B. TECH
CIVIL ENGINEERING
CURRICULUM & SYLLABUS

2025 REGULATION

B.Tech

CIVIL ENGINEERING

2025 REGULATION

CURRICULUM & SYLLABUS

CONTENTS

B.Tech in Civil Engineering (2025 Regulation)

SEMESTER 2

CURRICULUM

SLOT	COURSE CATEGORY	COURSE CODE	COURSE NAME	L	T	J	P	S	C
A	BST	B250902/MA200A	Mathematics for Physical Science-2	3	1	0	0	2	3
B	BSE	B250902/CH910B	Chemistry for Physical Science	3	0	0	2	3	4
C	EST	B250902/CN200C	Engineering Graphics	2	0	0	2	2	3
D	EST	B250001/CE200D	Building Materials and Construction	4	0	0	0	4	4
E	PCT	B250001/CE200E	Mechanics of Solids	3	1	0	0	4	4
F	ESB	B250908/CN220F	Entrepreneurship and IPR	2	0	1	0	3	3
K	HMT	B250908/CN910K	Health and Wellness	1	0	0	1	0	1
U	PCL	B250001/CE230U	Civil Engineering Planning and Drafting Lab	0	0	0	2	0	1
I	Skill Enhancement Course: NASSCOM or equivalent								1
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work, C- Credit)									

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	3-1-0-0-2	Version	25/0	Credits	3
Course Code	**Course Name**						**Course Category**
B250902/MA200A	**MATHEMATICS FOR PHYSICAL SCIENCE-2**						**BST**
Pre-requisite							
Sound knowledge in calculus of one real variable.							
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE OBJECTIVES

1	To enable the students to apply multivariable differentiation techniques—including chain rule, implicit differentiation and optimization methods for solving engineering-related problems.
2	To equip students with the skills to evaluate double and triple integrals and to apply coordinate transformations for computing areas, volumes, and related quantities in engineering applications.
3	To develop a deep understanding of vector fields through the analysis of gradient, divergence, curl, and line integrals, and to apply these in evaluating conservative fields and constructing potential functions in physical systems.
4	To enable the students to apply vector integral theorems in the evaluation of line, surface and flux integrals and to solve engineering problems involving circulation, flux and work.

COMPETENCY & OUTCOMES

Competency Statements	CC 1	Demonstrate the ability to analyze mathematical models of physical systems and find its solution using appropriate calculus-based methods.

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	**Apply** the concept of partial derivatives to find maxima and minima of multivariable functions.	CC 1	A	–	Rs
CO 2	**Use** the concept of multiple integrals to find area and volume of geometrical shapes.	CC 1	A	_	Rs

CO 3	**Apply** the calculus of vector valued functions to solve physical problems.	CC 1	A	_	Rs
CO 4	**Apply** vector integral theorems in the evaluation of line integrals, surface integrals and volume integrals.	CC 1	A	_	Rs

Cognitive (Revised blooms Level): - ***R****: Remember;* ***U****: Understand;* ***A****: Apply;* ***An****: Analyse;* ***E****: Evaluate;* ***C****: Create*

Psychomotor Domain (Dave's): - ***I****-Imitation,* ***M****-Manipulation,* ***P****-Precision,* ***Ar****-Articulation,* ***N****-Naturalisation*

Affective (Krathwohl): - ***Re****-Receiving,* ***Rs****-Responding,* ***V****-Valuing,* ***O****-Organization,* ***Ch****-Characterization*

Program Outcomes & Program Specific Outcomes Correlation Matrix

	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	2									1			
2	2	2									1			
3	2	2									1			
4	2	2									1			
	2	2									1			

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

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						Total
							Theory			Practical			
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**	**CIA**	**ESE**	**Total**	
3	1	0	0	2	3	90	40	60	100	-	-	-	100

L*: Lecture (One unit is of one-hour duration),* ***T****: Tutorial (One unit is of one-hour duration),* ***P****: Practical (One unit is of one-hour duration),* ***J****: Project (One unit is of one-hour duration),* ***S****: Self-Learning & Team Work (One unit is of one-hour duration),* ***CIA****: Continuous Internal Assessment,* ***ESE****: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Contact Hours
1	**Multivariable Calculus-Differentiation**	Limits and Continuity, Partial derivatives, Local linear approximation, The Chain Rule, Maxima and Minima of functions of Two variables.**(Relevant topics from sections 13.2,13.3, 13.4,13.5, 13.8 of Text 1)**	**11**

2	**Multivariable Calculus-Integration**	Double Integrals, Reversing the order of integration, Converting Double integrals from Cartesian Coordinates to Polar Coordinates, Triple Integrals, Converting Triple integrals in Cartesian coordinates to Cylindrical coordinates. **(Relevant topics from sections 14.1,14.2,14.3, 14.5,14.6 of Text 1)**	**11**
3	**Calculus of Vector Functions**	Vector valued function of a single variable, Concept of scalar and vector field, Gradient and its properties, Directional Derivatives, Divergence and Curl of vector fields, Line integral of vector fields, Conservative vector fields, Potential function. **(Relevant topics from sections 12.1,12.2,13.6, 15.1,15.2,15.3 of Text 1)**	**12**
4	**Vector Integral Theorems**	Green's theorem for simply connected region (without proof), Applications of Green's theorem, Surface integrals, Flux integrals, Divergence theorem (without proof), Stokes' theorem (without proof), finding work done using Stokes' theorem. **(Relevant topics from sections 15.4,15.5,15.6, 15.7,15.8 of Text 1)**	**11**

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning Topics / Team Work Description	Hrs/Semester (30)
1	Differentiability (1 Hour)	
2	Practice problems on Partial Derivatives, Local linear approximation, Chain Rule and Maxima and Minima of functions of Two variables (5 Hours)	7
3	**Team Work** - Contour plot, Graphing functions of two variables using GeoGebra/ Python (1 Hour)	
4	Center of gravity using Multiple integrals-Mass and Center of gravity of inhomogeneous laminas, Center of gravity and Centroid of a solid (2 Hours)	
5	Practice problems on double integrals and triple integrals (5 Hours)	8
6	**Team Work** – Visualizing solids and their intersections using GeoGebra/ Python (1 Hour)	
7	Motion along a curve-velocity, acceleration, speed, displacement and distance travelled (1 Hour)	
8	Practice problems on Gradient and Directional Derivative of scalar fields, Curl and Divergence of vector fields, Line Integrals and Conservative vector fields. (5 Hours)	
9	**Team work** – Visualizing gradient and its properties using GeoGebra/ Python, visualizing vector fields using GeoGebra/ Python and presenting their applications. (1 Hour)	7
10	Curl viewed as circulation (2 Hour)	

11	Practice problems on Line integrals using Green's theorem, Surface integrals, Flux integrals, Flux integrals using Divergence theorem, Work done using Stokes' theorem. (5 Hours)	8
12	**Team Work –** Visualizing Curl and Divergence using GeoGebra/ Python (1 Hour)	

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	Calculus	H. Anton, I. Biven, S. Davis	Wiley, 12th edition, 2024
Reference			
1	Advanced Engineering Mathematics	Dennis G Zill, Warren S. Wright	Jone's and Bartlett Learning, 4th edition,2011
2	Thomas' Calculus	Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki	Pearson 15th edition, 2023
3	Engineering Mathematics (Vol. 2)	S S Sastry	PHI, 2011
4	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons 10th edition, 2016
5	Higher Engineering Mathematics	B V Ramana	Mc Graw Hill,2021
6	Engineering Mathematics (Vol. I)	A.C. Srivastava, P. K. Srivastava	PHI,2010
Web Resource			
1	https://nptel.ac.in/courses/111107108	**NPTEL**	

DETAILED SYLLABUS *(Self-learning if any to be marked)*								
Module	Title	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
					C	P	A	
1	**Multivariable Calculus-Differentiation**	Limits and Continuity	L	1	3			1
		Partial derivatives of functions of two variables, Partial derivatives	L	1	3			2

		viewed as rate of change and slopes						
		Tutorial	T	1	3		2	1
		Partial derivatives of functions with more than two variables, Higher order partial derivatives	L	1	3			2
		Tutorial	T	1	3		2	1
		Local linear approximation	L	1	3			2
		Tutorial	T		3		2	1
		The Chain Rule, Implicit partial differentiation	L	1	3			2
		Maxima and Minima of functions of Two Variables-Finding relative extrema.	L	1	3			2
.		**Tutorial**	T		3		2	1
2	**Multivariable Calculus-Integration**	Double Integrals, Evaluating double integrals over rectangular regions	L	2	2			1
		Evaluating double integrals over nonrectangular regions	L	2	3			2
		Reversing the order of integration	L	2	3			1
		Tutorial	T		3		2	1
		Converting Double integrals from Cartesian Coordinates to Polar Coordinates	L	2	3			1
		Area calculated as a double integral, finding volumes using double integration	L	2	2			2
		Triple Integrals-Evaluating triple integrals over rectangular boxes	L	2	2			1
		Evaluating triple integrals over more general regions	L	2	3			1
		Tutorial	T	2	3		2	1
		Volume calculated as a triple integral	L	2	3			1
		Converting Triple integrals in Cartesian coordinates to Cylindrical coordinates	L	2	3			1
		Tutorial	T	2	3		2	1
3	**Calculus of Vector Functions**	Vector valued function of a single variable	L	3	2			1

No.	Module	Topic	Type					
		Limit, continuity and derivatives of vector valued function of a single variable	L	3	2			1
		Tutorial	T	3	3		2	1
		Concept of scalar and vector field	L	3	2			1
		Gradient and Directional Derivatives of a scalar field and its properties.	L	3	3			2
		Tutorial	T	3	3		2	1
		Divergence and curl of a vector field	L	3	2			2
		Line integral of vector fields	L	3	3			2
		Work as line integral	L	3	3			1
		Tutorial	T	3	3		2	1
		Conservative vector fields, Independence of path and Potential function(results without proof)	L	3	3			2
		Tutorial	T	3	3		2	1
4	**Vector Integral Theorems**	Green's theorem for simply connected region	L	4	2			2
		Applications of Green's theorem	L	4	3			1
		Tutorial	T	4	3		2	1
		Surface integrals over surfaces of the form $z = g(x, y)$.	L	4	3			1
		Flux integrals over surfaces of the form $z = g(x, y)$.	L	4	3			2
		Tutorial	T	4	3		2	1
		Divergence theorem (without proof)	L	4	2			1
		Finding flux using Divergence theorem, Sources and sinks	L	4	3			2
		Tutorial	T	4	3		2	1
		Stokes' theorem (without proof)	L	4	2			1
		Finding work done using Stokes' theorem	L	4	3			1
		Tutorial	T	4	3		2	1

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)

Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Multivariable Calculus-Differentiation	✓	✓	✓				15
2	Multivariable Calculus-Integration	✓	✓	✓				15
3	Calculus of Vector Functions	✓	✓	✓				15
4	Vector Integral Theorems	✓	✓	✓				15
This ToS shall be treated as a general guideline for students and teachers for distribution of marks.								

ASSESSMENT PATTERN

Assessment		Weightage
Continuous Internal Assessment		**40**
1	Internal Examination	20
2	Learning Activity	15
3	Regularity	5
4	Course Project	-
End Semester Examination		**60**
Total		**100**

B.Tech in Civil Engineering (2025 Regulation)

MODEL QUESTION PAPER

		Total Pages: …….
Register No.:	……………	Name: ……………………………………………

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	**B250902/MA200A**		
Course Name:	**MATHEMATICS FOR PHYSICAL SCIENCE -2**		
Max. Marks	**60**	**Duration**:	2 hours 30 minutes
Common to CE and ME			

PART A			
(Answer all questions. Each question carries 3 marks)			
No.	**Question**	**CO**	**Marks**
1	Find the slope of the surface $z = 3ye^x + e^{4y-x}$ in the x-direction at the point (3,0).	CO1	(3)
2	Show that the function $z = e^x \cos y + e^y \sin x$ satisfies Laplace's equation $\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0$.	CO1	(3)
3	Use a double integral to find the volume of the solid that is bounded above by the plane $z = 2 - x^2 - y^2$ and below by the rectangle $R = [-1, -1] \times [1,1]$.	CO2	(3)
4	Use polar co-ordinates to evaluate $\iint_R e^{-(x^2+y^2)} dA$, where R is the region enclosed by the circle $x^2 + y^2 = 1$.	CO2	(3)
5	Find a unit vector in the direction in which $f(x,y) = 3x - \log y$ increases most rapidly at the point (2, 4). Also, find the rate of change of $f(x,y)$ at (2, 4) in that direction.	CO3	(3)
6	Determine the value of a so that the vector field, $\vec{F}(x,y,z) = (x + 3y)\,\hat{\imath} + (y - 2z)\,\hat{\jmath} + (x + az)\hat{k}$ is solenoidal.	CO3	(3)
7	Determine whether the vector field, $\vec{F}(x,y,z) = x^3\hat{\imath} + y^3\hat{\jmath} + z^3\hat{k}$ is free of sources and sinks. If it is not, locate them.	CO4	(3)
8	Use Green's theorem to find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.	CO4	(3)

PART B			
(Answer any one full question from each module, each question carries 9 marks)			
No.	**Question**	**CO**	**Marks**
MODULE I			

B.Tech in Civil Engineering (2025 Regulation)

9	a)	Let f be differentiable function of three variables, and suppose that $w = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$. Show that $x\frac{\partial w}{\partial x} + y\frac{\partial w}{\partial y} + z\frac{\partial w}{\partial z} = 0$.	CO1	(4)
	b)	Find all points on the portion of the plane $3x + 2y + z = 6$ in the first octant at which $w = x^2y^3z$ attains its maximum value.	CO1	(5)

OR

10	a)	Find the local linear approximation $L(x, y, z)$ to $f(x, y, z) = xy + yz + zx$ at the point $(1, 2, 3)$. Also find the error in the approximation of f at the point $(0.99, 2.03, 2.98)$.	CO1	(4)
	b)	Let $u = ln\ (x^2 + y^2)$, $v = 2\ tan^{-1}\left(\frac{y}{x}\right)$ and $x = r\ cos\ \theta$, $y = r\ sin\ \theta$. Show that u and v satisfy the polar form of the Cauchy Riemann equation: $\frac{\partial u}{\partial r} = \frac{1}{r}\frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r}\frac{\partial u}{\partial \theta}$.	CO1	(5)

MODULE II

11	a)	Use a double integral to find the area of the region between the parabola $y = 2x^2$ and the straight-line $y = 3x$.	CO2	(4)
	b)	Sketch the region of integration and evaluate the integral $\int_0^\pi\ \int_y^\pi\ \frac{sin\ x}{x}\ dx\ dy$ by changing the order of integration.	CO2	(5)

OR

12	a)	Evaluate $\iint_R y\ cos\ x\ dA$, where R is the triangular region bounded by the lines $y = x, x = 0$ and $y = \pi$.	CO2	(4)
	b)	Find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.	CO2	(5)

MODULE III

13	a)	Evaluate the line integral $\int_C\ (x^2 + y^2)\ dx + 2x\ dy$, where C is the curve $x^2 + y^2 = 1$, traversed counterclockwise from $(1,0)$ to $(0,1)$.	CO3	(4)
	b)	Find the work done by the force field $\vec{F}(x, y) = xy\ \hat{\imath} + x^3j$ on a particle moving along the curve C, given by $x = y^2$, from $(0, 0)$ to $(1, 1)$.	CO3	(5)

OR

14	a)	Find the divergence and curl of the vector field: $\vec{F}(x, y, z) = x^2y\hat{\imath} + 2y^3z\ \hat{\jmath} + 3z\ \widehat{k}$.	CO3	(4)
	b)	Show that the line integral $I = \int_{(1,4)}^{(3,1)}\ 2xy^3\ dx + (1 + 3\ x^2y^2)\ dy$ is independent of the path. Hence, use the potential function to evaluate the line integral I.	CO3	(5)

MODULE IV

15	a)	Find the mass of the lamina that is portion of the cone $z = \sqrt{x^2 + y^2}$, lying between the planes $z = 1$ and $z = 2$, if the density function is $\delta(x, y, z) = 5y^2z$.	CO4	(4)

	b)	Using Green's theorem, evaluate work done by the force field $\vec{F}(x, y) = (e^{2x} - y^3)\,\hat{\imath} + (\sin y + x^3)\hat{\jmath}$ on a particle that travels once around the circle $x^2 + y^2 = 4$ in the counterclockwise direction.	CO4	(5)
		OR		
16	a)	Use Stokes', theorem to find the circulation of the vector field $\vec{F}(x, y, z) = (x - z)\,\hat{\imath} + (y - x)\,\hat{\jmath} + (z - xy)\,\hat{k}$ around the triangle with vertices $A\,(1, 0, 0)$, $B\,(0, 1, 0)$ and $C\,(0, 0, 1)$ oriented counterclockwise, when viewed from the origin towards the first octant.	CO4	(4)
	b)	Use the Divergence theorem to find the outward flux of the vector field, $\vec{F}(x, y, z) = (x^2 + y)\hat{\imath} + z^2\,\hat{\jmath} + (e^y - z)\hat{k}$ across the surface of the rectangular solid bounded by the coordinate planes and the planes $x = 1, y = 2$ and $z = 3$.	CO4	(5)

****

B.Tech in Civil Engineering (2025 Regulation)

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	3-0-0-2-3	Version	25/0	Credits	4
		(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)					

Course Code	Course Name	Course Category
B250902/CH910 B	**CHEMISTRY FOR PHYSICAL SCIENCE**	BSE

Pre-requisite
Concepts of chemistry introduced at the plus two levels especially Electrochemistry, Polymers, Structure of Molecules, Environmental Pollution and Volumetric Analysis.

COURSE OBJECTIVES

1	To equip students with a comprehensive understanding of electrochemical principles and their applications in energy storage, corrosion science, and measurement techniques to solve problems in areas such as battery development, corrosion protection, and pH measurement.
2	To enable students to understand and analyze the properties, characterization, and applications of fuels and lubricants in industrial processes, and to explore the synthesis, structural characteristics, and technological applications of nanomaterials and polymers in energy storage, electronics, and advanced materials.
3	To equip students with a comprehensive understanding of molecular spectroscopy, thermal analysis, and electron microscopic techniques, enabling them to analyse and interpret the structure and properties of materials.
4	To equip students to analyse water quality, treatment methods, waste management practices, and recognize the role of chemistry in promoting environmental sustainability and achieving SDGs.

COMPETENCY

CC1	Apply fundamental principles of electrochemistry, engineering materials, and spectroscopy to design, analyse, and develop materials and systems for various technological applications, including energy storage, corrosion protection, and advanced materials characterization.
CC2	Apply the principles of water chemistry and waste management to analyse water quality parameters, and implement sustainable strategies for waste reduction and resource recovery.

COURSE OUTCOMES (CO)

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	**Apply** the basic concepts of electrochemistry and corrosion to explore the possible applications in various engineering fields.	CC1	A	M	V
CO2	**Identify** the use of various engineering materials like fuels, lubricants, nanomaterials and polymers in different industries.	CC1	A	M	V
CO3	**Apply** the knowledge of spectroscopic techniques and instrumental methods for characterizing different materials in engineering applications.	CC1	A	M	V
CO4	**Select** various water treatment and waste management methods to solve different	CC2	A	M	V

environmental issues in a
sustainable way.

*Cognitive (Revised blooms Level): - **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
*Psychomotor Domain (Dave's): - **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
*Affective (Krathwohl): - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

CO	Program Outcomes & Program Specific Outcomes Correlation Matrix													
	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3	3	3	3	2	2	2		2			
2	2	2	3	3		3	2	2	1		2			
3	3	3		2	3		2	2	2		2			
4	3	3	3	3	3	3	3	2	2		3			

TEACHING AND ASSESSMENT SCHEME												
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme					
							Theory			Practical		Total
L	T	J	P	S	C		CIA	ESE	Total	CIA	ESE	Total	
3	0	0	2	3	4	120	25	60	85	15	0	15	100

*L: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	**Electrochemistry and Corrosion Science**	Electrochemical Cell- Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Electrochemical series - Applications –Reference electrodes – Glass & Calomel electrode-pH Measurement- using glass electrode-Conductivity-Measurement using Digital conductivity meter. Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only). Corrosion –Electrochemical corrosion mechanism - Galvanic series - Corrosion control methods - Cathodic Protection.	9
2	**Engineering Materials**	Fuels: Calorific value-Experimental determination of calorific value of solid fuels. Analysis of coal – Octane & Cetane Number. Biofuels- Biodiesel-Green Hydrogen. Lubricants: Classification - Properties of lubricants. Nanomaterials: Classification-Synthesis– Sol gel & Chemical Reduction - Applications of nanomaterials – Supercapacitor Materials - Carbon Nanotubes, Fullerenes & Graphene – structure, properties & application. Polymers: ABS & Kevlar - Synthesis, properties and applications. Conducting Polymers-Classification – Application.	9
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 – Vibrational spectroscopy – Principle- Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications. Thermal analysis: –TGA- Principle, instrumentation and applications – TGA of $CaC_2O_4.H_2O$ and polymers. DTA-Principle, instrumentation and applications - DTA of $CaC_2O_4.H_2O$. Electron Microscopic Techniques: SEM - Principle, instrumentation and Applications.	9
4	**Environmental Chemistry**	Water characteristics - Hardness - Disadvantages of hard water - Degree of hardness (Numericals)-Water softening methods-Ion exchange process-Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water disinfection methods – chlorination, Break point chlorination, ozone and UV	9

	irradiation. Dissolved oxygen (DO), BOD and COD. Waste Management: Sewage water treatment-Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. Solid waste-disposal methods- Composting, Landfill & Incineration.	

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs
1	Standard Hydrogen Electrode- Electrolysis-Electroplating of copper - Electroless plating of Copper	12
2	Cement: Manufacture of Portland cement – Theory of setting and hardening of cement.	12
3	Chromatography-Gas Chromatography-Principle-Instrumentation- Application – Analysis of chemical composition of exhaust gases.	12
4	Air Pollution- Sources & Effects- Greenhouse Gases- Ozone depletion. Control methods.	12
5	Pre- lab work.	16

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	Physical Chemistry	P. W. Atkins	Oxford University Press
2	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers
3	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company
4	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book
Reference			
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc
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.
6	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing
Web Resource			
1	https://onlinecourses.nptel.ac.in/noc25_mm35/preview		
2	https://onlinecourses.nptel.ac.in/noc25_ch51/preview		

DETAILED SYLLABUS (Self-learning if any to be marked)							
Module	Topic	Mode of Delivery	Relevant COs	Learning Domain			Hrs
				C	P	A	
1	**Electrochemical Cell**: Electrochemical Cell- Electrode potential	L	CO1	U		Rs	1
	Nernst equation for single electrode and cell (Numerical problems)	L, P	CO1	A	M	V	1

	Nernst Equation-Numerical Problems	L	CO1	A		Rs	1
	Electrochemical series and applications	L, P	CO1	A	M	V	1
	Reference electrodes – Glass & Calomel electrode –Construction and Working	L	CO1	U		Rs	1
	pH Measurement using Glass Electrode-Conductivity-Measurement using Digital conductivity meter	L, P	CO1	A	M	V	1
	Li-ion battery & H_2-O_2 fuel cell (acid electrolyte only) construction and working.	L	CO1	U		Rs	1
	Corrosion Electrochemical corrosion mechanism (acidic & alkaline medium)	L	CO1	U		Rs	1
	Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection.	L	CO1	U		Rs	1
	Standard Hydrogen Electrode- Electrolysis-Electroplating of copper - Electroless plating of Copper	S	CO1	U		Rs	
2	**Fuels**: Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels.	L	CO2	U		Rs	1
	Analysis of coal – Proximate analysis-Octane & Cetane Number	L	CO2	U		Rs	1
	Biofuels- Biodiesel-Green Hydrogen.	L	CO2	U		Rs	1
	Lubricants: Classification - Solid, Semisolid and Liquid lubricants.	L	CO2	U		Rs	1
	Properties of lubricants - Viscosity Index, Flash point, Fire point, Cloud Point, Pour Point & Aniline Point.	L	CO2	U		Rs	1
	Nanomaterials:Classification based on Dimension & Materials.	L	CO2	U		Rs	1
	Synthesis – Sol gel & Chemical Reduction-Applications of nanomaterials.	L	CO2	U		Rs	1
	Supercapacitor Materials - Carbon Nanotubes, Fullerenes, Graphene-–structure, properties & application.	L	CO2	U		Rs	1
	Polymers: ABS & Kevlar - Synthesis, properties and applications-Conducting Polymers- Classification & Applications	L, P	CO2	A	M	V	1
3	**Spectroscopy:** Types of spectra-Molecular energy levels	L	CO3	U		Rs	1
	Beer Lambert's law- Numerical problems	L, P	CO3	A	M	V	1
	Electronic Spectroscopy – Principle, Types of electronic transitions.	L	CO3	U		Rs	1
	Electronic Spectroscopy- Role of conjugation in absorption maxima. – Instrumentation-Applications –	L, P	CO3	A	M	V	1
	Vibrational spectroscopy – Principle	L, P	CO3	A	M	V	1
	Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Applications	L	CO3	U		Rs	1
	Thermal Analysis –TGA- Principle, instrumentation (block diagram) and applications – TGA of $CaC_2O_4.H_2O$ and polymers.	L	CO3	U		Rs	1
	DTA-Principle, instrumentation (block diagram) and applications - DTA of $CaC_2O_4.H_2O$.	L	CO3	U		Rs	1
	Electron Microscopic Techniques: SEM - Principle, instrumentation and Applications.	L	CO3	U		Rs	1

B.Tech in Civil Engineering (2025 Regulation)

	Chromatography-Gas chromatography-Principle-Instrumentation- Application – Analysis of chemical composition of exhaust gases.	S	CO3	U		Rs	
4	**Water characteristics** - Hardness - Types of hardness- Temporary and Permanent hardness	L	CO4	U		Rs	1
	Disadvantages of hard water -Degree of hardness.	L, P	CO4	A	M	V	1
	Degree of hardness (Numericals)	L	CO4	A		Rs	1
	Water softening methods-Ion exchange process- Principle, procedure and advantages.	L	CO4	U		Rs	1
	Reverse osmosis – principle, process and advantages	L	CO4	U		Rs	1
	Water disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation.	L	CO4	U		Rs	1
	Dissolved oxygen (DO), BOD and COD-Definition & Significance.	L, P	CO4	A	M	V	1
	Waste Management:Sewage water treatment: Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process.	L	CO4	U		Rs	1
	Solid waste-disposal methods-Composting, Landfill & Incineration.	L	CO4	U		Rs	1
	Air Pollution- Sources & Effects-Greenhouse Gases- Ozone depletion. Control methods.	S					

PRACTICAL SYLLABUS						
Topic	Objective	CO	Learning Domain			Hrs
			C	P	A	
Calibration of pH meter and determination of pH of a solution.	To calibrate a digital pH meter using standard buffer solutions and to accurately determine the pH of the given unknown solutions.	CO1	A	M	V	2
Determination of cell constant and conductance of solutions.	To determine the cell constant of a conductivity cell using a standard KCl solution and to measure the conductance of given solutions using a digital conductivity meter.	CO1	A	M	V	2
Verification of Nernst equation for electrochemical cell.	To verify the Nernst equation by measuring the electrode potential of a given electrochemical cell at different ion concentrations and comparing the experimental values with theoretical values.	CO1	A	M	V	2
Estimation of iron in iron ore.	To estimate the percentage of iron present in a given iron ore sample using a redox titration method with potassium permanganate as the titrant.	CO1	A	M	V	2
Synthesis of polymers (a)Urea- formaldehyde resin (b)Phenol- formaldehyde resin.	To synthesise the polymers such as urea formaldehyde resin and phenol- formaldehyde resin and hence to note their yield.	CO2	A	M	V	2
Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} in solution.	To determine the wavelength of maximum absorption of Fe^{3+} using a colorimeter and to estimate the concentration of Fe^{3+} in a given	CO3	A	M	V	2

B.Tech in Civil Engineering (2025 Regulation)

	solution based on Beer-Lambert's law.					
Determination of molar absorptivity of a compound (KMnO₄ or any water-soluble food colorant).	To determine the molar absorptivity (ε) of a coloured compound such as potassium permanganate by measuring absorbance at its λmax and applying Beer-Lambert's law.	CO3	A	M	V	2
Analysis of IR spectra.	To analyse the IR spectrum of given compounds based on characteristic absorption bands and to characterize the unknown compounds	CO3	A	M	V	2
Estimation of total hardness of water- EDTA method.	To determine the total hardness of a given water sample by complexometric titration using Ethylene diamine tetra acetic acid (EDTA) as the titrant and Eriochrome Black T as the indicator.	CO4	A	M	V	2
Estimation of dissolved oxygen by Winkler's method.	To estimate the amount of dissolved oxygen (DO) present in a water sample using Winkler's iodometric method, which is essential for assessing water quality and aquatic life sustainability.	CO4	A	M	V	2

TABLE OF SPECIFICATIONS (ToS) FOR QUESTION PAPER DESIGN								
Module	Module Title	Distribution of Marks (Revised Bloom's Level)						Total Marks
		R	U	A	An	E	C	
1	Electrochemistry and Corrosion Science	√	√	√				15
2	Engineering Materials	√	√	√				15
3	Instrumental Methods of Analysis	√	√	√				15
4	Environmental Chemistry	√	√	√				15
This ToS shall be treated as a general guideline for students and teachers for distribution of marks.								

ASSESSMENT PATTERN		
Assessment		**Marks**
Continuous Internal Assessment		**40**
1	Internal Examination (Theory)	**20**
2	Continuous Lab Evaluation	**10**
3	Internal Examination -Lab	**5**
4	Regularity	**5**
5	Course Project	**0**
End Semester Examination - Lab		**0**
End Semester Examination _ Theory		**60**
Total		**100**

MODEL QUESTION PAPER

	Total Pages: ....
Register No.:	**Name:** ....

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, MAY 2026 (2025 SCHEME)			
Course Code:	**B250902/CH910B**		
Course Name:	**Chemistry for Physical Science**		
Max. Marks	**60**	**Duration:**	**2 hours 30 minutes**
Common to CE and ME			

PART A
(Answer all questions. Each question carries 3 marks)

No.	Question	CO	Marks
1	An automotive engineer notices that the battery of electric vehicles degrades faster in tropical countries like India compared to temperate regions. The Li-ion battery voltage drops from 3.7V to 3.2V after 2 years of operation in hot conditions. Taking Nernst equation of Daniel Cell as an example, explain how temperature affects the electrode potential.	CO1	(3)
2	A glass electrode system shows an EMF of 0.428 V when measuring an unknown solution. With standard buffer (pH = 4), EMF = 0.236 V. Calculate the pH of unknown solution if the slope is 0.059 V/pH unit.	CO1	(3)
3	<table><tr><td>Column A(Property)</td><td>Column B (Significance)</td></tr><tr><td>A. Flash Point</td><td>1. Temperature at which lubricant becomes cloudy</td></tr><tr><td>B. Cloud Point</td><td>2. Minimum temperature for continuous combustion</td></tr><tr><td>C. Pour Point</td><td>3. Temperature at which vapours ignite momentarily</td></tr><tr><td>D. Fire Point</td><td>4. Lowest temperature at which oil ceases to flow</td></tr></table> Match the column A with column B. Based on the answer write four characteristics of a good liquid lubricant.	CO2	(3)
4	How do the different types of bonding present in Kevlar contribute to its exceptional mechanical strength and suitability for applications such as bullet proof vests and aerospace materials?	CO2	(3)
5	Which molecule will absorb at longer wavelength in UV? Justify the answer. 	CO3	(3)
6	A pharmaceutical lab is testing drug purity using UV-Visible spectroscopy. Two samples of the same drug show: Sample A: Absorbance = 0.845 at λ_max = 265 nm	CO3	(3)
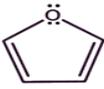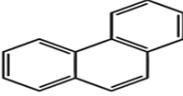
Sample B: Absorbance = 0.650 at λ_max = 265 nm

Both were measured in 1 cm cells. Sample A is the standard with concentration 5 x 10^{-4} M. Calculate the concentration of sample B.

| 7 | Compare the disinfection efficiency, mechanism of action, and advantages of ozone and chlorine in water treatment processes. | CO4 | (3) |
| 8 | What is DO in water? What are the factors which govern the amount of DO in water? | CO4 | (3) |

PART B
(Answer any one full question from each module, each question carries 9 marks)

No.		Question	CO	Marks
MODULE I				
9	a)	A zinc electrode is immersed in 0.01 M $ZnSO_4$ solution at 25°C. (i) Derive the Nernst equation for this single electrode. (ii) Calculate the electrode potential if $E^0_{Zn^{2+}/Zn}$ = -0.76 V.	CO1	(6)
	b)	Represent an electrochemical cell with Saturated Calomel Electrode and a Glass Electrode. How this system is used for the determination of pH of an unknown solution.	CO1	(3)
OR				
10	a)	Describe the construction and working of Li ion cell. Why full charging is not allowed in this cell?	CO1	(6)
	b)	Write any three applications of Electrochemical series with examples.	CO1	(3)
MODULE II				
11	a)	A coal sample was analysed using bomb calorimeter with the following data: Weight of coal = 0.8 g, Water equivalent of calorimeter = 2500 g, Rise in temperature = 2.4°C, Fuse wire correction = 50 cal, Acid correction = 60 cal. **(i)** Calculate the Higher Calorific Value (HCV) of coal in cal/g. **(ii)** If the coal contains 4% hydrogen, calculate the Lower Calorific Value (LCV). **(iii)** Explain why LCV is more relevant for practical fuel applications than HCV.	CO2	(6)
	b)	What is Biodiesel? Explain the preparation.	CO2	(3)
OR				

12	a)	Two fuel samples are tested:
		         Sample X: Octane number = 92, Cetane number = 25
		         Sample Y: Octane number = 45, Cetane number = 52
		 (i) Identify which sample is suitable for petrol engines and which for diesel engines. Justify.
		 (ii) Explain the chemical basis of octane and cetane ratings.
			CO2	(6)

	b)	Graphene-based materials are increasingly used in the fabrication of supercapacitors. Explain why graphene is suitable for this application with reference to its surface area, electrical conductivity, and mechanical strength.	CO2	(3)
MODULE III				
13	a)	In the CH_3COOH molecule, various types of electrons contribute to different electronic transitions. Discuss the possible electronic transitions in this molecule and illustrate them using a suitable energy level diagram.	CO3	(5)
	b)	Explain the instrumentation and working of Scanning Electron Microscopy.	CO3	(4)
OR				
14	a)	Explain how DTA differs from TGA. What additional information can DTA provide about $CaC_2O_4.H_2O$ decomposition that TGA cannot?	CO3	(5)
	b)	Calculate the number of vibrational modes in CO_2 and H_2O. Sketch the different vibrational modes and predict the IR activity.	CO3	(4)
MODULE IV				
15	a)	A smart city project requires water supply for 100,000 people (150 L/person/day). Source water analysis gives the following data: $Ca(HCO_3)_2$ = 162 mg/L, $Mg(HCO_3)_2$ = 73 mg/L, $CaSO_4$ = 136 mg/L, $MgCl_2$ = 95 mg/L, SiO_2 = 20 mg/L, Fe^{2+} = 0.8 mg/L, Turbidity = 25 NTU	CO4	(5)

B.Tech in Civil Engineering (2025 Regulation)

		(i) Calculate total, temporary, and permanent hardness in ppm. **(ii)** Design a complete disinfection strategy using Break Point Chlorination method.		
	b)	How is reverse osmosis used for the purification of sea water?	CO4	(4)
		OR		
16	a)	A solid waste management facility handles 100 tons of municipal waste daily with the following composition: Biodegradable: 60%, Non-biodegradable: 30% and Hazardous: 10% **(i)** Propose an integrated waste disposal strategy using composting, landfill, and incineration. **(ii)** Explain the scientific principle behind composting and mention two advantages. **(iii)** What precautions are necessary for landfill disposal to prevent groundwater contamination?	CO4	(5)
	b)	Explain the different stages in sewage water treatment with the help of a flow diagram.	CO4	(4)

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	2-0-0-2-2	Version	25/0	Credits	3
Course Code	**Course Name**						**Course Category**
B250902/ CN200C	**Engineering Graphics**						**EST**
Pre-requisite if any: NIL							
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE OBJECTIVES

1	To equip students with the ability to visualize, represent, and interpret engineering designs using technical drawings.
2	To learn the features of CAD software

COMPETENCY & OUTCOMES

Competency Statements	C1	Demonstrate the ability to interpret, construct, and communicate technical drawings by applying standard conventions and projection techniques, enabling effective visualization and representation of engineering components for design, analysis, and manufacturing applications.
	C2	Develop the ability to use CAD software for 2D drawings.

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO 1	Draw the orthographic projection of points and lines located in different quadrants	C1	A		
CO 2	Generate multi-view orthographic projections of engineering objects by visualizing them in different positions	C1	A		
CO 3	Plot sectional views of engineering solids.	C1	A		
CO4	Develop surfaces of engineering objects.	C1	A		
CO 5	Prepare pictorial drawings using the principles of isometric projection	C1	A		
CO 6	Sketch simple 2D drawings using CAD tools.	C2	A		Rs

Cognitive (Revised blooms Level): *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*

Psychomotor Domain (Dave's): *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*

Affective (Krathwohl): *- **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

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			x							3										1			
2			x							3										1			
3			x							3										1			
4			x							3										1			
5			x							3										1			
6			x							3				2						1			

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

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week				Self-Learning (S) / Semester	Total Hours / Semester	Credits C	Examination Scheme						
L	T	J	P				Theory			Practical			Total
							CIA	ESE	Total	CIA	ESE	Total	100
2	0	0	2	2	90	3	40	60	100				

L: *Lecture (One unit is of one-hour duration),* **T**: *Tutorial (One unit is of one-hour duration),* **P**: *Practical (One unit is of one-hour duration),* **J**: *Project (One unit is of one-hour duration),* **S**: *Self-Learning & Team Work (One unit is of one-hour duration),* **CIA**: *Continuous Internal Assessment,* **ESE**: *End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Contact Hours
1	**Orthographic projection of points and lines**	Introduction: Relevance of technical drawing in the engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing. (No questions for the end semester examination) Orthographic Projection of points in different quadrants, Projection of straight lines inclined to one plane, and inclined to both planes. Trace of a line. Inclination of lines with reference planes. True length and true inclinations of line inclined to both the reference planes.	**12**
2	**Orthographic projection of solids**	Orthographic Projection of Simple solids such as Triangular, Rectangular, Square, Pentagonal and Hexagonal Prisms and Pyramids, Cube, 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.	**12**
3	**Sections of solids and Development of surfaces**	Sections of Solids: Sections of Prisms, Pyramids, Cube, Cone and Cylinder with axis in vertical position and cut by different section planes. True shape of the sections. (Exclude true shape given problems).	**12**

		Development of Surfaces: Development of surfaces of the solids and solids cut by different section planes. (Exclude problems with through holes)	
4	**Isometric projection**	Isometric Projection: Isometric scale- Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Hemisphere and their combinations.	**10**
5	**Computer Aided Drawing (CAD)**	Computer Aided Drawing (CAD): Introduction, Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawing with dimensions using suitable software. (CAD, only internal evaluation)	**14**

SELF-LEARNING / TEAM WORK		
Sl. No	Self-learning / Team Work Description	Hrs/Semester
1	Application problems from projection of lines	**6**
2	Application problems from development of surfaces	**6**
3	https://www.autodesk.in/campaigns/autocad-tutorials	**6**
4	https://knowledge.autodesk.com/support/autocad/getting-started?sort=score	**6**
5	https://all3dp.com/autocad-tutorial-beginners/	**6**

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	Engineering Graphics	Varghese, P. I.	V I P Publishers, 2018.
2	Engineering Graphics	Benjamin, J.	Pentex Publishers, 2016.
3	Engineering Graphics	John, K. C.	Prentice Hall India Publishers, 2009.
4	Engineering Drawing	Bhatt, N., D.	Charotar Publishing House Pvt Ltd, 2019.
5	Engineering Graphics	Anilkumar, K. N.	Adhyuth Narayan Publishers, 2022.
Reference			
1	Engineering Graphics with AutoCAD,	Kulkarni, D. M., Rastogi, A. P. and Sarkar, A. K.,	Prentice Hall India Publishers, 2009.
2	Engineering Drawing & Graphics	Venugopal, K.	New Age International Publishers, 2011.
3	Engineering Drawing	Parthasarathy, N. S., and Murali, V.	Oxford University Press, 2015.
Web Resource			

1	NPTEL Course – Engineering Drawing (Web) - https://archive.nptel.ac.in/courses/112/102/112102304/
2	A R STUDY DESK – Engineering Graphics - Introduction Videos
Online learning App	
1	A R STUDY DESK – Engineering Graphics: Your Animated Notebook (EGYAN)

DETAILED SYLLABUS *(Self-learning if any to be marked)*

Module	Title	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
					C	P	A	
1		Orthographic projection of points	**CL**	**CO1**	**A**			**2**
1		Orthographic projection of lines	**CL**	**CO1**	**A**			**10**
1		Orthographic projection of lines – self learning	**SL**	**CO1**	**A**			**6**
2		Orthographic projection of solids	**CL**	**CO2**	**A**			**12**
3		Sections of Solids	**CL**	**CO3**	**A**			**6**
3		Development of surfaces	**CL**	**CO4**	**A**			**6**
3		Development of surfaces – self learning	**SL**	**C04**	**A**			**6**
4		Isometric projection	**CL**	**CO5**	**A**			**10**
5		Computer Aided Drawing (CAD)	**CL**	**CO6**	**A**		**Rs**	**14**
5		CAD - self learning	**SL**	**CO6**	**A**		**Rs**	**18**

TABLE OF SPECIFICATIONS (ToS) 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	Orthographic projections of points and lines	12			√				15

B.Tech in Civil Engineering (2025 Regulation)

2	Orthographic projections of solids	12			√				15
3	Sections of solids and development of surfaces	12			√				15
4	Isometric projection	10			√				15
5	Computer aided Drawing (CAD)	14			√				No ESE

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

Assessment	Weightage
Continuous Internal Assessment	**40**
Learning Activity (Assignments + CAD)	**5 + 10 =15**
Regularity	**5**
Internal Examinations	**20**
Course Project	**-**
End Semester Examination	**60**
Total	**100**

B.Tech in Civil Engineering (2025 Regulation)

MODEL QUESTION PAPER

	Total Pages: ...1....
Register No.:	Name: ....

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

FIRST SEMESTER B. TECH DEGREE REGULAR EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:	**B250902/CN200C**		
Course Name:	Engineering Graphics and Computer Aided Drawing		
Max. Marks	**60**	**Duration**:	2 hours 30 minutes
(ME, CE)			

Instructions: Retain all Construction lines. Show necessary dimensions. Answer any ONE question from each module. Each question carries 15 marks

No.	*Question*	*CO*	*Marks*
	MODULE 1		
1	A line 75mm long is in the first quadrant with the end A in the HP and the end B in the VP. The line is inclined at 30º to the HP and 45º to the VP. Draw the projections of AB.	CO1	(15)
2	The top view of a line PQ is 60mm long measures 50mm, while the length of its front view is 40mm. Its end P is in the VP and is 10mm below the HP. Draw the projections of the line and find its inclination with HP and VP.	CO1	(15)
	MODULE 2		
3	Draw the projections of a pentagonal prism of 30mm base side and 60mm height which is resting on its base edge on the ground such that its axis is inclined at 45º to HP and the resting base edge at 30º to VP.	CO2	(15)
4	A square prism of base side 30mm and axis length 60mm is resting on HP on one of its base edges with the axis inclined at 45º to HP. The vertical plane containing its axis is inclined at 35º to VP. Draw its projections.	CO2	(15)
	MODULE 3		
5	A pentagonal pyramid 30mm edge of base and 60mm height stands with its base on the ground and an edge of base perpendicular to VP. A section plane perpendicular to HP and inclined at 30º to VP cuts the pyramid at a distance of 5mm from its axis. Draw its sectional views. Also show the true shape of the section.	CO3	(15)
6	A vertical cone of 35mm diameter and axis 50mm is cut by a section plane which makes 45º to HP and bisects the axis of the cone. Draw the development of the lateral surface of the truncated cone.	CO4	(15)
	MODULE 4		
7	A truncated cone is having base diameter 60mm, top diameter 30mm and axis 40mm. A hemisphere 40mm in diameter is resting centrally on top of this, with its flat face facing upward. Draw the isometric view of the combination of solids.	CO5	(15)
8	A cylinder 50mm base diameter and 70mm high is resting on its base on the HP. It is surmounted centrally by a sphere of 30mm diameter. Draw the isometric projection of the solids.	CO5	(15)

****

B.Tech in Civil Engineering (2025 Regulation)

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	4-0-0-0-4	Version	25/0	Credits		4
Course Code			**Course Name**					**Course Category**
B250001/CE200D			**BUILDING MATERIALS AND CONSTRUCTION**					**EST**
Pre-requisites								
Course Code		**Course Name**						
B250902/CN100D		Introduction to Mechanical Engineering and Civil Engineering						

(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)

	COURSE OBJECTIVES
1	Enable the students to select proper building materials used in the construction industry.
2	To introduce the concepts of various construction practices in the Civil Engineering field.

COMPETENCY & OUTCOMES

Competency Statements	CC-1	To apply the knowledge of building materials and methods in construction practices.

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Apply the knowledge of building materials in construction practices.	CC-1	A		Rs
CO2	Perceive the components of a building based on its functions.	CC-1	U		Rs
CO3	Comprehend the construction practices of a residential building.	CC-1	U		Rs

***Cognitive (Revised blooms Level): - R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create **Psychomotor Domain (Dave's): - I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation **Affective (Krathwohl)**: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

CO	Program Outcomes & Program Specific Outcomes Correlation Matrix													
	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	-	-	-	-	-	-	-	-	-	-	3	-	2
2	3	2	-	-	-	-	2	-	-	-	-	3	2	2
3	3	2	3	-	-	-	-	-	-	-	-	3	2	3

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme						Total
							Theory			Practical			
L	**T**	**J**	**P**	**S**	**C**		**CIA**	**ESE**	**Total**	**CIA**	**ESE**	**Total**	
4	0	0	0	4	4	120	40	60	100	-	-	-	100

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Building Materials	Bricks, Cement, Aggregates – Properties and Testing.	15
2	Concrete and modern materials	Concrete: Types of concrete Modern materials	18
3	Building Components	Foundation and superstructure	15
4	Construction practices	Site selection and Preparation, Earthwork, Masonry, Damp-Proofing, Scaffolding, Shoring. Emerging Technologies in Construction.	12

SELF-LEARNING / TEAM WORK

Sl. No	Self-learning / Team Work Description	Hrs
1	Comparative analysis of traditional and modern building materials with sustainability concepts (Group presentation).	30
2	Case study: Presentation on recent innovative structures-Location and major civil engineering features (Group presentation)..	30

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	Concrete Technology: Theory and Practice	Gambhir, M.L.	Tata McGraw-Hill, 5th Edition, 2013
2	Building Materials	Duggal, S.K.	New Age International Publishers, 2009.
Reference			
1	Properties of Concrete	Neville, A.M.	Pearson Education, 5th Edition, 2012
2	Concrete Technology: Theory and Practice	Shetty, M.S.	S. Chand & Company, 2008.
3	Civil Engineering Materials	Somayaji, S.	Prentice Hall, 1995.
4	Concrete	Mindess, S. and Young, J.F.	Prentice Hall, 2nd Edition, 2003.
Web Resource			
1	IS 456: Code of Practice for Plain and Reinforced Concrete	Bureau of Indian Standards	www.bis.gov.in
2	IS 383: Specification for Coarse and Fine Aggregates	Bureau of Indian Standards	www.bis.gov.in
3	Construction Materials Database	National Institute of Construction Management	www.nicm.ac.in
4	Sustainable Construction Materials Portal	Green Building Council of India	www.igbc.in

DETAILED SYLLABUS
(Self-learning if any to be marked)

Module	Title	Major Topic & Sub Topic	Mode of Delivery	CO	C	P	A	Hours
					Learning Domain Level			
MODULE 1: BUILDING MATERIALS								
1.1	**Bricks**	Manufacturing: Moulding, drying, burning processes Properties of bricks Tests: Compressive strength, water absorption, field tests.	Lecture	CO1	A		-	6
1.2	**Cement**	Manufacturing, Composition, Grades, hydration of cement (Concept only) Tests: Fineness, Consistency, Setting time, Compressive Strength	Lecture	CO1	A		-	6

		Types - Portland Pozzolana Cement (PPC), Rapid hardening cement, Quick setting cement, white and coloured cement						
1.3	**Aggregates**	Types, Role of aggregates, Basic Properties	Lecture	CO1	A		-	3
		Tests - Sieve Analysis, Crushing value, Impact value, Abrasion value						

<div align="center">

MODULE 2: CONCRETE AND MODERN MATERIALS

</div>

2.1	**Cement mortar**	Proportioning and uses	Lecture	CO1	A	-	-	1
2.2	**Concrete**	Constituent materials, Grades	Lecture	CO1	A	-	-	8
		Mix-Nominal mix and Design Mix (Concepts only)						
		Water Cement Ratio						
		Batching, Mixing, Placing, Compaction, Curing						
		Properties: Fresh concrete: workability, segregation, bleeding. Hardened concrete: Compressive, Tensile, and Flexural Strength						
		Types of Concrete (concepts only)- PCC, RCC, PSC, RMC Concrete						
2.3	**Special Concrete**	Self-Compacting Concrete (SCC), High-Performance and High Strength Concrete, Geopolymer Concrete, Lightweight concrete Fiber Reinforced Concrete: Steel fibre, glass fibre, polypropylene fibres, Shotcrete (Concepts only)	Lecture	CO1	A	-	-	5
2.4	**Engineered wood**	Plywood, Particle Board and Medium Density Fibreboard	Self-learning	CO1	A	-	-	2
2.5	**Modern Materials**	Glass-Tempered, laminated, tinted, Reflective	Self-learning	CO1	A	-	-	2
		Plastics and Polymers: PVC, Polyethylene, Polycarbonate, Epoxy resins, Ceramic Products, Uses						
		Gypsum and Fiber cement boards (concept only)						

<div align="center">

MODULE 3: BUILDING COMPONENTS

</div>

3.1	**Foundations**	Purpose	Lecture	CO2	U	-		6
		Shallow foundation: Footings, raft						
		Deep foundation: Pile and well foundation						
3.2	**Super structure**	Basement, walls, Lintels, arches, beams columns, doors, windows, ventilators (Functions)	Lecture	CO2	U	-		2
		Partition Walls, shear wall and Cavity Walls	Lecture	CO2	U			1
3.3	**Roofing and Flooring**	Roofing - Types and materials Flooring: Types - Cement concrete, ceramic tiles, stone, wooden	Lecture	CO2	U	-	-	6

<div align="center">

MODULE 4: CONSTRUCTION PRACTICES

</div>

4.1	**Site Selection**	Criteria for selection, Preparation	Lecture	CO3	U			1

4.2	**Earthwork (Concept only)**	Excavation, Bracing, Filling, Compaction	Lecture	CO3	U			2
4.3	**Masonry**	Brick Masonry Types of bonds (Concept only) Stone Masonry: Rubble and Ashlar masonry	Lecture	CO3	U		-	2
4.4	**Damp-Proofing**	Causes and effects of dampness	Lecture	CO3	A	-	-	2
		Damp-proof course (DPC) Method of Treatment						
4.5	**Scaffolding, Shoring**	Scaffolding: Types, components, safety Shoring: Types and applications	Lecture	CO3	U	-	-	1
4.6	**Emerging Technologies (Elementary Concepts)**	3D Printing: Concept, Materials used, Benefits, limitations	Lecture, Demo	CO3	U	-	-	2
		Precast Construction: Applications, Advantages and challenges						
		Modular Construction: Concept and Advantages						
		Sustainable Construction Practices	Self-learning	CO3	U	-	-	2

TABLE OF SPECIFICATIONS(ToS) FOR QUESTION PAPER DESIGN

Module	Module Title	Distribution of Marks (Revised Bloom's Level)						Total Marks
		R	U	A	An	E	C	
1	Building Materials			√				15
2	Concrete and modern materials		√					15
3	Building Components		√					15
4	Construction Practices		√					15
This ToS shall be treated as a general guide line for students and teachers for distribution of marks								

Assessment		Weightage
Continuous Internal Assessment		**40**
1	Internal Examination	20
2	Learning Activity	15
3	Regularity	5
4	Course project	-
End Semester Examination		**60**
Total		100

B.Tech in Civil Engineering (2025 Regulation)

			Total Pages: 3
Register No.:	....	Name:	....

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

SECOND SEMESTER B. TECH DEGREE(REGULAR) EXAMINATION, DECEMBER 2025 (2025 SCHEME)			
Course Code:		B250001/CE200D	
Course Name:		Building Materials and Construction	
Max. Marks	**60**	**Duration**:	2 hours 30 minutes

PART A			
Answer all questions by choosing a convenient optional set, each question carries 15 marks			
No.	**Question**	**CO**	**Marks**
1	a) Describe the manufacturing process of brick.	CO1	(6)
	b) Match the following: **Column A** i) Compressive strength ii) Fineness iii) Soundness iv) Crushing value v) Gradation **Column B** i) Aggregate ii) Bricks iii) Cement iv)Measured in N/mm^2 v) Measured as percentage	CO1	(5)
	c) In a bag of cement, it is written as 43 grade. Give the significance of this number and list the other grades available.		(4)
OR			
2	a) You are given a batch of brick at the construction site. Explain the tests to be conducted to find the suitability of the brick.	CO1	(5)
	b) Portland Pozzolana cement is widely used in marine constructions. Why?	CO1	(5)
	c) The observations of a typical sieve analysis are given below. Determine the fineness modulus of the given sample of aggregate. Explain its significance.	CO1	(5)

Sieve size(mm)	Weight retained(g)	Sieve size(mm)	Weight retained(g)
4.75	0	0.6	120
2.36	20	0.3	170
1.18	60	0.15	30

No.	**Question**	**CO**	**Marks**
3	a) The nominal mix proportion of M15 concrete is 1:2:4. What does M15 and the proportion indicates?	CO1	(4)
	b) i) Define water cement ratio. ii) Differentiate between RCC, PCC and PSC	CO1	(2+3)
	c) Write any two uses and merits of the following materials i) Tempered glass ii) MDF board iii) Epoxy resins	CO1	(6)
OR			

4	a)	Distinguish between nominal mix and design mix? Why design mix is significant in construction field?	CO1	(5)
	b)	Match the following: i) Workability a) M60 ii) Curing b) Fresh concrete iii) Design mix c) Green technology iv) Geopolymer concrete d) Engineered wood v) Particle board e) Hydration f) Hardened concrete	CO1	(5)
	c)	It is mentioned that curing of concrete is very significant in the initial two weeks after casting. Share your opinion with proper justification.		(5)
5	a)	i) The function of lintel is to............................. ii) Basement is the part of a building between................ and........... ii) Foundation suited for an RCC bridge is.....................	CO2	(3)
	b)	Explain any three types of flooring based on materials used		(6)
	c)	i) Explain the function of a load bearing pile and give a situation where it is preferred. ii) Explain the purpose of a shear wall.		(6)
		OR		
6	a)	i) Foundations are provided to .... ii) Raft foundation is preferred while............... iii)Flat roofs are usually made of ....slabs	CO2	(3)
	b) c)	Describe the function of the following building components: i) Walls ii) Beams iii) Columns iv) Arches		(8)
	d)	Explain different types of roofs according to shape.		(4)
7	a)	You want to buy a plot for a residential building. List any five major parameters to be considered to account the suitability of the site.	CO3	(5)
	b)	Explain purpose of bracing in earth work excavation for a foundation		(5)
	c)	Why damp proof courses are provided in buildings		(5)
		OR		
8	a)	Write any two differences between random rubble masonry and ashlar masonry	CO3	(5)
	b)	"Modern construction is witnessing a revolution with the advent of emerging technologies. 3D printing enables layer-by-layer construction of building components using specialized concrete mixtures. Precast construction involves manufacturing building elements in factories under controlled conditions. Modular construction takes this further by creating complete 3D room units off-site. These technologies promise 40-60% reduction in construction time while ensuring better quality control." Based on the above paragraph: i) Name two advantages of precast construction over conventional methods. ii) List the advantages and disadvantages of 3D printing		(5)
	c)	Give a brief note on sustainable construction practices		(5)

****

B.Tech in Civil Engineering (2025 Regulation)

33

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	3-1-0-0-4	Version	25/0	Credits	4
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

Course Code	Course Name	Course Category
B250001/CE200E	MECHANICS OF SOLIDS	PCT

Pre-requisite
Engineering Mechanics

COURSE OBJECTIVES

1	To impart the skill in student to visualise the effect of external loads as internal stresses & strains/ forces & deformations and present them
2	To foster the competency in student to determine the Shear force and bending moment in structural components
3	To introduce the concept of form failure – buckling and to predict the strength of structural member against it.

COMPETENCY STATEMENT (CC)

CC1	Apply the fundamental principles of Mechanics of Solids to analyse structural components

COURSE OUTCOMES (CO)

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Analyse stresses, strains, and deformations in members subjected to different force conditions.	CC1	A		
CO2	Apply the relationships among elastic constants to solve engineering problems involving stress and strain.	CC1	U		
CO3	Develop shear force diagram and bending moment diagram for beams subjected to different loading conditions	CC1	A		
CO4	Analyse the behavior of short columns, slender columns and circular shafts.	CC1	A		
CO5	Analyze stresses on inclined planes in two-dimensional stress states using analytical methods and Mohr's circle.	CC1	A		

Cognitive (Revised blooms Level): *- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
Psychomotor Domain (Dave's): *- **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
Affective (Krathwohl)*: - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

CO	Program Outcomes (PO) & Program Specific Outcomes (PSO) Correlation Matrix													
	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	3		2		1				2	1		
2	3	2	2		2		1				2	1		
3	3	2	2		2		1	2			2	1		
4	3	3	2		2		1				2	1		
5	3	3	2		3		1	2			2	1		
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME									
Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	T	J	P	S	C		CIA	ESE	Total
3	1`	0	0	4	4	120	40	60	100

L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one- hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination

SYLLABUS (Major Topics)			
Module	Title	Major Topics	Hrs
1	Mechanics of linear elastic deformable bodies under axial load & relation between elastic constants	Concept of stress and strain – types, stress–strain relation - Hooke's law, Young's modulus of elasticity. Stress-strain diagram of mild steel. Factor of safety, working stress. Axially loaded bars with uniform and uniformly varying cross-section–stress, strain and deformation. Temperature effects, temperature stress in composite bars. Impact Shear stress and shear strain, Modulus of rigidity, Lateral strain, Poisson's ratio, and volumetric strain. Bulk modulus of elasticity, relationships between elastic constants	16
2	BMD & SFD in beams	Beams – different types. Types of support and loading on beams. Concept of bending moment and shear force. Relationship between intensity of load, shear force and bending moment. Shear force and bending moment diagrams of cantilever beams, simply supported beams, and overhanging beams for different type of loads (Point load, UDL, UVL, Moment), Point of contraflexure.	12
3	Variation of normal and shear stresses, strains in beam cross sections and deformation in beams	Theory of simple bending, assumptions and limitations. Calculation of normal stress in beams, moment of resistance. Shear stress in beams (Derivation not required). Beams of uniform strength. Strain energy due to bending – calculation of strain energy in beams. Moment curvature relation – Flexural rigidity.	14
4	Stress in inclined plane, short &long column & torsion of circular shaft	2D Stress tensor, Stresses on inclined planes for uniaxial and biaxial stress fields. Principal stresses and principal planes, maximum shear stress in 2D problems. Mohr's circle of stress for 2D problems. Short column – direct and bending stress. Kern of a section. Slender column – Euler's buckling load,	18

| | | slenderness ratio, limitation of Euler's formula. Rankine's formula.

Torsion of circular and hollow circular shafts, Strain energy due to torsion. | |

SELF-LEARNING / TEAM WORK		
Sl.No	Self-learning / Team Work Description	Hrs
1	Review report on history of Mechanics of Solids	3
2	Visualize the animation/video on idealization and properties of materials.	7
3	Solve problems based on Hooke's law on bars of uniform and uniformly varying cross sections	8
4	Identify and document (photos/sketches) 6 real-life supports (roller, hinge, fixed, suspension,) and beams (cantilever, simply supported, continues fixed etc.,).	6
5	Check the BMD & SFD of given beams with mobile app installed.	6
6	Calculate the bending stress and shear stress variations of cross sections of different beams.	6
7	Create beams of uniform strength by varying depth /breadth for given simple loading system.	6
8	Interpretation of results obtained by the integration / differentiation of moment curvature relation.	6
9	Determination of buckling load for slender columns in the lab for various boundary conditions	6
10	Comparison of resisting torque developed in solid and hollow circular shafts of same material length and weight	6

SUGGESTED LEARNING RESOURCES

Text Book			
Sl. No.	Title of Book	Author	Publication
1	Mechanics of Structures	H. J. Shah and S. B. Junnarkar	Charotar Publishing House, 32nd Edition, 2016.
2	A Text book of Strength of Materials	R. K. Bansal	Laxmi Publications, 6th Edition, 2015.
3	Mechanics of Materials	B. C. Punmia, Ashok, K. Jain, Arun Kumar Jain	Laxmi Publications, 3rd Edition, 2016.

Reference			
Sl. No.	Title of Book	Author	Publication
1	Mechanics of Solids	Egor P. Popov	Prentice Hall International Series, 2nd Edition, 2015.
2	Mechanics of Materials	James M Gere, S.P. Timoshenko	CBS Publishers and Distributors, 2nd Edition, 2004.
3	Mechanics of Materials	R.C. Hibbeler	Pearson, 11th Edition (latest), 2022.
4	Strength of Materials	S. Ramamrutham and R.Narayanan	Dhanpat Rai Publishing Co., 2025.
5	Strength of Materials	Rattan	McGraw Hill Education India
6	Engineering Mechanics	Egor P. Popov	Prentice Hall International Series
Web Resource			
1	https://onlinecourses.nptel.ac.in/noc22_ce46		

2	https://onlinecourses.nptel.ac.in/noc25_ce74/preview
3	https://web.mit.edu/emech/dontindex-build/

DETAILED SYLLABUS *(Self-learning if any to be marked)*

Module	Topic	Mode of Delivery	COs	Learning Domain			Hrs
				C	P	A	
1	Introduction to Mechanics of solids & mechanical properties of engineering materials	L, S	CO1	U			2
	Concept of load - displacement, stress - strain relation, types of stresses and strains	L, T	CO1	U			2
	Linear elastic material, Hooke's law. Axial deformation expression	L, T, S	CO1	A			2
	Stress strain plot of mild steel	L	CO1	A			1
	Concept of factor of safety &working stress	L, S	CO1	A			1
	Axially loaded bars with uniform and uniformly varying cross section–stress, strain and deformation.	L, T	CO1	A			3
	Temperature effects, temperature stress in composite bars.	L, S	CO1	A			1
	Shear stress and shear strain, Modulus of rigidity,	L, S	CO2	A			1
	Lateral strain, Poisson's ratio	L, S	CO2	A			1
	Volumetric strain, Bulk modulus of elasticity,	L, S	CO2	A			1
	Relationships between elastic constants	T, S	CO2	A			1
2	Various types of beams, types of supports and loading on beams	L, S	CO2	A			1
	Concept of bending moment and shear force.	L, T	CO2	A			3
	Relationship between intensity of load, shear force and bending moment.	L, S	CO2	A			1
	Shear force and bending moment diagrams of cantilever beams, simply supported beams and overhanging beams for different type of loads (Point load, UDL, UVL, Moment),	L, T, S	CO2	A			6
	Point of contraflexure	L	CO2	U			1
3	Theory of simple bending, equation of simple bending, assumptions and limitations.	L	CO3	A			2
	Calculation of normal stress in beams, moment of resistance.	L, T	CO3	A			2
	Shear stress in beams (Derivation not required).	L	CO3	A			1
	Beams of uniform strength.	L	CO3	A			1

	Strain energy due to bending and calculation of strain energy in beams.	L, T, S	CO3	A			3
	Moment curvature relation and the concept of flexural rigidity.	L, S	CO3	A			2
	Deflection of beams – Macaulay's method	L, T, S	CO3	A			3
4	Stresses on inclined planes for uniaxial and biaxial stress fields	L,T,S	CO4	U			3
	Principal stresses and principal planes, maximum shear stress in 2D problems. Mohr's circle of stress for 2D problems.	L, T, S	CO4	A			4
	Stress at a point -Stress tensor (Concept only)	L	CO4	A			1
	Short column – direct and bending stress. Kern of a section.	L, T,S	CO5	A			3
	Slender column – Euler's buckling load, slenderness ratio, limitation of Euler's formula. Rankine's formula.	L, T,S	CO5	A			4
	Torsion of circular and hollow circular shafts, Strain energy due to torsion	L, T, S	CO1	A			3

TABLE OF SPECIFICATIONS (ToS) (ESE Question Paper Design)								
Module	Module Title	Distribution of Marks (RBL)						Total Marks
		R	U	A	An	E	C	
1	Mechanics of linear elastic deformable bodies under axial load & relation among elastic constants		√	√				15
2	BMD & SFD in beams		√	√				15
3	Variation of normal and shear stresses, strains in beam cross sections and deformation in beams		√	√				15
4	Stress in inclined plane, short &long column & torsion of circular shaft		√	√				15
This ToS shall be treated as a general guideline for students and teachers for distribution of marks.								

ASSESSMENT PATTERN		
Assessment		**Weightage**
Continuous Internal Assessment		**40**
1	Internal Examination	20
2	Learning Activity	15
3	Regularity	5
4	Course Project	-
End Semester Examination		**60**
Total		**100**

Register No.:	....	Name:	....

(AN AUTONOMOUS COLLEGE AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANATHAPURAM)

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, APRIL 2026 (2025 SCHEME)			
Course Code:	B250001/CE200E		
Course Name:	MECHANICS OF SOLIDS		
Max. Marks	**60**	**Duration**:	2 hours 30 minutes

Assume any Missing data suitably

PART A			
(Answer all questions. Each question carries 3 marks)			
No.	**Question**	**CO**	**Marks**
1	Derive the expression for elongation of an axially loaded bar of uniform cross-section.	CO1	(3)
2	Explain the significance of Poissons ratio in engineering design.	CO2	(3)
3	Explain graphically how bending moment varies along the length of a cantilever beam with a point load at free end.	CO3	(3)
4	Describe the relationship between load intensity, shear force, and bending moment.	CO3	(3)
5	Plot the variation distribution of shear stress and bending stress along the depth in a rectangular beam cross-section.	CO5	(3)
6	Explain how strain energy due to bending varies with beam length and flexural rigidity.	CO5	(3)
7	Distinguish between short and long columns based on slenderness ratio.	CO4	(3)
8	A solid circular shaft of diameter 60 mm and length 1.2 m is subjected to a torque of 800 Nm at centre. Take G = 80 GPa. Determine the maximum shear stress in the shaft.	CO5	(3)

PART B			
(Answer any one full question from each module, each question carries 9 marks)			
No.	**Question**	**CO**	**Marks**
MODULE I			
9	During the construction of a steel bridge, a long steel beam is fixed between two rigid supports on early morning. Later in the day, due to sunlight, the temperature rises by 40°C. *(Given: Coefficient of expansion $12 \times 10^{-6} /^0C$, modulus of elasticity E = 200GPa).*		
a)	Determine the thermal stress developed in the beam if it cannot expand.	CO1	(5)
b)	Explain why such stresses must be considered during bridge design.	CO1	(4)
OR			
10	In a material testing lab, an engineer measures the modulus of rigidity (G) and Poisson's ratio (μ) for a new polymer material used in 3D printing. The measured values are $G = 0.9 \times 10^9 N/m^2$ and $\mu = 0.35$. He wants to determine other elastic constants for design use.		
a)	Derive the relationships among E, K, and μ.	CO2	(4)
b)	Compute the values of Young's modulus (E) and bulk modulus (K).	CO2	(3)
c)	Interpret what these values indicate about the axial stiffness and compressibility of the material.	CO2	(2)
MODULE II			
11	a)	By observing the BMD How engineer can the point of contraflexure and explain its practical importance in design.	CO3	(4)
	b)	Using an example of an overhanging beam, show where this point typically occurs, and sketch the B.M. diagram.	CO3	(5)

B.Tech in Civil Engineering (2025 Regulation)

		OR		
12		A cantilever beam of length 4 m carries a uniformly varying load (UVL) from zero at the free end to 12 kN/m at the fixed end.		
	a)	Derive expressions for shear force and bending moment at a distance x from the free end.	CO3	(3)
	b)	Calculate the maximum bending moment and its location	CO3	(2)
	c)	Sketch the SFD and BMD, indicating the nature of variation.	CO3	(4)
		MODULE III		
13		A steel beam of uniform strength is proposed for a warehouse roof. The beam must carry a UDL of 5 kN/m over a 4 m span. The design team wants to minimize material usage while maintaining safety.		
	a)	Explain the concept of beams of uniform strength and how it differs from standard beam design.	CO3	(3)
	b)	Calculate the maximum bending moment and suggest a variable depth profile to achieve uniform strength.	CO3	(3)
	c)	Estimate the strain energy stored in the beam and discuss its relevance in fatigue analysis.	CO3	(3)
		OR		
14		A reinforced concrete floor beam of a small residential building is designed as a simply supported rectangular section of size 230 mm × 450 mm (effective depth) and span 4.5 m. The beam supports a total factored load (including self-weight) of 35 kN/m. The permissible bending stress in concrete is 7 N/mm² and the permissible shear stress is 0.6 N/mm².		
	a)	Determine the maximum bending moment in the beam and check whether the section is safe in bending.	CO3	(3)
	b)	Calculate the moment of resistance of the beam section and comment on the adequacy of the chosen dimensions.	CO3	(3)
	c)	Evaluate the maximum shear stress in the beam and assess whether it satisfies the permissible limit.	CO3	(3)
		MODULE IV		
15		A thin rectangular steel plate is fixed at its edges and subjected to direct stresses of 80 MPa (tensile) along the x-axis and 50 MPa (compressive) along the y-axis. Using the principles of plane stress transformation and Mohr's circle, answer the following:		
	a)	Define Stress tensor and formulate the Stress tensor	CO5	(4)
	b)	For the given stress condition, determine: 1. The principal stresses and their directions, and 2. The maximum shear stress and its plane orientation.	CO5	(5)
		OR		
16		A steel column of circular cross-section (diameter 200 mm, length 3 m) is pinned at both ends and subjected to an eccentric load of 200 kN with an eccentricity of 25 mm. Take E = 2 × 10⁵ N/mm² and σ_{cr} = 360 N/mm². Short column		
	a)	Define Slenderness ratio, direct stress and bending stress.	CO4	(3)
	b)	Calculate the maximum and minimum stresses developed in the column section due to eccentric loading.	CO4	(6)

****

B.Tech in Civil Engineering (2025 Regulation)

COURSE DESCRIPTION							
Regulation	**2025**	**L-T-J-P-S**	**2-0-1-0-3**	**Version**	**25/0**	**Credits**	**3**
Course Code	**Course Name**						**Course Category**
B250908/CN220F	**ENTREPRENEURSHIP AND INTELLECTUAL PROPERTY RIGHTS**						**ESB**
Pre-requisite							
Course Code	**Course Name**						
Nil	Nil						
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Teamwork)							

COURSE OBJECTIVES
The course introduces the fundamentals of entrepreneurship and innovation, focusing on how ideas develop into ventures. It helps students identify and validate business opportunities, understand the role of Intellectual Property Rights (IPR) in protecting innovations and learn basic procedures for managing and commercializing intellectual property.

COMPETENCY & OUTCOMES		
Competency Statements	CC1	Develop entrepreneurial thinking and the ability to conceptualize, plan, and implement new ventures.
	CC2	Apply knowledge of Intellectual Property Rights (IPR) to protect and commercialize innovative ideas.

Course Outcomes (CO): At the end of this course, learners will be able to:					
CO	**CO Statement**	**Competency Statement Mapping**	**Cognitive**	**Psychomotor**	**Affective**
CO 1	**Explain** the fundamentals of entrepreneurship and innovation.	CC1	U	-	Re
CO 2	**Analyse** business models and plans for technology-based startups.	CC1	An	-	V
CO 3	**Explain** various forms of intellectual property.	CC2	U	-	Re
CO 4	**Apply** IPR concepts to protect, manage, and commercialize innovations.	CC2	A	-	Rs
CO 5	**Present** a project that evaluates business potential by applying suitable IP protection measures.	CC1, CC2	E	Ar	O
*Cognitive (Revised blooms Level): - **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*					
*Psychomotor Domain (Dave's): - **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*					
*Affective (Krathwohl): - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*					

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					1		1	1		2			
2	*		*					*	*	3			2	1	2	1	2	2	2	3			
3	*		*					*	*	2			1	2	2	2	1	1	2	3			
4	*		*					*	*	3			2	2	2	2	2	1	2	3			
5	*		*					*	*	3			2	3	3	2	2	3	3	3			

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

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week				Self-Learning (S) / Semester	Total Hours / Semester	Credits C	Examination Scheme			
L	T	J	P				Theory			Total
							CIA	ESE	Total	
2	-	1	-	3	90	3	60	40	100	100

L: *Lecture (One unit is of one-hour duration)*, **T**: *Tutorial (One unit is of one-hour duration)*, **P**: *Practical (One unit is of one-hour duration)*, **J**: *Project (One unit is of one-hour duration)*, **S**: *Self-Learning & Team Work (One unit is of one-hour duration)*, **CIA**: *Continuous Internal Assessment*, **ESE**: *End Semester Examination*

SYLLABUS (Major Topics)

Module	Title	Major Topics	Contact Hours
1	Entrepreneurship Fundamentals	Introduction to Innovation and Entrepreneurship – Entrepreneurial mindset – Types of entrepreneurs – Idea generation – Design thinking – Startup ecosystem – Government initiatives.	8
2	Business Planning and Startup Management	Market research and validation – Business model canvas – Revenue and pricing strategies – Business plan preparation – Prototype and MVP development – Risk management.	8
3	Fundamentals of IPR	Introduction to IPR – Patents, Trademarks, Copyrights, Industrial Designs – Patentability, filing procedures – Patent databases and search – Infringement-Rights and obligations – Case studies.	8
4	IPR Management and Commercialization	IP strategy for startups – Licensing, technology transfer – IPR in digital era – Emerging trends in AI and software patents – Ethical issues and Indian IP policy framework.	8

SELF-LEARNING / TEAM WORK

Sl. No	Self-learning / Team Work Description	Hrs/Semester
1	Analysis of government initiatives for startups (Startup India, Kerala Startup Mission, MSME schemes) and their impact on young entrepreneurs.	3

2	Case study on successful Indian startups and analysis of their innovation and growth journey.	3
3	Survey on entrepreneurial mindset among students and analysis of key motivating factors.	3
4	Preparation of a Business Model Canvas (BMC) for a technology or engineering-based idea.	3
5	Role-play exercise on negotiation between inventor and investor for licensing a technology	3
6	Comparative study of patents, trademarks, and copyrights through real-world Indian examples.	3
7	Patent search activity using the Indian Patent Advanced Search System (InPASS) or Google Patents.	3
8	Study on IPR infringement cases in India (e.g., Ilaiyaraaja vs *Manjummel Boys*, Novartis vs Union of India) and lessons learned.	3
9	Case study on the commercialization of academic research through technology transfer.	3
10	Seminar or debate on AI-generated content and copyright ethics in the digital era.	3

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Book			
1	The Engineering Handbook	Richard C.Dorf	CRC Press
2	Business Model Generation	Alexander Osterwalder & Yves Pigneur	Wiley
3	Innovation and Entrepreneurship for Engineers	Bharat Bhushan and Seema Bhushan	CRS Press
4	Indian Patent Law	P. Narayanan	Eastern Book Company
5	The Law of Copyright and Designs	B.L. Wadehra	Universal Law
6	Intellectual Property Rights (Including IPR in the Digital Age)	Prabuddha Ganguli	Tata McGraw-Hill Education
Web Resource			
1	https://onlinecourses.nptel.ac.in/noc25_mg81		
2	https://nptel.ac.in/courses/110107094		
3	https://onlinecourses.nptel.ac.in/noc22_hs59		

Module	Major Topic & Sub Topic	Mode of Delivery	Relevant COs	Learning Domain Level			Teaching Hours
				C	**P**	**A**	
1	Introduction to Innovation and Entrepreneurship – Meaning, need, and importance	L	CO1	U		Re	1

	Entrepreneurial mindset – Characteristics and motivation of entrepreneurs	L	CO1	U		Re	1
	Types of entrepreneurs – Intrapreneurs, social, tech-based, women entrepreneurs	L	CO1	U		Re	1
	Idea generation techniques – Creativity, brainstorming, problem identification	L	CO1	U		Re	1
	Design thinking – Empathy, define, ideate, prototype, and testing	L	CO1	U		Re	1
	Startup ecosystem – Incubators, accelerators, funding agencies	L	CO1	U		Re	1
	Government initiatives for startups – Startup India, Make in India, MSME schemes	L	CO1	U		Re	1
	Self-Learning 1	S	CO1	U		Re	
	Self-Learning 2	S	CO1	U		Re	
	Case study / activity – Successful Indian startups and their founders	L	CO1	U		Re	1
2	Market research and validation – Identifying customer needs	L	CO2	An		V	1
	Business model canvas – Key partners, activities, value proposition	L	CO2	An		V	1
	Revenue and pricing strategies – Cost-based and value-based pricing	L	CO2	An		V	1
	Business plan preparation – Structure and key components	L	CO2	An		V	1
	Self-Learning 3	S	CO2	An		V	
	Prototype and MVP development – Concept and significance	L	CO2	An		V	1
	Self-Learning 4	S	CO2	An		V	
	Risk management – Types of risks and mitigation plans	L	CO2	An		V	1
	Startup funding sources – Angel investors, venture capital, crowdfunding	L	CO2	An		V	1

B.Tech in Civil Engineering (2025 Regulation)

	Self-Learning 5	S	CO2	An		V	
	Case study / activity – Analyze a startup's business model canvas	L	CO2	An		V	1
3	Introduction to IPR – Need, importance, and categories	L	CO3	U		Re	1
	Patents – Concepts, requirements, and types	L	CO3	U		Re	1
	Trademarks and Copyrights – Differences, examples, and protection	L	CO3	U		Re	1
	Industrial Designs and Geographical Indications – Overview	L	CO3	U		Re	1
	Self-Learning 6	S	CO3	U		Re	
	Patentability and filing procedures – Steps involved in India	L	CO3	U		Re	1
	Patent databases and search – Hands-on demonstration (Google Patents)- Infringement	L	CO3	U		Re	1
	Self-Learning 7	S	CO3	U		Re	
	Self-Learning 8	S	CO3	U		Re	
	Rights and obligations of patent holders	L	CO3	U		Re	1
	Case study – Patent disputes and lessons learned	L	CO3	U		Re	1
4	IP strategy for startups – Importance and methods	L	CO4	E	Ar	O	1
	Licensing and technology transfer – Process and agreements	L	CO4	E	Ar	O	1
	IPR in the digital era – Copyrights in AI, software, and digital content	L	CO4	E	Ar	O	1
	Emerging trends – AI-generated inventions, data protection, open-source issues	L	CO4	E	Ar	O	1

Self-Learning 9	S	CO4	E	Ar	O	
Self-Learning 10	S	CO4	E	Ar	O	
Software patents – Challenges and case examples	L	CO4	E	Ar	O	1
Ethical issues in IPR – Plagiarism, fair use, and data ethics	L	CO4	E	Ar	O	1
Indian IP policy framework – Overview and updates	L	CO4	E	Ar	O	1
Case study / seminar – IP commercialization success stories	L	CO4	E	Ar	O	1

TABLE OF SPECIFICATIONS (ToS) 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	Entrepreneurship Fundamentals	8		√	√				10
2	Business Planning and Startup Management	8			√	√			10
3	Fundamentals of IPR	8		√	√				10
4	IPR Management and Commercialization	8			√	√			10

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

ASSESSMENT PATTERN	
Assessment	**Marks**
Continuous Internal Assessment	**60**
Learning Activity	5
Attendance	5
Internal Examination	20
Course Project	30
End Semester Examination	**40**
Total	**100**

Register No.:	....	Name:	....

SECOND SEMESTER B. TECH DEGREE (REGULAR) EXAMINATION, APRIL 2026 (2025 SCHEME)

Course Code:	B250908/CN220F		
Course Name:	ENTREPRENEURSHIP AND INTELLECTUAL PROPERTY RIGHTS		
Max. Marks	**40**	**Duration**:	2 hours 30 minutes

	PART - A		
	(Answer all questions. Each question carries 2 marks)		
No.	**Question**	**CO**	**Marks**
1	The five stages of Design Thinking are _____, Define, Ideate, _____ and Test.	CO1	(2)
2	Compare entrepreneurs and intrapreneurs in terms of their approach to innovation	CO1	(2)
3	Analyse the role of market validation in reducing startup failure risk.	CO2	(2)
4	Evaluate the importance of Minimum Viable Product (MVP) development.	CO2	(2)
5	The criteria for patentability include novelty, _____ step and _____ applicability.	CO3	(2)
6	Analyse how Geographical Indications (GIs) help in protecting regional products such as *Palakkadan Matta Rice* from Kerala.	CO3	(2)
7	Match the terms in **Column A** with the appropriate descriptions in **Column B**. <table><tr><th>Column A</th><th>Column B</th></tr><tr><td>(a) Licensing vs. Assignment</td><td>(i) Assessing economic worth of IP assets</td></tr><tr><td>(b) Patent Pooling</td><td>(ii) Fair use, plagiarism, and data ownership</td></tr><tr><td>(c) IP Ethics</td><td>(iii) Permission vs. complete ownership transfer</td></tr><tr><td>(d) IP Valuation</td><td>(iv) Sharing IP among multiple holders</td></tr></table>	CO4	(2)
8	Suggest two ways companies like *Adobe* and *Netflix* can prevent plagiarism and digital piracy.	CO4	(2)

	PART - B		
	(Answer any one full question from each module, each question carries 6 marks)		
No.	**Question**	**CO**	**Marks**
	MODULE I		
9	Kerala has witnessed a steady rise in youth-led entrepreneurship through initiatives like **Kerala Startup Mission (KSUM),** which provides incubation, mentorship, and seed funding support. Programs such as **Young Innovators Programme (YIP)** encourage school and college students to identify real-world problems and propose innovative solutions. Many student startups—ranging from agritech to renewable energy—have evolved from these programs and are now scaling globally		
	a) Analyse how Kerala's startup ecosystem supports the development of an entrepreneurial mindset among students.	CO1	(2)
	b) Explain how design thinking principles can be applied to initiatives like YIP to improve innovation outcomes		(2)

	c)	Evaluate the challenges faced by youth entrepreneurs in Kerala in accessing funding and markets.		(1)
	d)	Suggest one policy-level improvement that could further strengthen Kerala's entrepreneurial ecosystem.		(1)
OR
10		In Kerala, there has been a growing presence of social and women entrepreneurs who are redefining business with a focus on sustainability and inclusivity. Initiatives like **Kudumbashree** and **WE Mission** (Women Entrepreneurship Mission) have empowered thousands of women to start micro and small-scale ventures across sectors like food processing, handicrafts, and local tourism. Meanwhile, social entrepreneurs such as *G. Venu (Natanakairali)* and *Jose Kutty Panackal (Farmvent)* have used innovation to address social and environmental issues. These ventures not only create employment but also promote sustainable development aligned with the UN SDGs.

	a)	Differentiate between social entrepreneurs and commercial entrepreneurs with suitable examples from Kerala		(2)
	b)	Analyse how programs like Kudumbashree and WE Mission contribute to women entrepreneurship development.	CO1	(2)
	c)	Evaluate the role of social entrepreneurship in achieving sustainable and inclusive growth in Kerala.		(1)
	d)	Suggest one initiative the state government can introduce to strengthen the social entrepreneurship ecosystem.		(1)
MODULE II
11		A group of engineering graduates from Kochi developed an **IoT-based smart irrigation system** that optimizes water usage for farmers in Palakkad. With the support of KSUM's incubation center and an angel investor from Thrissur, the team built a Minimum Viable Product (MVP). However, scaling the product across India required a clear business model, pricing strategy, and risk assessment plan**.**

	a)	Construct the key components of a Business Model Canvas for this smart irrigation startup.		(3)
	b)	Suggest an appropriate pricing strategy and justify your choice.	CO2	(2)
	c)	Analyse two major risks this startup may face during national expansion and suggest mitigation strategies		(1)
OR
12		Founded in 2015, **Zomato** evolved from a simple restaurant discovery website to a multi-service platform offering food delivery, dining experiences, and grocery delivery. The startup adopted a commission-based revenue model, where it earned a percentage from restaurant orders, and later diversified into subscription models like Zomato Gold. Despite rapid expansion, Zomato faced major financial and operational challenges, including high delivery costs, customer retention issues, and intense competition from Swiggy. To remain sustainable, the company had to rethink its pricing strategy, manage investor expectations, and explore new sources of income such as advertising and cloud kitchens. This journey demonstrates how startup success depends not only on innovation but also on effective business planning, risk management, and strategic funding decisions.

	a)	Analyse Zomato's business model and identify how it balances value creation for customers and revenue generation for the company		(3)
	b)	Evaluate the effectiveness of Zomato's diversification strategy (e.g., Zomato Gold, grocery delivery) in maintaining market competitiveness.	CO2	(2)
	c)	Suggest any two alternative revenue model Zomato could adopt to achieve long-term profitability.		(1)
MODULE III
13		In 2023, India's Patent Office rejected **Johnson & Johnson's** patent extension request for its popular tuberculosis (TB) drug **Bedaquiline**. The company had sought to extend its patent beyond the original expiry date, claiming a new version of the same compound. However, the Patent Office ruled that the new version did not meet the criteria of novelty and inventive step under the Indian Patent Act, **Section 3(d).** As a result, Indian manufacturers were

		allowed to produce generic versions of Bedaquiline, reducing the cost of TB treatment from thousands of rupees per month to less than a few hundred. This decision was celebrated by public health organizations and patient-rights groups, as it made life-saving TB medicines affordable to thousands of patients in India and other developing nations.		
	a)	Explain why the Indian Patent Office rejected Johnson & Johnson's patent extension for Bedaquiline.		(3)
	b)	Analyse how Section 3(d) of the Patent Act helps prevent "evergreening" of pharmaceutical patents.	CO3	(2)
	c)	Evaluate the social and economic impact of this decision on TB treatment and Indian healthcare.		(1)
OR				
14		In early 2024, a major copyright controversy emerged in the Indian film industry when legendary composer **Ilaiyaraaja** issued a legal notice to the producers of the Malayalam film ***Manjummel Boys***, which featured his iconic Tamil song *"Kanmani Anbodu Kaadhalan"* from the 1991 film *Guna*. The song, deeply emotional and nostalgic, was used in a key scene of *Manjummel Boys*, which later became a massive box-office success across India. According to Ilaiyaraaja, the filmmakers had not obtained his personal permission to use the song, even though they had secured a license from the audio label that owned the recording rights. He claimed that under the Indian **Copyright Act, 1957**, a composer retains moral and authorial rights over their work — including the right to be acknowledged and to object to unauthorized or distorted use. He argued that simply acquiring a "sound recording licence" from a music company does not override the composer's ownership of musical and lyrical rights. This case reignited a larger debate in India's creative industry about ownership, moral rights, and licensing practices. Many musicians and lyricists supported Ilaiyaraaja, asserting that composers often lose control of their creations to record labels. Others argued that such disputes could discourage filmmakers from reviving classic songs. Eventually, media reports suggested that the matter was settled out of court, with the *Manjummel Boys* team reportedly compensating Ilaiyaraaja around ₹60 lakhs for the use of the song. The controversy highlighted the urgent need for clearer copyright awareness and ethical licensing practices in Indian cinema.		
	a)	Explain the types of rights Ilaiyaraaja holds under the Copyright Act, 1957, including economic and moral rights		(2)
	b)	Analyse why obtaining permission from a record label may not be sufficient to legally use a musical composition in a film.	CO3	(2)
	c)	Evaluate how this case impacts future relationships between composers, producers, and music companies in the Indian film industry.		(1)
	d)	Suggest one measure — legal, educational, or institutional — that could help prevent such copyright disputes in India's creative sector.		(1)
MODULE IV				
15		With rapid advances in **artificial intelligence (AI)**, India faces new challenges in defining ownership, authorship, and accountability for creative works generated by machines. AI tools such as **ChatGPT, Midjourney, and Bard** are now widely used by students, designers, and businesses. While these tools accelerate creativity and productivity, they also raise legal and ethical questions about originality, plagiarism, and copyright. In 2024, the Indian Ministry of Electronics and Information Technology initiated discussions on a framework for AI-generated content ownership and data protection, emphasising transparency and responsible innovation. Globally, courts and IP offices are divided: some countries allow limited copyright protection for AI-assisted works, while others — including India — still require human authorship as the basis for copyright registration. The debate highlights a social tension: how can society protect creators' rights while encouraging the open, democratic use of emerging technologies? Without clear IP policies, both human creators and innovators risk exploitation, plagiarism, and loss of credit for their work.		
	a)	Explain the challenges India faces in defining copyright ownership for AI-generated works.	CO4	(2)
	b)	Analyse the ethical implications of using AI tools for creative and academic content generation		(2)

	c)	Evaluate whether India should extend partial IP protection to AI-assisted works. Support your view with reasons.		(1)
	d)	Suggest one policy or guideline that could balance innovation and ethical IP use in the AI era.		(1)
	OR			
16		Over the past decade, India has witnessed explosive growth in digital entertainment and online media platforms such as **Netflix, Hotstar, Zee5** and **SonyLIV**. However, this growth has been accompanied by a surge in digital piracy, which severely affects the creative economy. According to a 2024 report by the **Motion Picture Association** (MPA), India ranks among the top five countries in illegal film downloads and streaming site traffic. The Cinematograph (Amendment) Act 2023 introduced strict penalties — including imprisonment — for individuals or groups involved in unauthorised recording or exhibition of films. Despite these legal measures, piracy persists through mirror sites, Telegram channels, and illegal OTT apps. This issue raises broader ethical and social questions: while piracy deprives creators and investors of revenue, it also exposes the affordability gap in India's digital ecosystem. Many argue that reducing piracy requires not only enforcement but also accessible pricing models and awareness among youth about IP ethics.		
	a)	Explain how licensing and distribution rights contribute to fair commercialisation of digital content in India.	CO4	(2)
	b)	Analyse the effectiveness of India's new anti-piracy laws in addressing the social and economic impacts of film piracy.		(2)
	c)	Evaluate the ethical dilemma between access and ownership in the context of digital piracy.		(1)
	d)	Suggest one initiative that could reduce piracy while ensuring affordable access to digital content.		(1)

****

COURSE DESCRIPTION

Regulation	2025	L-T-J-P-S	1-0-0-1-0	Version	25/0	Credits	1
			(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)				

Course Code	Course Name	Course Category
B250908/CN910K	HEALTH AND WELLNESS	HMT
Pre-requisite		

COURSE OBJECTIVES

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

COMPETENCY STATEMENT (CC)

CC1	Demonstrate a commitment to a healthy lifestyle through regular physical activity and avoidance of addictive substances to promote holistic wellness.

COURSE OUTCOMES (CO)

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	CC Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Explain the importance of physical activity in maintaining the human metabolic system.	CC1	U		Re
CO2	Practice life style management strategies to improve mental health and wellness.	CC1	U	M	Rs
CO3	Practice healthy life style through regular physical activities and abstaining from addictive substances	CC1	U	M	Ch

*Cognitive (Revised blooms Level):- **R**: Remember; **U**: Understand; **A**: Apply; **An**: Analyse; **E**: Evaluate; **C**: Create*
*Psychomotor Domain (Dave's): - **I**-Imitation, **M**-Manipulation, **P**-Precision, **Ar**-Articulation, **N**-Naturalisation*
*Affective (Krathwohl): - **Re**-Receiving, **Rs**-Responding, **V**-Valuing, **O**-Organization, **Ch**-Characterization*

CO	Program Outcomes (PO) & Program Specific Outcomes (PSO) Correlation Matrix													
	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	2					1	1		1		1			
2	2					1	1		1		1			
3	2					1	1		1		1			
	2					1	1		1		1			
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME

Teaching Scheme / Week					Credit	Hours / Semester	Examination Scheme		
							Theory		
L	T	J	P	S	C		CIA	ESE	Total
1	0	0	1	0	1	30	30		30

***L**: Lecture (One unit is of one-hour duration), **T**: Tutorial (One unit is of one-hour duration), **P**: Practical (One unit is of one-hour duration), **J**: Project (One unit is of one-hour duration), **S**: Self-Learning & Team Work (One unit is of one-hour duration), **CIA**: Continuous Internal Assessment, **ESE**: End Semester Examination*

B.Tech in Civil Engineering (2025 Regulation)

SYLLABUS (Major Topics)

Module	Title	Major Topics	Hrs
1	Physical well-being and fitness.	Human Body Systems. Quantifying Physical Activity Energy Expenditure. FITT principle	4
2	Mental health awareness & balanced diet	Understanding Mental Health, Addiction and Related Issues, Resources for Mental Wellness.	4
3	Health and wellness through lifestyle management	Manage common hypokinetic diseases and disorders. Meaning, Aims and objectives of yoga. Understanding on substance abuse and addiction	4
4	First Aid Essentials	First aid and principles of first aid	2

SELF-LEARNING / TEAM WORK

Sl. No	Self-learning / Team Work Description	Hrs
1	Team activities : Group presentations (Sample topics: Addiction /mental health awareness and suicide prevention ,Nutrition concepts, Popular dietary trends, Nutritional needs at different life stages)	4

SUGGESTED LEARNING RESOURCES

Text Book

Sl. No.	Title of Book	Author	Publication
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
3	The Mental Health Handbook A Cognitive Behavioural Approach	Trevor Powell	Routledge 2009

Reference

Sl. No.	Title of Book	Author	Publication
1	Fit to be Well Essential Concept	Thygerson, A.L. ,Thyge son , S.M.,& Thygerson, J. S.	Jones & Bartlett Learning 2018
2	Introduction to physical education, fitness, and sports	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
7	Positive Psychology for Improving Mental Health ; Well-Being	Dr.Geetika Patnaik	Notion Press 2019

Web Resource

1	https://www.nutrition.gov/ #:~:text=Nutrition.gov%20is%20powered%20by,you%20make%20healthful%20eating%20choices
2	https://www.ncbi.nlm.nih.gov/pmc/artic1es/PMC2879108/
3	https:/ /yoga.ayush.gov.in/
4	https:/ /www.mindful.org/

B.Tech in Civil Engineering (2025 Regulation)

Module	Topic	Mode of Delivery	CO	Learning Domain			Hrs
				C	P	A	
1	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.	L	CO 1	U		Re	1
	Quantifying Physical Activity Energy Expenditure and Metabolic equivalent of task (MET)**.** Exercise Continuum :Light-intensity physical activity, Moderate intensity physical activity, Vigorous - intensity physical activity.	L	CO 1	U		Re	1
	Defining Physical Activity, Aerobic Physical Activity, Anaerobic Physical Activity, Exercise and Health-Related Physical Fitness. FITT principle to design an Exercise programme.	L	CO 1	U		V	1
	Components of Health-related Physical Fitness: - Cardiorespiratory Fitness-Muscular strength- Muscular endurance-Flexibility-Body composition.	L	CO 1	U		Re	1
2	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	L	CO2	U		V	2
	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	L	CO2	U		Rs	2
3	Life style management strategies to prevent manage common hypokinetic diseases and disorders-Obesity Cardiovascular diseases - Diabetes - Osteoporosis - Musculoskeletal disorders(e.g., osteoarthritis, Low back pain, Kyphosis, lordosis,flat-foot, Knock knee	L	CO2	U		Re	1
	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	L	CO2	U			1
	Understand on substance abuse and addiction psychoactive substance &its ill effects -alcohol opioids- cannabis - sedative -cocaine- other stimulants including caffeine - hallucinogens-tobacco - volatile solvents.	L	CO2	U			1
4	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.	L	CO3	U		Rs	1

Module	Topic	Objective	CO	L	CO3	U		Rs	1
	First Aid Procedures: Cardiopulmonary Resuscitation (CPR) Heimlich Maneuver - Applying a sling Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain)			L	CO3	U		Rs	1

Module	Topic	Objective	CO	Learning Domain Level			Teaching Hours
				C	P	A	
	Stretching exercise (V sit and reach)	Improving Flexibility through Stretching Exercises	CO3		M		
	Strength exercises (Partial Curl Up & Push Up)	Improving Flexibility through Stretching Exercises.	C03		M		12
	Endurance Exercises (Run& Walk)	To assess and improve cardiovascular endurance	C03		M		

ASSESSMENT PATTERN	
Assessment	**Marks**
Continuous Internal Assessment	**50**
1	Internal Examination	
2	Activity Evaluation	20
3	Learning Activity	20
4	Regularity	10
5	Course Project	
End Semester Examination	
Total	**50**

Regulation	2025	L-T-J-P-S	0-0-0-2-0	Version	25/0	Credits	1
Course Code			**Course Name**			**Course Category**	
B250001/CE230U		Civil Engineering Planning & Drafting Lab				PCL	
Pre-requisite if any							
Course Code		**Course Name**					
B250902/CN100D		Introduction to Mechanical Engineering and Civil Engineering					
(L- Lecture, T-Tutorial, J-Project, P-Practical, S-Self-learning & Team Work)							

COURSE OBJECTIVES	
1	To introduce the fundamentals of Civil Engineering Drawing and the principles of planning of buildings.
2	To enable the students to prepare working drawings of buildings manually and using AutoCAD.

COMPETENCY		
Competency Statements	CC1	Prepare working drawings of buildings as per the given requirements in compliance with NBC, KMBR and KBPR standards

COURSE OUTCOMES

Course Outcomes (CO): At the end of this course, learners will be able to:

CO	CO Statement	Competency Statement Mapping	Cognitive (C)	Psychomotor (P)	Affective (A)
CO1	Prepare detailed drawings of components of a building.	CC1	A	P	V
CO2	Prepare building drawings as per the specifications.	CC1	A	P	V
CO3	Prepare site plan and service plan of a building as per the specifications	CC1	A	P	V
CO4	Develop working drawings of buildings as per the given requirements	CC1	A	P	V

Cognitive (Revised blooms Level): - ***R****: Remember;* ***U****: Understand;* ***A****: Apply;* ***An****: Analyse;* ***E****: Evaluate;* ***C****: Create*
Psychomotor Domain (Dave's): - ***I****-Imitation,* ***M****-Manipulation,* ***P****-Precision,* ***Ar****-Articulation,* ***N****-Naturalisation*
Affective (Krathwohl): - ***Re****-Receiving,* ***Rs****-Responding,* ***V****-Valuing,* ***O****-Organization,* ***Ch****-Characterization*

CO	Program Outcomes & Program Specific Outcomes Correlation Matrix													
	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3				3		3		1		2	2		1
2	3				3		3		1		2	2		2
3	3				3		3		1		2	2		2
4	3				3		3		1		2	2		2
Correlation [3 – High, 2 -Medium, 1 – Low]														

TEACHING AND ASSESSMENT SCHEME				
Teaching Scheme / Week		**Credit**	**Hours / Semester**	**Examination Scheme**
				Practical

L	T	J	P	S	C			CIA	ESE	Total
0	0	0	2	0	1		30	60	40	100

L: Lecture (One unit is of one-hour duration), T: Tutorial (One unit is of one-hour duration), P: Practical (One unit is of one-hour duration), J: Project (One unit is of one-hour duration), S: Self-Learning & Team Work (One unit is of one-hour duration), CIA: Continuous Internal Assessment, ESE: End Semester Examination

	SYLLABUS (Major Topics)		
Module	Title	Major Topics	Hrs
	Manual Drafting	Introduction to Civil Engineering Drawing.	2
		Preparation of plan, section and elevation of one-bedroom residential building.	4
		Preparation of plan, section and elevation of a single storied building with more than one bedroom.	2
		Preparation of plan, section and elevation of single storied building.	4
	Planning and Drafting using AutoCAD	Introduction to Auto CAD: Preparation of sectional details and elevation of a panelled door.	4
		Preparation of plan, section and elevation of a dog legged staircase.	2
		Detailed drawing for a steel roof truss.	2
		Preparation of plan, section and elevation of single storied building.	2
		Preparation of plan, section and elevation of a two-storied framed building.	4
		Preparation of site plan and service plan of a given residential building.	2
		Preparation of plan, section and elevation of a residential building as per the given requirements.	2

It is mandatory to do the manual drafting in A2 sheets

	SELF-LEARNING / TEAM WORK
1	Prepare a model of a single storied residential building with card board/foam board from given line sketch (Home Assignment)
2	Preparation of sectional details and elevation of a glazed window and top hung ventilator.

SUGGESTED LEARNING RESOURCES

Sl. No.	Title of Book	Author	Publication
Text Books			
1	Building Drawing and Detailing, Detailing.	Dr. Balagopal, T.S. Prabhu	Spades Publishers, Calicut, Revised Edition ,2022
2	Building Drawing with an Integrated Approach to Built Environment.	Shah M.G., Kale C. M. and Patki S.Y	Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition, 2017
3	Building Planning and Drawing.	M V Chitawadagi, S S Bhavikatti	Dreamtech Press, 2019
References			
1	SP7:2016, National Building Code of India 2016		
2	Kerala Panchayat Building Rules 2019		
3	Kerala Municipality Building Rules 2019		
4	IS962: 1989 (Reaffirmed 2022) Indian Standard Code of practice for architectural and building drawings		
Web Resource			
1	Engineering Drawing, nptel.ac.in/courses/112103019	Prof. P S. Robi, IIT Guwahati	NPTEL

PRACTICAL SYLLABUS

Topic	Objective	CO	Learning Domain C	A	P	Hrs
Introduction to Civil Engineering Drawing- Concept of Scale, drawing tools and accessories for manual drafting. Plan, Section and Elevation of a building. Symbols used in building drawing.		**CO1**	A	P	R	2
Preparation of plan, section and elevation of one-bedroom residential building. (*Manual drafting based on given drawing).	To prepare plan, section and elevation of a building by manual drafting.	**CO2**	A	P	R	4
Preparation of plan, section and elevation of a single storied building with more than one bedroom. (*Manual drafting based on given drawing).		**CO2**	A	P	R	2
Preparation of plan, section and elevation of single storied building. (*Manual drafting based on given line sketch).		**CO2**	A	P	R	4
Introduction to Auto CAD: Preparation of sectional details and elevation of a panelled door (Using AutoCAD).		**CO1**	A	P	R	4
Preparation of plan, section and elevation of a dog legged staircase (Using AutoCAD).		**C01**	A	P	R	2
Detailed drawing for a steel roof truss (Using AutoCAD).		**CO1**	A	P	R	2
Preparation of plan, section and elevation of single storied building. (Using AutoCAD, based on the given line sketch).	To prepare plan, section and elevation of a building using AutoCAD.	**CO2**	A	P	R	2
Preparation of plan, section and elevation of a two-storied framed building. (Using AutoCAD, based on the given line sketch).		**CO2**	A	P	R	4
Preparation of site plan and service plan of a given residential building (Using AutoCAD).		**CO3**	A	P	R	2
Preparation of plan, section and elevation of a residential building as per the given requirements (Using AutoCAD).		**CO4**	A	P	V	2

ASSESSMENT PATTERN

Assessment Method		Marks
Continuous Internal Assessment		**60**
1	Continuous Lab Evaluation	30
2	Internal Examination	25
3	Regularity	5
4	Course Project	-
End Semester Examination		**40**
Total		**100**