared, all tasks completed, clear concepts	Minor gaps, overall understandings	Partially completed, some confusion	Minimal effort, weak comprehension	No prep, unable to explain
2	Experimental Skills	30%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	15%	In-depth analysis, insightful, correct inference	Good analysis, few gaps	Basic interpretation	Minimal interpretation, errors	No analysis
4	Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted
5	Viva	20%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer

RUBRICS FOR END INTERNAL EXAMINATION

Sl.	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Experimental Preparation	20%	Fully prepared with clear understanding of experiment objectives, correct selection of apparatus, and proper setup with safety compliance.	Minor errors in setup or procedure ; overall concept clear.	Partially prepared; requires some guidance to perform setup	Minimal preparation; unable to set up independently.	No preparation; unable to start the experiment
2	Problem Solving/Execution	30%	Performs experiment systematically and independently; accurate procedure and correct data recording; logical approach to problem-solving.	Minor procedural or calculation errors; generally accurate execution.	Requires moderate assistance ; some errors in methodology.	Heavily dependent on help; major procedural inaccuracies.	Unable to perform experiment or follow steps correctly.
3	Quality of Results	20%	Results are accurate, consistent, and well presented; complete data with correct graphs and calculations.	Results mostly correct; minor deviations ; acceptable presentation.	Average results with few missing readings or calculation errors.	Incomplete or inconsistent results; poor presentation.	No valid results obtained.
4	Inference/Interpretation (Viva Voce)	20%	Demonstrates excellent conceptual understanding; provides clear, logical interpretation of results and relates them to theory.	Good understanding; minor errors in explanation.	Basic understanding; partial interpretation of results.	Weak understanding; unable to relate results to theory.	No explanation or incorrect responses.
5	Record Submission	10%	Record book complete, neat, and includes all data, calculations, and inferences; professionally presented.	Minor omissions ; good organization.	Average record; lacks neatness or partial data.	Incomplete or poorly maintained record.	Record not submitted.

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



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

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

SYLLABUS			
Module	Title	Topics	Hours
1	Partial Derivatives	Limits and continuity, Partial derivatives, Partial derivatives of functions with two variables, Partial derivatives viewed as rate of change and slopes, Partial derivatives of functions with more than two variables, Higher order partial derivatives, Local Linear approximations, Chain rule, Implicit differentiation, Maxima and minima of functions of two variables - relative maxima and minima (Text 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

(AUTONOMOUS)

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				
SLNo	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 PO1 1
2	Laplace Transform Worksheet	Use Laplace transforms to solve a set of linear ODEs, including problems involving the unit step and Dirac delta functions; verify with Python.	8 hrs	2	2	WK2 WK3	PO1, PO2, PO4
3	Vector Field Visualisation	Use GeoGebra 3D / Python to visualise gradient, divergence and curl of sample fields; identify conservative fields and potential functions.	7 hrs	3	3	WK2 WK3 WK4	PO1, PO2, PO4
4	Integral Theorems Problem Set	Solve problems applying Green's, divergence and Stokes' theorems; verify the equality of the two sides for sample regions.	8 hrs	4	4	WK1 WK2 WK3 WK4	PO1, PO2, PO4

TERM WORK ACTIVITIES (15 Hrs)							
Sl.No.	Activity	Description	Time	Module	CO	WK	PO
1	Partial Derivatives Problem.	Submit a computational report by solving 5 problems on partial derivatives, the chain rule and optimisation of two-variable functions.	5	1	CO1	WK2 WK3 WK4	PO1, PO2, PO4
2	Laplace Transform Problem.	Submit a computational report by solving 5 problems on Laplace transforms, shifting theorems and convolution applied to differential equations.	5	2	CO2	WK2 WK3 WK4	PO1, PO2, PO4
3	Vector Calculus Computational Report	Submit a computational report with two vector-field problems (gradient/divergence/curl, line integral) and one application of an integral theorem.	5	3,4	CO3 CO4	WK1 WK2 WK3	PO1, PO2, PO4

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

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

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

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

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

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

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

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

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

SYLLABUS

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

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

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

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

REFERENCE

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

VIDEO LINKS (NPTEL, SWAYAM...)

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

VIRTUAL LAB/SIMULATION TOOLS

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

COURSE CONTENTS AND LECTURE SCHEDULE

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

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

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

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

TERM WORK ACTIVITIES (30 Hrs)

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

RUBRICS FOR TERM WORK EVALUATION

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

LAB EVALUATION RUBRICS

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

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

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

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

Course Code	Course Name					Credits
J1EST233	BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING					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 Understand thermodynamic cycles and working of IC engines.
2	To Understand the refrigeration cycles and psychrometric concepts.
3	To Develop a strong foundation in electrical engineering fundamentals by understanding DC and AC circuits.
4	To Describe the fundamental concepts of essential electrical machines, power supply systems, renewable energy resources and electrical safety practices.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Explain the fundamental principles governing energy conversion systems, including basic thermodynamic cycles, IC engines, and refrigeration.	K2
2	Describe the working principles and applications of fluid machinery, machine elements, and manufacturing processes, including pumps, turbines, gears, clutches, bearings, metal forming, joining techniques, and machining operations.	K2
3	Apply fundamental electrical circuit laws and concepts (Ohm's law, Kirchhoff's laws, AC/DC circuits, power factor, and three-phase systems) to solve basic electrical engineering problems.	K3
4	Explain the construction, operating principles and applications of electrical machines, transformers, renewable energy sources, and electrical safety devices.	K2

COURSE ARTICULATION MATRIX																								
CO	Knowledge Attitude Profile									Program Outcomes & Program Specific Outcomes														
	WK									PO											PSO			
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9	10	11	1	2	3	
1	2	-	3	-	-	2	-	-	-	3	3	-	-	-	-	-	-	-	-	-				
2	-	2	3	-	-	2	-	-	-	3	3	-	-	2	2	-	-	-	-	-				
3	2	3	3	2	-	2	-	-	-	3	3	2	-	-	-	-	-	-	-	2				
4	2	2	3	3	2	3	-	-	2	3	2	-	-	-	2	-	-	-	-	2				
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.	11
2	Fluid Machinery, Machine Elements, and Manufacturing Technology	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump. Different type of gears and its applications (spur, helical, bevel, worm and worm wheel), Bearings and their classification (Journal bearing and ball bearing) Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications. Machining processes: Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	11

3	Introduction to Electrical Circuits and AC Systems	DC Circuits: Resistance in Series and Parallel, Ohm's Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems). Faraday's laws of Electromagnetic induction, Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveform: frequency, time period, average, RMS values and form factor (concept only). AC circuits: Purely resistive, inductive and capacitive circuits. (Simple numerical problems) Power in AC circuits: Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems). Three phase AC systems: Representation of three phase voltages, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents.	12
4	Introduction to Electrical Supply, Machines, and Protection Systems	Generation of electrical energy: Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description). Electrical supply system: simple layout of Generation, transmission and Distribution of power. Distribution system: Feeder, distributor, service mains. Introduction to renewable energy resources: Solar-Photovoltaic, wind. Transformers: Construction and Working principle of a single-phase Transformer. DC Motor: Construction, principle of operation, Different types of DC motors, significance of back EMF, applications. Introduction to AC motors: Three Phase Induction Motor, Construction and Principle of Operation. Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing. Safety devices: MCB, ELCB.	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
Sl.	Name of Book	Name of Author/s	Publisher	Year
1.	Basic Mechanical Engineering	Pravin Kumar	Pearson Education	1 st Edition, 2013
2	Textbook of Basic Mechanical Engineering	R.K. Rajput	Laxmi Publications	3 rd Edition, 2017
3	Fundamentals of Mechanical Engineering	G.S. Sawhney	PHI Learning Pvt. Ltd.	1 st Edition, 2013
4	Basic Electrical Engineering	D. P Kothari and I. J Nagrath	Tata McGraw Hill	2019
5	Basic Electrical Engineering	V. K. Mehta, Rohit Mehta	S. Chand & Company, Limited	2006

REFERENCE				
Sl.	Name of Book	Name of Author/s	Publisher	Year
1	Automotive Engineering Fundamentals	Richard Stone and Jeffrey K. Ball	SAE International	1 st 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	2 nd Edition, 2015
4	Basic Electrical Engineering	D C Kulshreshtha	Tata McGraw Hill	2019
5	Electrical Engineering Fundamentals	Del Toro V	Pearson Education	2019
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	Fundamentals of Electrical Engineering (NPTEL) - https://nptel.ac.in/courses/108105112			
5	Transformer Basics (NPTEL) - https://www.youtube.com/watch?v=NkRk_xaRwjg&t=16s			
	Fundamentals of Three Phase Induction Motor (NPTEL) - https://www.youtube.com/watch?v=tqYzGdSbTFE			
VIRTUAL LAB/SIMULATION TOOLS				
1	Online Interactive Psychrometric Chart / Calculator			
2	CFD Simulation Software (e.g., ANSYS Fluent/SimScale/MATLAB Simscape)			
3	V-Lab (Virtual Lab) Manufacturing Processes			
4	https://bes-iitr.vlabs.ac.in/List%20of%20experiments.html			
5	https://www.circuitlab.com/			

Course Contents and Lecture Schedule				
Module	Part	Part Name	Topics Covered	Hours
1. Thermodynamics, IC Engines and Refrigeration (11 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.	2
	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 (11 Hrs)	Part 1	Fluid Machinery	Classification of hydraulic pumps and turbines, Description about working with sketches of: Reciprocating pump, Centrifugal pump.	3
	Part 2	Machine Elements	Different type of gears and its applications (spur, helical, bevel, worm and worm wheel, Bearings and their classification (Journal bearing and ball bearing)	3
	Part 3	Manufacturing Processes	Manufacturing Process: Sand Casting, Forging, Rolling, Extrusion. Metal Joining Processes: List types of welding, Description with sketches of Arc Welding, Soldering and Brazing and their applications.	3
	Part 4	Metal Joining and Machining Processes	Machining processes: Description and operations performed on Lathe, Drilling machine, Milling machine, CNC machine, 3D printing.	2
3. Introduction to Electrical Circuits and AC Systems (12 Hrs)	Part 1	DC Circuits	Resistance in Series and Parallel, Ohm's Law and Kirchhoff's laws, Voltage and current divider rule (Simple numerical problems).	3
	Part 2	Generation of Alternating Voltages	Generation of Alternating Voltage, Representation of ac voltage and currents, sinusoidal waveform: frequency, time period, average, RMS values and form factor (concept only).	3

	Part 3	AC circuits & Power in AC circuits	AC circuits: Purely resistive, inductive and capacitive circuits. (Simple numerical problems). Power factor; active, reactive and apparent power in single phase and three phase system. (Simple numerical problems).	3
	Part 4	Three phase AC systems:	Representation of three phase voltages, star and delta connections (balanced only), relation between line and phase voltages, line and phase currents.	3
4. Introduction to Electrical Supply, Machines, and Protection Systems (11 Hrs)	Part 1	Generation of Electrical energy & Electrical supply system	Conventional Sources: Hydro, thermal, nuclear plants (Block diagram description). Electrical supply system: simple layout of Generation, transmission and Distribution of power.	3
	Part 2	Distribution system & Introduction to renewable energy resources	Distribution system: Feeder, distributor, service mains. Solar- Photovoltaic, wind	2
	Part 3	Transformers & Introduction to DC motors	Transformers: Construction and Working principle of a single-phase Transformer. DC Motor: Construction, principle of operation, Different types of DC motors, significance of back EMF, applications.	3
	Part 4	Introduction to AC motors & Earthing	Introduction to AC motors: Three Phase Induction Motor, Construction and Principle of Operation. Earthing: Need for earthing, Types of earthing; pipe earthing, plate earthing. Safety devices: MCB, ELCB	3

SELF LEARNING ACTIVITIES (30 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Research Report	Prepare a brief report on a Hybrid Engine technology or Central Air Conditioning System layout, focusing on recent innovations.	8 hrs	1	1	WK4 , WK8	PO8, PO12
2	Research Paper Analysis	Review an IEEE or ASME paper on sustainable IC engine technology (e.g., alternative fuels or net-zero design). Submit a 500-word summary and critical evaluation.	7 hrs	1	1	WK5 , WK8	PO6, PO11

3	Virtual lab	Perform verification of ohms law and Kirchoff's law using simulation tools.	4 hrs	3	3	WK1 WK3	PO1 PO2 PO5
4	Video Study	Watch short documentary clips on how each power plant works and prepare a table comparing efficiency, cost, and environmental impact of each plant.	5 hrs	4	4	WK1 WK4 WK7	PO1 PO2
5	Application Research	List 10 real-world applications of DC motors in your home/college. Identify which type (series/shunt/compound) is likely used in each and justify why.	6 hrs	4	3	WK1 WK4	PO1 PO2

TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Mechanical System Model	In a group of 3-4, create a detailed sketch or simple 3D model (using free CAD tool or physical materials) of any one key component: a 4-stroke engine system, a centrifugal pump, or a gear train.	8 hrs	1,2	CO1 , CO2	WK3 , WK6	PO1, PO8
2	Simulation of R, L and C Circuits	Simulate purely resistive, inductive, and capacitive circuits and observe the phase difference between the voltage and current waveforms.	7 hrs	3	CO3	WK1 WK6	PO1 PO2

RUBRICS FOR TERM WORK EVALUATION						
Sl.	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	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report & Presentation	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork & Engagement	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

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

TABLE OF SPECIFICATIONS FOR QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Thermodynamics, IC Engines and Refrigeration	11	6	6	3				15
2	Fluid Machinery, Machine Elements, and Manufacturing Technology	11	7	8					15
3	Introduction to Electrical Circuits and AC Systems	12	3	6	6				15
4	Introduction to Electrical Supply, Machines, and Protection Systems	11	6	9					15
<i>This shall be treated as a general guideline for students and teachers for distribution of marks.</i>									

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

Course Code	Course Name				Credits
J1ESP244	ENGINEERING DRAWING				3
Regulation	2026	L: T:P:H:S	3:0:2:0:5.5	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 + 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 the ability to apply the principles, standards, and conventions of engineering drawing for accurate graphical representation of engineering objects and geometries.
2	To impart knowledge and skills in preparing orthographic projections of points, lines, solids, building components, and staircases using standard engineering drawing practices
3	To introduce Computer-Aided Drafting (CAD) tools for creating, editing, dimensioning, and presenting engineering drawings in accordance with industry standards.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Apply the principles, standards, and conventions of engineering drawing to construct projections of points, lines, and simple geometric entities.	K3
2	Prepare orthographic projections of engineering solids in different orientations and interpret sectional, development, isometric, and perspective views.	K3
3	Develop detailed architectural drawings of building components and staircases using standard drafting conventions.	K3
4	Create basic engineering drawings using CAD software by applying appropriate drafting commands, layers, dimensions, and plotting techniques.	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	
CO1	2	-	3	2	-	3	-	-	-	3	2	-	-	-	-	-	-	2	-	-	3	-	-	
CO2	-	2	3	2	-	3	-	-	-	3	3	2	-	-	-	-	-	2	-	-	3	2	-	
CO3	-	-	3	3	2	3	2	-	-	2	2	3	-	2	-	-	-	2	-	-	3	2	-	
CO4	-	2	2	-	-	3	-	2	-	2	2	3	-	3	-	-	-	2	-	1	3	-	-	
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																								

SYLLABUS			
Module	Title	Topics	Hours
1	Introduction to Engineering Drawing	Basic principles of engineering drawing, Standards and conventions, types of lines, Introduction, planes of projection, projection of points in all the four quadrants. Projection of straight lines inclined to one plane and inclined to both planes. Trace of line, inclination of lines with reference planes, true length of line inclined to both the reference planes.	8
2	Orthographic Projection of Solids	Projection of simple solids such as triangular, rectangle, square, pentagonal and hexagonal prisms, pyramids, cone and cylinder. Projection of solids in simple position including profile view. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both reference planes. Introduction to section, development, isometric and perspective projection (Concept only).	10

3	Building Components: Graphical Representation and Detailing	Graphical representation and standard terminology of doors, windows, & ventilators; Types, proportions, and standard sizes of these components. Drawing of plan, elevation, and sectional views for: Panel door, Glazed window and Louvered ventilator	10
4	Staircase Design and Introduction to CAD Drafting	Drawing of plan, elevation, and sectional views for Dog-legged stairs and open well staircase. Introduction to CAD Software (AutoCAD): Basic commands, coordinate systems, layers, dimensioning, and text; 2D drafting and 3D visualization; Plotting and layout management (Brief description only).	8

LIST OF EXPERIMENTS (24 Hours)		
Minimum 10 experiments must be conducted.		
Sl. No.	Experiment	CO
1	Orthographic Projection of Lines in Simple and Oblique Positions	CO1
2	Projection of Prisms and Pyramids in Simple Positions	CO2
3	Projection of Cylinders and Cones in Simple and Oblique Positions	CO2
4	Sectional Views of Solids and Determination of True Shapes	CO2
5	Draw the isometric view and isometric projection of simple solids.	CO2
6	Convert given isometric views into orthographic projections.	CO2
7	Development of Surfaces of Prisms	CO2
8	Development of Surfaces of Pyramids	CO2
9	Development of Surfaces of Cylinders	CO2
10	Drawing of Door: Plan, Elevation, and Sectional View	CO3
11	Drawing of Windows : Plan, Elevation, and Sectional View	CO3
12	Drawing of Ventilators : Plan, Elevation, and Sectional View	CO3
13	Drawing of Dog-legged Staircase	CO3
14	Drawing of Open Well Staircase	CO3
15	AutoCAD 2D Drafting: Lines, Shapes, Layers, Dimensioning, and Text	CO4

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXT BOOKS

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	Engineering Drawing	N.D. Bhatt	Charotar Publishing House Pvt. Ltd.	2023
2	Engineering Graphics	Varghese, P. I.	VIP Publishers	2018
3	Engineering Graphics	Anilkumar, K.N.	Adhyuth Narayan Publishers	2022
4	Engineering Graphics	John, K. C.	Prentice Hall India Publishers	2017

REFERENCE BOOKS

Sl. No.	Name of Book	Name of Author/s	Publisher	Year
1	A course in Civil Engineering Drawing	V.B.Sikka	Katson Books	2013
2	Engineering Drawing	Agrawal B. and Agrawal, C.M.	Tata McGraw Hill Publishers	2019
3	Engineering Graphics	Benjamin J.	Pentex Publishers - 3rd Edition	2016
4	Engineering Design and Visualisation	Duff, J.M. and Ross, W.A.	Cengage Learning	2012
5	Engineering Graphics with AutoCAD	Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K.	PHI	2009
6	Fundamentals of Engineering Drawing	Luzaddff, W.J. and Duff, J.M.	PHI	2015
7	Civil Engineering Drawing	Sharma & Kumar	S. Chand Publications	2020
8	Engineering Drawing + AutoCAD	K. Venugopal & M. Prabhu Raja	New Age International Publishers	2021
9	Engineering Drawing Practice for Schools and Colleges	SP 46:2003	BIS	2003

VIDEO LINKS	
1	https://onlinecourses.nptel.ac.in/noc25_me173/preview
2	https://onlinecourses.nptel.ac.in/noc24_me140/preview
3	https://www.youtube.com/watch?v=gfmदाTlzK6k
4	http://digimat.in/nptel/courses/video/112104172/L25.html
5	https://www.youtube.com/channel/UCkCk0nvNyWhEOLge9JtDLdG
6	https://nptel.ac.in/courses/112105294
VIRTUAL LAB/SIMULATION TOOLS	
1	AutoCAD (Autodesk) - 2D CAD Drafting and Plotting Software
2	Geo-Gebra (online) - Geometric construction tool

Course Contents and Lecture Schedule				
Module	Part	Part Name	Topics Covered	Hours
1. Introduction to Engineering Drawing (8 Hrs)	Part 1	Engineering Drawing Standards and Conventions	Introduction to Engineering Drawing, BIS standards, drawing instruments, drawing sheets, lettering, dimensioning, scales, types of lines and engineering conventions.	2
	Part 2	Projection of Points	Introduction to planes of projection, reference planes (HP & VP), quadrants, projection of points in all four quadrants.	2
	Part 3	Projection of Straight Lines-I	Projection of straight lines parallel and inclined to one reference plane, determination of apparent lengths and inclinations.	2
	Part 4	Projection of Straight Lines-II	Projection of lines inclined to both reference planes, true length, true inclination, traces of lines.	2
2. Orthographic Projection of Solids (10 Hrs)	Part 1	Projection of Solids in Simple Positions	Orthographic projection of prisms, pyramids, cylinders and cones with axis perpendicular or parallel to principal planes.	3

	Part 2	Projection of Inclined Solids	Projection of solids with axis inclined to one reference plane including profile view.	3
	Part 3	Projection of Solids in Complex Positions	Projection of solids with axis inclined to both reference planes using change of position method.	2
	Part 4	Introduction to Advanced Projections	Introduction to sectional views, development of surfaces, isometric projection and perspective projection (concept only).	2
3. Building Components: Graphical Representation and Detailing (10 Hrs)	Part 1	Doors – Types and Detailing	Terminology, types, proportions & standard sizes of doors, windows & ventilators	3
	Part 2	Windows – Types and Detailing	Panel door — plan, elevation, sectional view	3
	Part 3	Ventilators – Types and Detailing	Glazed window — plan, elevation, sectional view	2
	Part 4	Integrated Building Components	Louvered ventilator — plan, elevation, sectional view	2
4. Staircase Design and Introduction to CAD Drafting (8 Hrs)	Part 1	Dog-Legged Staircase Drawing	Dog-legged staircase — plan, elevation, sectional view	2
	Part 2	Open Well Staircase Drawing	Open well staircase — plan, elevation, sectional view	2
	Part 3	Introduction to CAD Drafting	AutoCAD basics: commands, coordinate systems, layers, dimensioning, text; 2D drafting & 3D visualization	2
	Part 4	CAD Visualization and Plotting	Plotting & layout management (brief)	2

SELF LEARNING ACTIVITIES (30 Hrs) (Any 1 Course)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Online Course	Master AutoCAD Basics: Create, Modify & Annotate 2D Drawings — https://www.coursera.org/learn/master-autocad-basics-create-modify-annotate-2d-drawings	30	4	CO 4	WK3, WK5, WK6	PO1, PO3, PO5, PO10
2	Online Course	AutoCAD for Beginners: Drafting Blueprints and Schematics — https://www.coursera.org/projects/autocad-for-beginners-drafting-blueprints-and-schematics	30	4	CO 4	WK4, WK5, WK6	PO1, PO3, PO5, PO9, PO10

TERM WORK ACTIVITIES (30 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Component Survey	Photograph or sketch real doors, windows, ventilators and staircase around campus or home, note their type and approximate standard proportions, and compare with textbook standard sizes.	15	1 -3	CO 1 – CO 3	WK1, WK3, WK4	PO1, PO2, PO4, PO6, PO10
2	Solid Models Visualization Exercise	Build simple 3D solids (prism, pyramid, cone, and cylinder) from paper, then relate them to their orthographic views.	15	2	CO 2	WK1, WK2, WK3, WK5	PO1, PO2, PO3, 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	Clear, in-depth, demonstrate s originality	Good clarity, minor gaps	Adequate but lacks depth	Partial understanding	Very limited understanding

2	Implementation & Coding	Correct, optimized, well-documented	Correct but not optimized	Basic implementation with errors	Incomplete with major errors	No attempt
3	Analysis & Interpretation	Strong analysis with metrics & insights	Good analysis, limited metrics	Basic interpretation	Minimal interpretation	No analysis
4	Report Presentation &	Well-structured, professional, references included	Clear, minor issues in organization	Average, lacks polish	Poorly structured	Not submitted
5	Teamwork Engagement &	Highly collaborative and proactive	Good participation	Moderate effort	Low effort	Absent

Lab Evaluation Rubrics

Sl. No.	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Preparation	25%	Comes fully prepared with drawing sheet, instruments, and reference data ready.	Minor gaps in preparation of sheet/instruments.	Partial preparation of sheet/instruments.	Minimal preparation; instruments/sheet incomplete.	No preparation; sheet/instruments missing.
2	Drawing Skills & Performance	50%	Executes the drawing independently with correct technique	Draws independently with minor technique lapses	Requires occasional guidance; construction technique is inconsistent	Requires frequent guidance; poor handling of instruments	Unable to execute the drawing without step-by-step guidance

3	Drawing assessment	25%	Final drawing is fully accurate	Drawing is mostly accurate with minor errors in dimensioning, scale	Drawing shows moderate errors in projection, dimensioning, or convention	Drawing has significant errors affecting correctness of views/projections; poor dimensioning and conventions	Drawing is largely incorrect or incomplete; fails to represent the intended views/projections
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ASSESSMENT PATTERN	
Assessment	Weightage
Continuous Internal Assessment	60%
Lab Evaluation	40 %
Learning Activity (Self Learning, Term Work, Assignments,)	20%
Attendance	10 %
Internal Examination	30 %
Course Project	NA
End Semester Examination	40%
Total	100

(AUTONOMOUS)

TABLE OF SPECIFICATIONS FOR ESE QUESTION PAPER DESIGN									
Module	Module Title	Teaching Hours	Distribution of Marks (Revised Bloom's Level)						Total Marks
			R	U	A	An	E	C	
1	Introduction to Engineering Drawing	8		10					10
2	Orthographic Projection of Solids	10		10					10
3	Building Components: Graphical Representation and Detailing	10			10				10
4	Staircase Design and Introduction to CAD Drafting	8			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 questions from one module (Including Choice)	8	10	4 x 10	40
TOTAL MARKS					40



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

COURSE OBJECTIVE

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

COURSE OUTCOMES

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

COURSE ARTICULATION MATRIX

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

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

SYLLABUS

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

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

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

REFERENCE

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

VIDEO LINKS

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

VIRTUAL LAB/SIMULATION TOOLS

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

COURSE CONTENTS AND LECTURE SCHEDULE

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

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

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

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

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

(AUTONOMOUS)

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

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

TERM WORK ACTIVITIES (15 Hrs)

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

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

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

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

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

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

SYLLABUS

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

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION

TEXTBOOKS

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

REFERENCE

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

VIDEO LINKS

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

COURSE CONTENTS AND LECTURE SCHEDULE

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

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

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

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

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

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

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

Course Code	Course Name					Credits
J1CET207	SURVEYING AND GEOMATICS					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 impart fundamental knowledge of surveying principles , methods, and instruments used for measurement, mapping, and computation of areas and volumes.
2	To familiarize students with advanced and modern surveying techniques including total station, GPS, and curve setting for precise data acquisition and analysis.
3	To introduce recent geospatial technologies such as Remote Sensing, GIS, GNSS, and LiDAR for effective spatial data management and engineering applications.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Describe the basic principles and methods used in surveying and levelling.	K2
2	Apply appropriate surveying techniques for measurement, computation of areas and volumes, and setting out of curves.	K3
3	Analyse and adjust survey data using the principles of error theory and advanced instruments such as total station and GPS.	K4
4	Integrate geospatial technologies like Remote Sensing, GIS, GNSS, and LiDAR for spatial data acquisition, processing, and interpretation in engineering applications.	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	3	2	-	-	-	-	-	3	2	-	-	1	-	-	-	-	-	-	3	2	1
2	-	2	3	3	2	2	-	-	-	3	3	2	2	2	-	-	1	1	-	-	3	3	2
3	-	2	3	3	2	3	3	-	-	3	3	2	3	3	-	-	1	1	-	-	2	3	3
4	-		2	3	2	2	3	2	-	2	2	2	2	3	2	3	1	-	1	-	2	3	3
Correlation levels: 1 - Low; 2 - Medium; 3 - High; No Correlation - “-”																							

SYLLABUS			
Module	Title	Topics	Hours
1	Introduction to Surveying and Levelling	Surveying: Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Local attraction, Declination, Methods of orientation (by compass and by back sighting) Levelling: Principles of levelling- Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling.	11
2	Advanced Field and Computational Methods in Surveying	Contouring: Characteristics, methods, uses. Areas and Volumes: computation of area by offsets to base line, by dividing area into number of triangles; volume of level section by prismoidal and trapezoidal formulae. Mass diagram: Construction, Characteristics and uses Theodolite survey: Instruments, Measurement of horizontal and vertical angle, principles of stadia and tangential tachometry (introduction only) Triangulation: Triangulation figures, Triangulation stations, Inter visibility of stations, Satellite Stations and reduction to centre.	11

3	Instrumentation and Modern Methods in Surveying	Traverse Surveying - Methods of traversing, Traverse computations, Balancing the traverse- Bowditch's rule, Transit rule, and graphical method based on Bowditch's rule. (introduction only) Theory of Errors: Types, theory of least squares, Weighting of observations, Most probable value, Computation of indirectly observed quantities - method of normal equations. Curve Surveying: Elements of simple and compound curve (introduction only) Total Station: Concept of EDM, principles and working, advantages and applications. Global Positioning Systems: Components and principles, satellite ranging-calculating position, signal structure, application of GPS, GPS Surveying methods-Static, Rapid static, Kinematic methods – DGPS.	12
4	Remote Sensing and Geographic Information Systems (GIS)	Recent trends in Surveying: GNSS, Smart Station and LIDAR. Remote Sensing: Definition- Electromagnetic Spectrum Energy interactions with atmosphere and earth surface features spectral reflectance of vegetation, soil and water- Classification of sensors- Active and Passive, Resolution- spatial, spectral radiometric and Temporal resolution, Multi spectral scanning -Along track and across track scanning. Geographical Information System: components of GIS, GIS operations, Map projections- methods, Coordinate systems -Geographic and Projected coordinate systems, Data Types- Spatial and attribute data, Raster and vector data representation. Software on GIS: Introduction to software's for GIS	11

INSTRUCTIONAL AND TECHNOLOGY SUPPORT INFORMATION				
TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Surveying Vol 1	Dr. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications (P) Ltd.	Seventeenth Edition Jan 2016
2	Surveying Vol II	Dr. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain	Laxmi Publications (P) Ltd.	July 2018
3	Introduction to Geographic Information Systems	Kang-Tsung Chang	Mc Graw Hill Education	2015
4	Fundamentals of Remote Sensing	George Joseph	Universities Press	2005

REFERENCES

SL.	Name of Book	Name of Author/s	Publisher	Year
1	Textbook of Surveying	C Venketaramaiah	Universities Press	2011
2	Surveying –Vol 1	S K Duggal	Mc Graw Hill	2019
3	Surveying Vol II	S K Duggal	Mc Graw Hill	Fifth Edition, 2019
4	A textbook of Surveying and Levelling	R Agor	Khanna Publishers	2005
5	Textbook of Remote Sensing And Geographical Information Systems	Ms. Anji Reddy	B.S Publications	Fourth Edition, 2012
6	Principles of Geographical Information Systems	Burrough P	Oxford University Press	1998
7	Remote Sensing and Image Interpretation,	Thomas M Lillesand, Ralph W. Kiefer	Wiley	Seventh Edition, 2000

VIDEO LINKS

1	https://nptel.ac.in/courses/105107122 Surveying Nptel IIT Roorkee , J K Ghosh
2	https://nptel.ac.in/courses/105107122 Surveying Nptel IIT Roorkee , J K Ghosh
3	https://archive.nptel.ac.in/courses/105/104/105104100/ Nptel Modern Surveying Techniques, IIT Kanpur
4	https://onlinecourses.nptel.ac.in/noc22_ce84/preview Nptel Swayam Remote Sensing and GIS , Prof. Rishikesh Bharti , IIT Guwahati

VIRTUAL LAB/SIMULATION TOOLS

1	https://sl-iitr.vlabs.ac.in/
2	QGIS

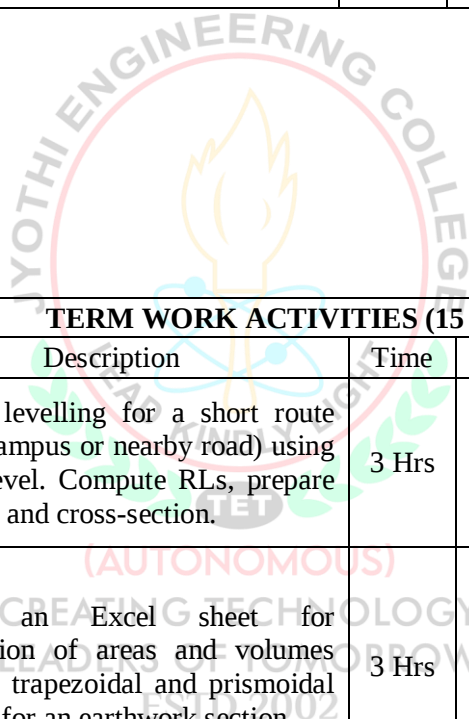
Course Contents and Lecture Schedule				
Module	Part	Part Name	Topics Covered	Hours
1. Introduction to Surveying and Levelling (11 Hrs)	Part 1	Surveying	Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Local attraction, Declination, Methods of orientation (by compass and by backsighting)	5
	Part 2	Levelling	Principles of levelling- Dumpy level, booking and reducing levels, Methods- simple, differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling.	6
2. Advanced Field and Computational Methods in Surveying (11 Hrs)	Part 1	Contouring	Characteristics, methods, uses.	1
	Part 2	Areas and Volumes	Computation of area by offsets to base line, by dividing area into number of triangles; volume of level section by prismoidal and trapezoidal formulae.	4
	Part 3	Mass diagram	Construction, Characteristics and uses	1
	Part 4	Theodolite survey	Instruments, Measurement of horizontal and vertical angle, principles of stadia and tangential tacheometry (introduction only)	2
	Part 5	Triangulation	Triangulation figures, Triangulation stations, Inter visibility of stations, Satellite Stations and reduction to centre.	3
3. Instrumentation and Modern Methods in Surveying (12 Hrs)	Part 1	Traverse Surveying	Methods of traversing, Traverse computations, Balancing the traverse- Bowditch's rule, Transit rule, graphical method based on Bowditch's rule. (introduction only)	3
	Part 2	Theory of Errors	Types, theory of least squares, Weighting of observations, Most probable value, Computation of indirectly observed quantities - method of normal equations	3
	Part 3	Curve Surveying	Elements of simple and compound curve (introduction only)	1
	Part 4	Total Station	Concept of EDM, principles and working, advantages and applications.	1
	Part 5	Global Positioning Systems	Components and principles, satellite ranging-calculating position, signal structure, application of GPS, GPS Surveying methods-Static, Rapid static, Kinematic methods – DGPS.	4

4 Remote Sensing and Geographic Information Systems (GIS) (11 Hrs)	Part 1	Recent trends in Surveying	GNSS, Smart Station and LIDAR.	1
	Part 2	Remote Sensing	Definition- Electromagnetic spectrum Energy interactions with atmosphere and earth surface features spectral reflectance of vegetation, soil and water- Classification of sensors- Active and Passive, Resolution-spatial, spectral radiometric and Temporal resolution, Multi spectral scanning - Along track and across track scanning	4
	Part 3	Geographical Information System	components of GIS, GIS operations, Map projections- methods, Coordinate systems -Geographic and Projected coordinate systems, Data Types- Spatial and attribute data, Raster and vector data representation.	3
	Part 4	Software on GIS	Introduction to software's for GIS	3

SELF LEARNING ACTIVITIES (30 Hrs)

Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Evolution of Surveying Instruments	Research the development of surveying tools from chain and compass to GNSS and LiDAR.	6	1	CO 1	WK1 , WK4 , WK6 , WK8 , WK9	PO1, PO2, PO9, PO1 1
2	Contouring & Topographic Mapping	Contour interpretation exercise: Use Google Earth or any online DEM to trace contour lines for a selected area and describe the topographic features.	6	2	CO 2	WK2 , WK3 , WK6 , WK9	PO4, PO5, PO8,
3	Traverse Computation and Balancing using Sample Data	Using given or field-collected traverse data, perform balancing using Bowditch's and Transit rules; plot the closed traverse.	6	3	CO 3	WK2 , WK3 , WK4	PO1, PO2, PO5, PO8

4	Technical Paper Review	Review a recent research paper on Remote Sensing, GPS, or GIS applications in civil engineering, summarizing objectives, methods, and key findings.	6	4	CO 4	WK2 , WK8 WK9	PO1, PO2, PO6, PO9, PO11
5	Reflective Journal	Document learning progress, challenges, and solutions with research paper discussions	6	All Modules	CO 1, CO 2, CO 3, CO 4	WK8 , WK9	PO11



TERM WORK ACTIVITIES (15 Hrs)							
Sl.	Activity	Description	Time	Module	CO	WK	PO
1	Levelling Route Profile and Cross Section Study	Conduct levelling for a short route (within campus or nearby road) using dumpy level. Compute RLs, prepare L-section and cross-section.	3 Hrs	1	CO 1	WK1 , WK2 , WK3	PO1, PO2, PO5
2	Area and Volume Computation (Spreadsheet Project)	Prepare an Excel sheet for computation of areas and volumes using the trapezoidal and prismoidal formulae for an earthwork section.	3 Hrs	2	CO 2	WK2 , WK3 , WK4 , WK5	PO1, PO2, PO3, PO4, PO5
3	GPS Survey for Coordinate Mapping	Collect GPS data points for key features within the campus using mobile or handheld GPS. Plot the points on Google Earth/QGIS and compare accuracy.	3 Hrs	3	CO 3	WK4 , WK6	PO4, PO5, PO8
4	GIS Application in Civil Engineering	Use Google Earth / Bhuvan / QGIS to prepare a simple thematic map (roads, water bodies, or land use).	6 Hrs	4	CO 4	WK3 , WK4 , WK6	PO1, PO4, PO5, PO8, PO11

RUBRICS FOR TERM WORK EVALUATION						
Sl.	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	Introduction to Surveying and Levelling	11	3	3	9				15
2	Advanced Field and Computational Methods in Surveying	11	3	6	6				15
3	Instrumentation and Modern Methods in Surveying	12	3	6	6				15
4	Remote Sensing and Geographic Information Systems (GIS)	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
J1ESL238	CIVIL ENGINEERING WORKSHOP					2
Regulation	2026	L: T:P:H:S	0:0:2: 0:1	Notional Learning Hours/Semester		60
(L: Lecture, T: Tutorial, P: Practical, H: Project, S: Self Learning and Term work (SL&TW))						
Course Type	PL	Course Delivery Mode			Practical	
Scheme of Evaluation		CIE: 100 Marks	ESE: Nil		Duration of ESE: NA	
Pre-requisite						

COURSE OBJECTIVE	
1	Introduce the basic principles and methods of land surveying.
2	Develop skills in levelling and contouring techniques.
3	Provide hands-on experience with theodolite and total station surveying.
4	Familiarize students with modern surveying instruments like distomat and GPS.

COURSE OUTCOMES		
Upon successful completion of this course, students will be able to:		Blooms Level
1	Use traditional surveying instruments such as the chain/tape, and compass to plot and determine areas.	K3
2	Apply the fundamental principles of levelling to determine relative elevations.	K3
3	Conduct triangulation and angular measurements using a theodolite for establishing control points.	K3
4	Operate total station equipment for accurate data collection and topographic surveying.	K3
5	Utilise modern surveying devices such as distomat and handheld GPS for location mapping and field applications.	K3

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

SYLLABUS			
Module	Title	Topics	Hours
1	Conventional surveying	Chain/ tape surveying-Compass surveying	3
2	Levelling	Differential levelling – Fly levelling – Profile levelling and Cross-sectioning	9
3	Theodolite Surveying	Accessible distance – Inaccessible distance (Horizontal Angle) – Level difference between two points –Height of building (Vertical angle) - Tangential tacheometry (Vertical angle) – Traversing – Balancing the traverse	9
4	Total Station Surveying	Heights and distances – Area computation – Contouring – Data downloading – Setting out of curve – Simple curve & Compound curve	9
5	Modern Surveying Instruments	Automatic level – Digital level – Handheld GPS – LIDAR Surveying – GNSS Surveying	6

LIST OF EXPERIMENTS (36 Hours)	
Instructions - Minimum 12 Experiments are mandatory. - Wear your full uniform and closed-toe shoes. - Handle all tools and instruments with care. - Read the manual before class and listen to instructions. - Record all data directly in your field book. - Students should maintain a record of the lab experiments.	

Sl. No.	Experiment	CO
1	Perform chain and compass surveying to measure distances, establish directions, and prepare a detailed plot of the surveyed area.	CO1
2	Perform differential levelling and determine the relative elevations of given points.	CO2
3	Carry out fly levelling between two benchmarks and check for closing error.	CO2
4	Perform profile levelling and cross-sectioning, and plot the cross-sectioning.	CO2
5	Determine the horizontal distance between two accessible points using a theodolite.	CO3
6	Determine the horizontal distance between two inaccessible points using a theodolite.	CO3
7	Find the difference in elevation between two points using vertical angle observations.	CO3
8	Determine the height of a building using the vertical angle method.	CO3
9	Determine horizontal distance and elevation using tangential tacheometry.	CO3
10	Perform a traverse survey and balance the traverse using Bowditch's rule, transit rule, and graphical method.	CO3
11	Determine heights and distances using a total station.	CO4
12	Compute the area of a plot using total station data.	CO4
13	Generate contours of a given area using total station.	CO4
14	Set out a simple curve using the angular method.	CO4
15	Set out a compound curve using the angular method only.	CO4
16	Study the working principle and operation of an automatic level.	CO5
17	Study the features and use of digital level and handheld GPS in surveying.	CO5
18	Compute the area of the given plot using a handheld GPS device.	CO5
19	Introduction to LIDAR surveying & GNSS surveying.	CO5

TEXTBOOKS				
SL.	Name of Book	Name of Author/s	Publisher	Year
1.	Surveying	Dr. B.C. Punmia , Ashok Kumar Jain &Arun Kumar Jain	Laxmi publications (P) Ltd	2005
2	Textbook of Surveying	C. Venkatramaiah	Universities Press (India) Private Limited	2011
3	Surveying Vol I and Vol II	K. R. Arora	Standard Book house	
4	Surveying and Levelling	Prof. T.P.Kenetkar&Prof.S.V.Kulkarni	Pune VidyarthiGriha Prakashan	2004
5	A Text book of Surveying and Levelling	R.Agor	Khanna Publishers	2005
6	Surveying Vol I and Vol II	S.K. Duggal	Tata McGraw Hill Ltd	Reprint 2015
REFERENCE				
SL.	Name of Book	Name of Author/s	Publisher	Year
1	The Civil Engineering Handbook	Chen W.F, Liew J Y R	CRC (Taylor and Francis), Canada	2002
VIDEO LINKS				
1	https://onlinecourses.nptel.ac.in/noc25_de24/preview -Geographic Information System			
2	https://nptel.ac.in/courses/105107122 - surveying			
VIRTUAL LAB/SIMULATION TOOLS				
1	Virtual Lab-surveying Lab			
2	Virtual lab- Advanced Remote Sensing and GIS			

SELF LEARNING ACTIVITIES (12 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	W K	PO
1	Comparison of Conventional and Digital Surveying Techniques	Prepare a comparative analysis of chain/tape, theodolite, and total station surveying in terms of accuracy, time, and applications. Include brief case examples.	4	1,3,4	CO5	W K2	PO1, PO2

2	Preparation of Contour Map using Google Earth Data	Extract elevation data from Google Earth or open-source GIS tools and generate a contour map; compare it with manually obtained contour data from field observations.	4	2	CO3	W K4	PO1, PO2, PO4, PO5
3	Error Analysis and Adjustment in Levelling Survey	Collect levelling data (from performed experiments) and perform arithmetic checks for misclosure, applying correction and adjustment methods. Present the process as a worksheet or report.	4	2	CO2	W K3	PO1, PO2, PO4

TERM WORK ACTIVITIES (12 Hrs)							
Sl. No.	Activity	Description	Time	Module	CO	WK	PO
1	Preparation of a Detailed Survey Report for a Selected Site	Select a small plot (e.g., campus block or playground) and prepare a complete survey report including field sketches, observations, computed areas, contour map, and remarks on accuracy and sources of error.	3	1,2	CO3, CO4	WK5	PO1, PO2, PO5, PO7
2	Preparation of a Detailed Survey Report for a Selected Site using Total Station	Conduct a detailed topographic survey of a selected site (e.g., campus block or playground) using a Total Station, record coordinates and elevations of key points, generate the contour map and area calculation digitally, and prepare a comprehensive survey report including field data, plots, and accuracy assessment.	3	3	CO6	WK7	PO1, PO2, PO5, PO1 1
3	Comparative Analysis of Conventional and Total Station Surveying Methods	Conduct a survey of the same site using both conventional instruments (chain, tape, compass, and level) and a Total Station. Compare the methods in terms of time efficiency, accuracy, data handling, and ease of plotting. Prepare a technical report summarizing observations, computed differences, and recommendations on method suitability.	3	3	CO5	WK2	PO1, PO2, PO5, PO1 1

4	Topographic Mapping using Handheld GPS	Record coordinates of at least 10 ground points using a handheld GPS, plot the same using suitable software, and interpret topographic variation.	3	5	CO5	WK7	PO1, PO2, PO5, PO1 1
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RUBRICS FOR TERM WORK EVALUATION

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

RUBRICS FOR CONTINUOUS ASSESSMENT

Sl. No.	Evaluation Criteria	Weightage	Excellent (100%)	Good (80%)	Satisfactory (60%)	Needs Improvement (40%)	Poor (10%)
1	Preparation & Pre-lab Work	25%	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	30%	Executes with precision, independent work	Minor help needed, mostly accurate	Frequent help, some errors	Constant help, major errors	Unable to perform
3	Analysis & Interpretation	15%	In-depth analysis, insightful, correct inference	Good analysis, a few gaps	Basic interpretation	Minimal interpretation, errors	No analysis
4	Timeliness of record Submission	10%	Professional, clear, well-structured, referenced	Mostly clear, minor errors	Average, lacks clarity	Poor, incomplete	Not submitted
5	Viva	20%	Demonstrates full mastery	Good responses	Can answer basic questions	Struggles with responses	Cannot answer

RUBRICS FOR END INTERNAL EXAMINATION

Sl.	Criteria	Weightage	Excellent (5)	Good (4)	Satisfactory (3)	Needs Improvement (2)	Poor (1)
1	Experimental Preparation	20%	Fully prepared with clear understanding of experiment objectives, correct selection of apparatus, and proper setup with safety compliance.	Minor errors in setup or procedure; overall concept clear.	Partially prepared; requires some guidance to perform setup.	Minimal preparation; unable to set up independently.	No preparation; unable to start the experiment.
2	Problem Solving/Execution	30%	Performs experiment systematically and independently; accurate procedure and correct data recording; logical approach to problem-solving.	Minor procedural or calculation errors; generally accurate execution.	Requires moderate assistance; some errors in methodology.	Heavily dependent on help; major procedural inaccuracies.	Unable to perform experiment or follow steps correctly.

3	Quality of Results	20%	Results are accurate, consistent, and well presented; complete data with correct graphs and calculations.	Results mostly correct; minor deviations; acceptable presentation.	Average results with few missing readings or calculation errors.	Incomplete or inconsistent results; poor presentation.	No valid results obtained.
4	Inference/Interpretation (Viva Voce)	20%	Demonstrates excellent conceptual understanding; provides clear, logical interpretation of results and relates them to theory.	Good understanding; minor errors in explanation.	Basic understanding; partial interpretation of results.	Weak understanding; unable to relate results to theory.	No explanation or incorrect responses.
5	Record Submission	10%	Record book complete, neat, and includes all data, calculations, and inferences; professionally presented.	Minor omissions; good organization.	Average record; lacks neatness or partial data.	Incomplete or poorly maintained record.	Record not submitted.

ASSESSMENT PATTERN

Assessment	Weightage
Continuous Internal Assessment	100%
Lab Evaluation (Continuous assessment)	35 %
Learning Activity (Self Learning, Term Work)	15%
Attendance	10 %
Internal Examination	40 %
Course Project	NA
End Semester Examination	NA
Total	100