MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM 686666

(AUTONOMOUS)

BACHELOR OF TECHNOLOGY (B. Tech)

CIVIL ENGINEERING

SCHEME 2024

SEMESTER 1

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA1T01	LINEAR ALGEBRA AND MULTI VARIABLE CALCULUS	3-1-0-3	4	4
B	B24ES1T01B	PROBLEM SOLVING AND PROGRAMMING TECHNIQUES (B)	2-1-0-2	3	3
C	B24CE1T01	INTRODUCTION TO CIVIL ENGINEERING	2-1-0-2	3	3
D	B24CE1T02	ENGINEERING MECHANICS	2-2-0-2	4	4
E	B24ES1T03C	GRAPHICS FOR CIVIL ENGINEERS	2-1-1-3	4	4
G	B24ES1L01B	PROGRAMMING LAB (B)	0-0-3-3	3	2
H	B24CE1L01	CIVIL ENGINEERING LAB	0-0-3-3	3	2
I	B24MC1T01	LIFE SKILLS	1-0-1-2	2	P/F
J	B24MC1T02	DESIGN THINKING	1-1-0-1	2	P/F
K	B24MC1L01	YOGA AND SPORTS	0-1-1-1	2	P/F
			TOTAL	30	22

SEMESTER 2

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA1T02	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS	3-1-0-3	4	4
B	B24PH1T01B	ENGINEERING PHYSICS (B)	2-1-0-2	3	3
C	B24CY1T01B	ENGINEERING CHEMISTRY (B)	2-1-0-2	3	3
D	B24ES1T04	BASIC ELECTRICAL AND MECHANICAL ENGINEERING	2-2-0-2	4	4
E	B24CE1T03	SURVEYING & GEOMATICS	2-1-0-2	3	3
F	B24ES1L03	MECHANICAL AND ELECTRICAL ENGINEERING WORKSHOP	0-0-2-2	2	1
G	B24CE1L02	ENGINEERING MECHANICS LAB	0-0-3-3	3	2
H	B24PH1L01	ENGINEERING PHYSICS LABORATORY (B)	0-0-2-2	2	1
	B24CY1L01	ENGINEERING CHEMISTRY LABORATORY (B)			
I	B24MC1T03	PROFESSIONAL COMMUNICATION AND ETHICS	2-0-1-3	3	P/F
J	B24MC1L02	IDEA LAB	0-0-3-3	3	P/F
			TOTAL	30	21

SEMESTER 3

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA2T03A	COMPLEX VARIABLES AND APPLICATIONS OF PDE	3-1-0-3	4	4
B	B24CE2T01	MECHANICS OF SOLIDS	3-1-0-3	4	4
C	B24CE2T02	FLUID MECHANICS & HYDRAULICS	3-1-0-3	4	4
D	B24CE2T03	FUNCTIONAL PLANNING OF BUILDINGS	2-1-0-2	3	3
E	B24HU2T02	ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS	2-1-0-2	3	3
G	B24CE2L03	SURVEYING LABORATORY	0-0-3-3	3	2
H	B24CE2L04	HYDRAULICS LABORATORY	0-0-3-3	3	2
I	B24MC2T04	UNIVERSAL HUMAN VALUE AND CONSTITUTIONAL RIGHTS	2-0-0-2	2	P/F
J	B24MC2T05	ENERGY CONSERVATION AND ENVIRONMENTAL SUSTAINABILITY	2-0-0-2	2	P/F
M		MINOR	3-1-0-3	4	4
			TOTAL	32	22

SEMESTER 4

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA2T04B	STATISTICAL ANALYSIS AND NUMERICAL METHODS	3-1-0-3	4	4
B	B24CE2T04	STRUCTURAL ANALYSIS	3-1-0-3	4	4
C	B24CE2T05	SOIL MECHANICS	3-1-0-3	4	4
D	B24CE2T06	HIGHWAY AND PAVEMENT ENGINEERING	3-1-0-3	4	3
E	B24HU2T01	BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT	3-0-0-3	3	3
F	B24CE2T07	CONSTRUCTION TECHNOLOGY & MANAGEMENT	2-1-0-2	3	3
G	B24CE2L05	MATERIAL TESTING LABORATORY - I	0-0-3-3	3	2
H	B24CE2L06	CIVIL ENGINEERING DRAFTING LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONOURS	3-1-0-3	4	4
			TOTAL	36	25

SEMESTER 5

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24CE3T01	DESIGN OF CONCRETE STRUCTURES	3-1-0-3	4	4
B	B24CE3T02	ADVANCED ANALYSIS OF STRUCTURES	3-1-0-3	4	4
C	B24CE3T03	WATER RESOURCES ENGINEERING	3-1-0-3	4	4
D	B24CE3T04	CONCRETE TECHNOLOGY	2-1-0-2	3	3
E	B24CE3T05	ENVIRONMENTAL ENGINEERING	3-1-0-3	4	4
F	B24CE3P1x	PROGRAM ELECTIVE I	2-1-0-2	3	3
G	B24CE3L07	SOIL MECHANICS LABORATORY	0-0-3-3	3	2
H	B24CE3L08	TRANSPORTATION ENGINEERING LABORATORY	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONOURS	3-1-0-3	4	4
			TOTAL	36	26

PROGRAMME ELECTVE I	
B24CE3P11	REMOTE SENSING & GIS
B24CE3P12	MODERN CONSTRUCTION MATERIALS
B24CE3P13	GEO-ENVIRONMENTAL ENGINEERING
B24CE3P14	SAFETY IN CONSTRUCTION
B24CE3P15	ENGINEERING GEOLOGY
B24CE3P16	HIGHWAY MATERIALS AND DESIGN

SEMESTER 6

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24CE3T06	DESIGN OF STEEL STRUCTURES	3-1-0-3	4	4
B	B24CE3T07	WATER AND WASTE WATER MANAGEMENT	3-1-0-3	4	4
C	B24CE3T08	QUANTITY SURVEYING AND VALUATION	3-1-0-3	4	4
D	B24CE3T09	FOUNDATION ENGINEERING	3-1-0-3	4	4
E	B24CE3P2x	PROGRAM ELECTIVE II	2-1-0-2	3	3
F	B24CE3G1x	OPEN ELECTIVE I	2-1-0-2	3	3
G	B24CE3L09	MATERIAL TESTING LABORATORY – II	0-0-3-3	3	2
H	B24CE3L10	CIVIL ENGINEERING DESIGN STUDIO	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONOURS	3-1-0-3	4	4
			TOTAL	36	26

PROGRAMME ELECTVE II	
B24CE3P21	ADVANCED CONCRETE TECHNOLOGY
B24CE3P22	ENGINEERING LAW
B24CE3P23	SOLID AND LIQUID WASTE MANAGEMENT
B24CE3P24	GROUND IMPROVEMENT TECHNIQUES
B24CE3P25	PRESTRESSED CONCRETE
B24CE3P26	SEISMOLOGY AND EARTHQUAKE ENGINEERING

OPEN ELECTIVE I	
B24CE3G11	SUSTAINABLE CONSTRUCTION MATERIALS AND PRACTICES
B24CE3G12	NATURAL DISASTER & MITIGATION
B24CE3G13	ENVIRONMENTAL RISK ASSESSMENT

SEMESTER 7

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24CE4T01	TRANSPORT INFRASTRUCTURE ENGINEERING	2-1-0-2	3	3
B	B24CE4P3x	PROGRAM ELECTIVE III	2-1-0-2	3	3
C	B24CE4P4x	PROGRAM ELECTIVE IV	2-1-0-2	3	3
D	B24CE4G2x	OPEN ELECTIVE II	2-1-0-2	3	3
E	B24HU4T04	DISASTER MANAGEMENT AND INDUSTRIAL SAFETY	2-1-0-2	3	3
F	B24CE4L11	ENVIRONMENTAL ENGINEERING LABORATORY	0-0-3-3	3	2
G	B24CE4L12	PROJECT PHASE I	0-0-6-6	6	3
H	B24CE4L13	SEMINAR	0-0-4-4	4	2
I	B24CE4T02	VIVA-VOCE	0-0-0-0	-	1
M		MINOR	3-1-0-3	4	4
N		HONOURS	3-1-0-3	4	4
			TOTAL	36	23

PROGRAMME ELECTVE III	
B24CE4P31	ARCHITECTURE AND INTERIOR DESIGNING
B24CE4P32	AIR QUALITY MANAGEMENT
B24CE4P33	SOIL STRUCTURE INTERACTION
B24CE4P34	ADVANCED DESIGN OF CONCRETE STRUCTURES
B24CE4P35	AI APPLICATIONS IN CIVIL ENGINEERING
B24CE4P36	PAVEMENT ANALYSIS

PROGRAMME ELECTVE IV	
B24CE4P31	INTRUDUCTION TO BIM 2D DRAFTING AND ARCHITECHTURAL MODELLING FUNDAMENTALS
B24CE4P32	TRANSPORTATION ECONOMICS
B24CE4P33	ENVIRONMENTAL IMPACT ASSESSMENT
B24CE4P34	ADVANCED FOUNDATION DESIGN
B24CE4P35	STRUCTURAL DYNAMICS
B24CE4P36	SUSTAINABLE CONSTRUCTION MATERIALS AND PRACTICES

OPEN ELECTIVE II	
B24CE4G21	ENERGY MANAGEMENT AND INTEGRATION
B24CE4G22	CLIMATE CHANGE AND SUSTAINABILITY
B24CE4G23	INTELLIGENT TRANSPORT SYSTEMS

SEMESTER 8

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A,B,C		INTERNSHIP & MOOC COURSES (3 NUMBERS)			9
OR					
A	B24CE4P5x	PROGRAM ELECTIVE V	2-1-0-2	3	3
B	B24CE4P6x	PROGRAM ELECTIVE VI	2-1-0-2	3	3
C	B24CE4G3x	OPEN ELECTIVE III	2-1-0-2	3	3
AND					
H	B24CE4L14	PROJECT PHASE II	0-0-12-12	12	6
N		MINOR PROJECT	0-0-3-3	3	6
M		HONOURS PROJECT	0-0-6-6	6	6
			TOTAL	30	15

PROGRAMME ELECTVE V	
B24CE4P51	CONSTRUCTION PLANNING AND MANAGEMENT
B24CE4P52	SUSTAINABILITY AND ENVIRONMENTAL HEALTH
B24CE4P53	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
B24CE4P54	TRAFFIC ENGINEERING AND SAFETY
B24CE4P55	GEO- TECHNICAL INVESTIGATION
B24CE4P56	GEOINFORMATICS
PROGRAMME ELECTVE VI	
B24CE4P61	CHARACTERISATION OF CONSTRUCTION MATERIALS
B24CE4P62	DESIGN OF ENVIRONMENTAL FACILITIES
B24CE4P63	APPLIED SOIL MECHANICS
B24CE4P64	ADVANCED ANALYSIS AND DESIGN USING ETABS
B24CE4P65	URBAN TRANSPORTATION PLANNING
B24CE4P66	ARCHITECHTURAL MODELLING AND ADVANCED BIM

OPEN ELECTIVE III	
B24CE4G31	ENVIRONMENTAL HEALTH AND SAFETY
B24CE4G32	LAND USE AND TRANSPORT PLANNING
B24CE4G33	CONDITION ASSESSMENT OF STRUCTURES

HONOURS COURSES

BASKET 1: STRUCTURAL ENGINEERING	
1	STRUCTURAL FORMS AND MATERIALS
2	FUNDAMENTALS OF EARTHQUAKE ENGINEERING
3	PRECAST STRUCTURES
4	ADVANCED STEEL DESIGN
5	MINI PROJECT
BASKET 2: STRUCTURAL HEALTH MONITORING AND REPAIR	
1	NON-DESTRUCTIVE TESTING
2	STRUCTURAL FORENSIC ANALYSIS
3	REPAIR AND REHABILITATION
4	HERITAGE STRUCTURES
5	MINI PROJECT
BASKET 3: SUSTAINABLE ENGINEERING	
1	CLIMATE CHANGE AND SUSTAINABILITY
2	ECO-FRIENDLY MATERIALS AND GREEN BUILDINGS
3	ECO-CONSCIOUS CONSTRUCTION
4	URBAN PLANNING
5	MINI PROJECT
BASKET 4: CONSTRUCTION MANAGEMENT	
1	CONSTRUCTION SCHEDULING & PLANNING
2	CONSTRUCTION CONTRACTS, METHODS AND EQUIPMENT
3	ADVANCED CONSTRUCTION TECHNIQUES
4	LEAN CONSTRUCTION
5	MINI PROJECT
BASKET 5: TRANSPORTATION ENGINEERING	
1	PUBLIC TRANSPORT SYSTEMS
2	TRANSPORTATION SAFETY ENGINEERING
3	LAND USE AND MOBILITY
4	INTELLIGENT TRANSPORTATION SYSTEMS
5	MINI PROJECT
BASKET 6: GEOTECHNICAL ENGINEERING	
1	REINFORCED SOIL AND GEOSYNTHETICS
2	GROUND MONITORING TECHNIQUES
3	STRUCTURAL DESIGN OF FOUNDATION AND EARTH RETAINING STRUCTURES
4	SOIL DYNAMICS AND MACHINE FOUNDATION
5	MINI PROJECT

MINOR COURSES

BASKET 1:	
1	BUILDING PLANNING AND INTERIOR
2	MODERN CONSTRUCTION TECHNIQUES AND MATERIALS
3	INFRASTRUCTURAL AESTHETICS
4	GREEN BUILDINGS AND ENERGY MANAGEMENT
5	MINI PROJECT
BASKET 2:	
1	WATER AND AIR QUALITY
2	SOILD WASTE MANAGEMENT
3	RENEWABLE ENERGY
4	SUSTAINABILITY AND ENVIRONMENTAL HEALTH
5	MINI PROJECT
BASKET 3:	
1	TRAFFIC SAFETY
2	LAND USE AND URBAN PLANNING
3	SUSTAINABLE TRANSPORTATION
4	TRANSPORTATION SYSTEMS
5	MINI PROJECT
BASKET 4:	
1	INTRODUCTION TO GEOTECHNICAL ENGINEERING
2	SOIL STABILISATION TECHNIQUES
3	GROUND INSTRUMENTATION AND MONITORING
4	ENVIRONMENTAL GEOTECHNICS
5	MINI PROJECT

MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH CIVIL ENGINEERING

SEMESTER 1

SYLLABUS

B24MA1T01	LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		3	1	0	3	4	2024

Preamble

This course introduces students to some basic mathematical ideas and tools which are at the core of any engineering course. A brief course in Linear Algebra familiarises students with some basic techniques in matrix theory which are essential for analyzing linear systems. The calculus of functions of one or more variables taught in this course are useful in modelling and analyzing physical phenomena involving continuous change of variables or parameters and have applications across all branches of engineering.

Prerequisites: Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Solve systems of linear equations, diagonalize matrices and characterise quadratic forms (Cognitive Knowledge level: Apply)
CO 2	Compute the partial and total derivatives and maxima and minima of multivariable functions(Cognitive Knowledge Level : Apply)
CO 3	Compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas. (Cognitive Knowledge Level : Apply)
CO 4	Compute the derivatives and line integrals of vector functions and learn their applications(Cognitive Knowledge Level : Apply)
CO 5	Evaluate surface and volume integrals and learn their inter-relations and applications. (Cognitive Knowledge Level : Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2	1	1	1					1		1
CO 2	3	2	1	1	1					1		1
CO 3	3	2	1	1	1					1		1
CO 4	3	2	1		1							1
CO 5	3	2	1	1	1					1		1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance 10 marks
Continuous Assessment Test (2 numbers) 25 marks
Assignment/Quiz/Course Project 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 (Linear Algebra)

(Text 2: Relevant topics from 7.3, 7.4, 7.5, 8.1,8.3,8.4)

Systems of linear equations, Solution by Gauss elimination, row echelon form and rank of a matrix, fundamental theorem for linear systems (homogeneous and non-homogeneous, without proof), Eigen values and eigenvectors. Diagonalization of matrices, orthogonal transformation, quadratic forms and their canonical forms.

MODULE 2 (Multivariable Calculus-Differentiation)

(Text 1: Relevant topics from sections 13.3, 13.4, 13.5, 13.8)

Partial derivatives, partial derivatives of functions of more than two variables, higher order partial derivatives, differentials and local linearity, The chain rule, Maxima and Minima of functions of two variables, extreme value theorem (without proof), relative extrema.

MODULE 3 ((Multivariable Calculus-Integration))

(Text 1: Relevant topics from sections 14.1, 14.2, 14.3, 14.5, 14.6, 14.8)

Double integrals (Cartesian), reversing the order of integration, Change of coordinates (Cartesian to polar), finding areas using double integrals, mass and centre of gravity of inhomogeneous laminas using double integral. Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates (computations involving spheres, cylinders).

MODULE 4 (Calculus of vector functions)

(Text 1: Relevant topics from sections 12.1, 12.2, 12.6, 13.6, 15.1, 15.2, 15.3)

Vector valued function of single variable, derivative of vector function and geometrical interpretation, motion along a curve-velocity, speed and acceleration. Concept of scalar and vector fields, Gradient and its properties, directional derivative, divergence and curl, Line integrals of vector fields, work as line integral, Conservative vector fields, independence of path and potential function(results without proof).

MODULE 5 (Vector integral theorems)

(Text 1: Relevant topics from sections 15.4, 15.5, 15.6, 15.7, 15.8)

Green's theorem (for simply connected domains, without proof) and applications to evaluating line integrals and finding areas. Surface integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z) , Flux integrals over surfaces of the form z = g(x, y), y = g(x, z) or x = g(y, z), divergence theorem (without proof) and its applications to finding flux integrals, Stokes' theorem (without proof) and its applications to finding line integrals of vector fields and work done.

Text Books

1. H. Anton, I. Biven, S. Davis, "Calculus", Wiley, 10^{th} edition, 2015.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10^{th} edition, John Wiley & Sons, 2015.

Reference Books

4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint,2002.

5. J. Stewart, Essential Calculus, Cengage, 2^{nd} edition, 2017.

6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43^{rd} Edition, 2015.

7. Peter O Neil, Advanced Engineering Mathematics, 7^{th} Edition, Thomson, 2007.

8. Veerarajan T. Engineering Mathematics for first year", Tata McGraw - Hill, 2008.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/Tutorial Hours**
	Total	45 hours
1	**Linear Algebra**	9
1.1	Systems of linear equations, Solution by Gauss elimination	1
1.2	Row echelon form, finding rank from row echelon form, fundamental theorem for linear systems	2
1.3	Eigen values and eigen vectors	2
1.4	Diagonalization of matrices	2
1.5	Orthogonal transformation, quadratic forms and their canonical forms.	2
2	**Multivariable Calculus - Differentiation**	9
2.1	Partial derivatives	2
2.2	Differentials, Local Linear approximations	2
2.3	Chain rule, total derivative	2
2.4	Maxima and minima	3
3	**Multivariable Calculus - Integration**	9
3.1	Double integrals (Cartesian)-evaluation	2
3.2	Change of order of integration in double integrals, change of coordinates (Cartesian to polar)	2
3.3	Finding areas, mass and centre of gravity of plane laminas	2
3.4	Triple integrals, volume calculated as triple integral, triple integral in cylindrical and spherical coordinates.	3
4	**Calculus of Vector Functions**	9
4.1	Vector valued function of a scalar variable - derivative of vector valued function of scalar variable t-geometrical meaning	2
4.2	Motion along a curve-speed, velocity, acceleration	1
4.3	Gradient and its properties, directional derivative, divergence and curl	3
4.4	Line integrals with respect to arc length, line integrals of vector fields. Work done as line integral	2

4.5	Conservative vector field, independence of path, potential function	1
5	**Vector Integral Theorems**	9
5.1	Green's theorem and it's applications	2
5.2	Surface integrals, flux integral and their evaluation	3
5.3	Divergence theorem and applications	2
5.4	Stokes theorem and applications	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1): Solve systems of linear equations, diagonalize matrices and characterise quadratic forms.

1. A is a real matrix of order 3×3 and $X = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$. What can you say about the solution of $AX = 0$ if rank of A is 2 ? 3 ?
2. Given A $= \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$, find an orthogonal matrix P that diagonalizes A.
3. The matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ has an eigenvalue 5 with corresponding eigenvector $X = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix}$. Find A^5X.

Course Outcome 2 (CO 2): Compute the partial and total derivatives and maxima and minima of multivariable functions.

1. Find the slope of the surface $z = x^2y + 5y^3$ in the x-direction at the point $(1, -2)$.
2. Given the function $w = xy + z$, use the chain rule to find the instantaneous rate of change of w at each point along the curve $x = \cos t$, $y = \sin t$, $z = t$.
3. Determine the dimension of rectangular box open at the top, having a volume 32 cubic ft and requiring the least amount of material for it's construction.

Course Outcome 3 (CO 3): Compute multiple integrals and apply them to find areas and volumes of geometrical shapes, mass and centre of gravity of plane laminas.

1. Evaluate $\iint_D (x + 2y)\, dA$ where D is the region bounded by the parabolas

   $y = 2x^2$ and $y = 1 + x^2$.

2. Explain how you would find the volume under the surface $z = f(x, y)$ and over a specific region D in the xy plane using triple integral?

3. Find the mass and centre of gravity of a triangular lamina with vertices (0,0), (2,1), (0,3) if the density function is $f(x, y) = x + y$.

Course Outcome 4 (CO 4): Compute the derivatives and line integrals of vector functions and learn their applications

1. How would you calculate the speed, velocity and acceleration at any instant of a particle moving in space whose position vector at time t is $\mathbf{r}(t)$?

2. Find the work done by the force field $\mathbf{F} = (e^x - y^3)\ \mathbf{i} + (\cos y + x^3)\ \mathbf{j}$ on a particle that travels once around the unit circle centered at origin having radius 1.

3. When do you say that a vector field is conservative? What are the implications if a vector field is conservative?

Course Outcome 5 (CO 5): Evaluate surface and volume integrals and learn their inter-relations and applications

1. Write any one application each of line integral, double integral and surface integral.

2. Use the divergence theorem to find the outward flux of the vector field $\mathbf{F}(x, y, z) = z\mathbf{k}$ across $x^2 + y^2 + z^2 = a^2$.

3. State Greens theorem. Use Green's theorem to express the area of a plane region bounded by a curve as a line integral.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24MA1T01

Course Name: LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS

Common to all branches

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$
2. Write down the eigen values of A = $\begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$
3. Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x,y) = 2x^3y^2 + 2y + 4x$.
4. Show that the function $u(x,t) = sin(x - ct)$ is a solution of the equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$.
5. Use double integral to find the area of the region enclosed between the parabola $y = \frac{x^2}{2}$ and the line $y = 2x$.
6. Use polar coordinates to evaluate the area of the region bounded by $x^2 + y^2 = 4$, the line y = x and the y axis in the first quadrant.
7. Is the vector $\mathbf{r}$ where $\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ conservative. Justify your answer.
8. Find a unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point (1,2,-1).
9. What is the outward flux of $\mathbf{F}(x,y,z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ across any unit cube.
10. What is the relationship between Green's theorem and Stokes theorem?

PART B

Answer any one question from each module. Each question carries 14 marks.

11. (a) Solve the following system of equations
y + z - 2w = 0
2x - 3y - 3z + 6w = 2
4x + y + z - 2w = 4 7

(b) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & 2 & 0 \end{bmatrix}$ 7

OR

12. (a) Diagonalize the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 4 & 1 \end{bmatrix}$ 7

(b) What kind of conic section the quadratic form $3x^2 + 22xy + 3y^2 = 0$ represents? Transform it to principal axes. 7

13. (a) Find the local linear approximation to $f(x, y) = \sqrt{x^2 + y^2}$ at the point (3,4). Use it to approximate $f(3.04, 3.98)$. 7

(b) Let $w = \sqrt{x^2 + y^2 + z^2}$, x = cos$\theta$, y = sin$\theta$, z = tan$\theta$. Use chain rule to find $\frac{dw}{d\theta}$ when $\theta = \frac{\pi}{4}$ 7

OR

14. (a) Let $z = f(x, y)$ where $x = rcos\theta$, $y = rsin\theta$, prove that

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = \left(\frac{\partial z}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial r}{\partial \theta}\right)^2$$

7

(b) Locate all relative maxima, relative minima and saddle points of $f(x, y) = xy + \frac{a^3}{x} + \frac{b^3}{y}, (a \neq 0, b \neq 0)$. 7

15. (a) Evaluate $\iint\limits_D (2x^2y + 9y^3)\, dx\, dy$ where D is the region bounded by $y = \frac{2}{3}x$ and $y = 2\sqrt{x}$.

(b) Evaluate $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3}\, dx\, dy$ by changing the order of integration. 7

OR

16. (a) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$. 7

(b) Evaluate $\iiint \sqrt{1 - x^2 - y^2 - z^2}\, dx\, dy\, dz$, taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ 7

17. (a) Prove that the force field $\mathbf{F} = e^y\mathbf{i} + xe^y\mathbf{j}$ is conservative in the entire xy-plane. 7

(b) Find the work done in moving a particle along a straight line from (0,0,0) to (2,1,3) by the force $\mathbf{F} = 3x^2\mathbf{i} + (2xz - y)\mathbf{j} + z\mathbf{k}$ 7

OR

18. (a) Find the divergence of the vector field $\mathbf{F} = x^3y^2z\mathbf{i} + xyz^3\mathbf{j} + xyz^2\mathbf{k}$ at (1,1,1). 7

(b) Find the work done by the force field $\mathbf{F}$(x, y, z) = xy$\mathbf{i}$ + yz$\mathbf{j}$ + xz$\mathbf{k}$ along C where C is the curve $\mathbf{r}(t) = t\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$. 7

19. (a) Use divergence theorem to find the outward flux of the vector field $\mathbf{F} = 2x\mathbf{i} + 3y\mathbf{j} + z^3\mathbf{k}$ across the unit cube bounded by x = 0, y = 0, z = 0, x =1, y = 1, z = 1. 7

(b) Find the circulation of $\mathbf{F}$ = (x − z)$\mathbf{i}$ + (y − x)$\mathbf{j}$ + (z − xy)$\mathbf{k}$ using Stokes theorem around the triangle with vertices A(1,0,0), B(0,2,0) and C(0,0,1). 7

OR

20. (a) Use divergence theorem to find the volume of the cylindrical solid bounded by $x^2 + 4x + y^2 = 7$, $z = -1$, $z = 4$ given the vector field $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ across surface of the cylinder. 7

(b) Use Stokes theorem to evaluate $\int_c F.dr$ where $\mathbf{F} = x^2\mathbf{i} + 3x\mathbf{j} - y^3\mathbf{k}$ where C is the circle $x^2 + y^2 = 1$ in the xy-plane with counterclockwise orientation looking down the positive z-axis. 7

B24ES1T01B	PROBLEM SOLVING AND PROGRAMMING TECHNIQUES (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

This course shall prepare the student to write efficient and robust Python programs for solving computational problems. Through a combination of theoretical concepts and practical applications, students will explore the fundamentals of Python programming, including data types, control structures, and functions. The course will also cover essential libraries and frameworks used in engineering applications, emphasizing best practices in coding. By the end of the course, students will be equipped with the skills needed to implement algorithms, and develop programs meet engineering standards.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Understand fundamental computing concepts, including algorithms, pseudocode, flowcharts, and algorithmic problem-solving techniques. (Cognitive Knowledge Level: Apply)
CO 2	Develop proficiency in using Python's data structures, control flow statements, and loops to effectively manage and manipulate data. (Cognitive Knowledge Level: Apply)
CO 3	Acquire skills in defining and calling functions, using modules and packages, and working with Python's standard libraries to create modular and efficient code (Cognitive Knowledge Level: Apply)
CO 4	Learn file handling techniques in Python (Cognitive Knowledge Level: Apply)
CO 5	Utilize Python for mathematical computations and understand its role in data analysis. (Cognitive Knowledge Level: Analyse)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3									1
CO 2	3	3	3									1
CO 3	3	3	3									1
CO 4	3	3	3									1
CO 5	3	3	3	3	2							1

Assessment Pattern

Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (%Marks)	**Test 2 (%Marks)**	
Remember			
Understand	20	20	20
Apply	60	60	60
Analyse	20	20	20
Evaluate			
Create			

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions (2 questions from each module), of 3 marks each and the student should answer all the questions. Part

B contains 2 questions from each module of which student should answer anyone. Each question can have a maximum of 2 sub-divisions and carry 14 marks.

SYLLABUS

MODULE 1 (6 hours)

Introduction to programming languages : low level & high level, compiler, assembler, and interpreter.
Fundamentals of computing – Algorithms, pseudocode, flowchart, algorithmic problem solving.
Introduction to Python, brief history of Python, installing Python, IDE, Python coding introduction, keywords and Identifiers, Python statements, comments in Python, getting user input, variables, data types, numbers, strings, Python operators, precedence of operators.

MODULE 2 (8 hours)

Data Structures - Lists, Tuples, Dictionary.
Control flow and Operators Control flow and syntax, if statement, if-else statement, nested conditionals, logical operators, Loop in Python - while Loop, break and continue, for loop, pass statement

MODULE 3 (7 hours)

Function in Python - introduction of function, defining and calling a function, function arguments, built in function, scope of variables.
Modules and Packages – creating custom modules, importing modules, standard modules-sys, os, datetime, math, random, introducing Python packages – numpy, pandas, matplotlib.

MODULE 4 (5 hours)

File handling - files, and directories, modes for opening a file, reading data from a file, writing data to a file, saving a file, deleting an existing file, try and except, navigating directories using os and pathlib, creating and removing directories

MODULE 5 (10 hours)

Data analysis - overview of numpy and pandas, numpy – array creation, special arrays, indexing, slicing, reshaping, flattening, concatenation, splitting, using numpy for mathematical computations - element wise addition, subtraction, multiplication, division, statistical operations - mean, median, variance, standard deviation, matrix multiplication, basic functions - sin, cos, tan, exp, power, log, sum, product, min, max, broadcasting, logical operators, creating dataframes – from csv/txt file, data frame manipulation - indexing, selecting, filtering, saving a dataframe as csv/txt file, line plot and scatter plot using matplotlib, customizing plots.

Text Books

1. Allen B Downey, "Think Python", O'Reilly.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython", Shroff/O'Reilly.

Reference Books

1. Charles Dierbach, "Introduction to Computer Science using Python", Wiley.
2. Yashavant Kanetkar, "Let Us Python", BPB Publications.
3. edX MOOC Course, "CS50 Introduction to Programming with Python".

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	36 Hours
	Module 1	6
1.1	Introduction to programming languages – low level & high level, compiler, assembler, and interpreter.	1
1.2	Fundamentals of computing – Algorithms, pseudo code, flow chart, algorithmic problem solving.	2
1.3	Introduction to Python, brief history of Python, installing Python, IDE.	1
1.4	Python coding introduction, keywords and Identifiers, Python statements, comments in Python.	1
1.5	Getting user input, variables, data types, numbers, strings, Python operators, precedence of operators.	1
	Module 2	8
2.1	Data Structures - Lists, Tuples, Dictionary.	2
2.2	Control flow and Operators Control flow and syntax, if statement, if-else statement, nested conditionals, logical operators.	2
2.3	Loop in Python - while Loop, break and continue.	2
2.4	For loop, pass statement.	2
	Module 3	7
3.1	Function in Python - introduction of function, defining and calling a function, function arguments	2
3.2	Built in function, scope of variables.	1

3.3	Modules and Packages – creating custom modules, Importing Modules, standard modules- sys, os, datetime, math, random.	2
3.4	Introducing Python packages – numpy, pandas, matplotlib.	2
	Module 4	5
4.1	File handling - files, and directories	1
4.2	Modes for opening a file, reading data from a file, writing data to a file, saving a file, deleting an existing file, try and except.	2
4.3	Navigating directories using os and pathlib, creating and removing directories.	2
	Module 5:	10
5.1	Data analysis - overview of numpy and pandas .	1
5.2	Numpy – array creation, special arrays, indexing, slicing, reshaping, flattening, concatenation, splitting.	2
5.3	Numpy for mathematical computations - element wise addition, subtraction, multiplication, division.	2
5.4	Statistical operations - mean, median, variance, standard deviation, matrix multiplication.	1
5.5	Basic functions - sin, cos, tan, exp, power, log, sum, product, min, max, broadcasting.	1
5.6	Logical operators.	1
5.7	Creating dataframes – from csv/txt file, data frame manipulation - indexing, selecting, filtering, saving a dataframe as csv/txt file, line plot and scatter plot using matplotlib, customizing plots.	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Discuss about pseudocode, algorithm, and a flow chart. What is the importance of writing an algorithm before writing the actual program?

2. Draw a flow chart to check if a given number is an Armstrong number.

Course Outcome 2 (CO 2):

1. Write a Python program that determines whether a given year is a leap year. Explain the logic used to make this determination

2. Write a Python program to calculate the factorial of a number using either a for loop or a while loop. Discuss why you chose the specific type of loop for this task.

Course Outcome 3 (CO 3):

1. How do Python modules and libraries simplify programming tasks? Provide examples of using a standard library to perform file handling operations.

2. Write a Python program to calculate the tax for an Indian citizen using both the old and new tax regimes. Utilize appropriate Python modules, libraries, and functions to structure your program.

Course Outcome 4 (CO 4):

1. How would you write a Python script to read data from a text file, process the data to remove any blank lines, and save the cleaned data to a new file?

2. How to check if a file exists in a particular directory? Give an error message if it doesn't exists.

Course Outcome 5 (CO 5):

1. How would you use NumPy to create an array of 10 random numbers and then convert it into a Pandas DataFrame?

2. Given a CSV file containing numerical data, explain how you would use NumPy and Pandas to calculate the mean and standard deviation of a specific column.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24ES1T01B

Course Name: PROBLEM SOLVING AND PROGRAMMING TECHNIQUES(B)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. What is the main difference between a compiler and an interpreter?
2. What is the difference between a high-level programming language and a low-level programming language?
3. What is the main difference between a list and a tuple in Python?
4. How does a for loop differ from a while loop in Python?
5. What is the scope of a variable in Python?
6. How can you import a specific function from a module in Python?
7. How can you list all files in a directory using Python?
8. Discuss the various modes for opening a file?
9. How do you create a NumPy array with random integers between 1 and 10?
10. What is the primary purpose of the pandas library in Python?

PART B

Answer any one question from each module. Each question carries 14 marks.

11. Compare and contrast high level and low level programming languages. Discuss the advantages and disadvantages of each with examples and explain how a compiler, interpreter and assembler play a role in executing programs written in these languages.

OR

12. Describe the steps involved in solving a problem using an algorithmic approach. Write an algorithm to find the maximum number in a list, present it using both pseudocode and a flowchart. Write a code for the same in Python.

13. Explain the key differences between lists, tuples, and dictionaries in Python. Provide examples of scenarios where each data structure would be most appropriately used, and discuss how their unique properties affect performance and usability in a program.

OR

14. Discuss the control flow mechanisms in Python, including conditional statements and loops. Explain the role of logical operators within control flow, and demonstrate using a Python program how they can be used to find the factorial of a number.

15. Explain the concept of functions in Python, including the use of arguments and return values. Illustrate with examples how defining and calling functions can improve code organization and reusability, and discuss the importance of variable scope in function design.

OR

16. Describe how modules and packages are used in Python to manage code complexity. Explain the process of creating a custom module and importing standard libraries. Write a Python program to create an array of random numbers in the range 1 to 100 and find its mean, median and standard deviation by defining a function. You can use the standard libraries of Python.

17. Explain the process of reading from and writing to files in Python. Discuss the different modes of file access. Provide an example of a program that reads the names of 30 students and total marks scored from a user and save the data to a file after the entry is complete.

OR

18. Write a Python program to read the contents of file, replace a particular name in the file with another one and save the updated contents as a new file.

19. Describe the role of NumPy in data analysis. Explain how NumPy arrays differ from Python lists and demonstrate how NumPy can be used to perform efficient mathematical operations on large datasets.

OR

20. Explain how the pandas library is used for data manipulation and analysis in Python. Provide an example of loading a dataset into a pandas DataFrame, performing filtering, and discuss how pandas simplifies data analysis tasks.

B24CE1T01	INTRODUCTION TO CIVIL ENGINEERING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

This course delves into the fundamental principles of civil engineering, exploring the fundamental science and engineering involved. Through comprehensive study, students will gain a deep understanding of pivotal infrastructure systems in transportation, water resources, environmental science and structural engineering. The subject aims to impart a deep understanding of the essential principles of Civil Engineering to students, illuminating the pivotal role of civil engineers in addressing societal needs and fostering sustainable development.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Describe the multifaceted role of civil engineers.(Cognitive Knowledge Level: Understand)
CO 2	Identify various building systems, methodologies, and materials, and apply them effectively in practical real-world scenarios.(Cognitive Knowledge Level: Apply)
CO 3	Understand different types of building structures, including framed and load-bearing wall structures. (Cognitive Knowledge Level: Understand)
CO 4	Gain insight into building area definitions, classifications, site planning regulations, smart environment concepts, and infrastructure services. (Cognitive Knowledge Level: Apply)
CO 5	Apply various surveying methods (chain, compass, plane table, theodolite, EDM, Total Station, and GPS) and techniques for measuring linear distances and angles. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	1			2	2	1	1	2		1
CO 2	3	2	3	2	2	1	2	1	2	3	2	2
CO 3	3	2	2			1	1			1		1
CO 4	2	1	2		2	2	3		1	1		2
CO 5	2	2	2	2	3	1	1		1	2	1	1

Assessment Pattern

Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (%Marks)	**Test 2 (%Marks)**	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub-divisions.

SYLLABUS

MODULE 1 (7 hours)

Civil Engineering: Past, Present and Future, Sustainable Development Goals: Environmental Protection, Social Responsibility, Economic Development, Smart, Clean and Safe infrastructure development.

Role of Civil Engineers – Planning, Designing, Execution, and Maintenance.

Introduction to Major Disciplines of Civil Engineering: Construction Management, Environmental Engineering, Geotechnical Engineering, Hydraulics & Water Resources Engineering, Structural Engineering, Surveying, Transportation Engineering.

MODULE 2 (7 hours)

Conventional Construction Materials: Types, Properties and Uses.

Concrete: Materials, Manufacturing, Properties and Applications.

Steel: Types, Properties and Applications.

Modern Construction Materials: Glass, Ceramics, Polymers, Composite Materials etc.

MODULE 3 (6 hours)

Types of Structures: Framed Structures and Load Bearing Wall Structures.

Components of a Building:

Sub-structure: Foundation - Types of foundations - Shallow and Deep foundation.

Super Structure: Masonry – Brick and Stone masonry, Columns, Beams, Partitions and Roofing – Materials and Types.

MODULE 4 (8 hours)

Building Area: Definition of terms, Classification of Buildings based on Occupancy (NBC, KMBR).

Site Planning and Building rules: Selection of Site - Site Plan, Preparation for Buildings - Relevance of NBC, KMBR & CRZ Norms - Exterior and Interior Open Spaces, Floor Area Ratio as per KMBR, General provisions regarding site and building requirements.

Smart built-environment: Intelligent Buildings and Green Buildings, Energy Efficiency, Recycling, Temperature and Sound Control, Security Systems.

Basic Infrastructure Services: MEP, HVAC, Elevators, Escalators and Ramps (Civil Engineering aspects only), Fire Safety in buildings.

MODULE 5 (8 hours)

Basic Principles of Surveying: Definition, objectives, and fundamental principles (accuracy, precision, working from whole to part).

Types of Surveying: Chain surveying, Compass surveying, Plane table surveying, Levelling, Theodolite surveying.

Modern techniques- Total Station and GPS surveying.

Linear Distance Measurements: Direct and indirect methods - Chains, tapes, EDM devices. Angle and Direction Measurements: Horizontal and vertical angle measurement techniques.

Text Books

1. ”Basic Civil Engineering” by Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain
2. ”Building Materials” by S.K. Duggal
3. ”Surveying (Vol. 1, 2 & 3)” by Dr. K.R. Arora
4. ”Civil Engineering Materials” by S.V. Deodhar
5. “Surveying Vol .I & II” by Dr. B. C. Punmia Publication Laxmi Publication Delhi

Reference Books

1. Chudley, R., Construction Technology, Vol. I to IV, Longman Group, England (2011)
2. Chudley, R. and Greeno, R., Building Construction Handbook, Addison Wesley, Longman Group, England (1998)

3. Mamlouk, M. S., and Zaniewski, J. P., Materials for Civil and Construction Engineering, Pearson Publishers (2011)

4. McKay, W. B. and McKay, J. K., Building Construction, Vol. 1 to 4, Pearson India Education Services.(2013)

5. Rangwala,S.C and Dalal,K.B., Building Construction, Charotar Publishing House (2017)

6. Kerala Municipal Building Rules (latest revision)

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/ Tutorial Hours
	Total Hours	**36 Hours**
1	**Module 1**	**7 hours**
1.1	Civil Engineering: Past, Present and Future	1 hour
1.2	Sustainable Development Goals: Environmental Protection, Social Responsibility, Economic Development, Smart, Clean and Safe infrastructure development.	2 hour
1.3	Role of Civil Engineers – Planning, Designing, Execution, and Maintenance.	1 hour
1.4	Introduction to Major Disciplines of Civil Engineering: Construction Management, Environmental Engineering, Geotechnical Engineering, Hydraulics & Water Resources Engineering, Structural Engineering, Surveying, Transportation Engineering.	3 hour
2	**Module 2**	**7 hours**
2.1	Conventional Construction Materials: Types, Properties and Uses.	2 hour
2.2	Concrete: Materials, Manufacturing, Properties and Applications.	3 hour
2.3	Steel: Types, Properties and Applications.	1 hour
2.4	Modern Construction Materials: Glass, Ceramics, Polymers, Composite Materials etc.	1 hour

3	**Module 3**	**6 hours**
3.1	Types of Structures: Framed Structures and Load Bearing Wall Structures.	1 hour
3.2	Components of a Building: Sub-structure: Foundation - Types of foundations - Shallow and Deep foundation.	2 hour
3.3	Super Structure: Masonry – Brick and Stone masonry, Columns, Beams, Partitions and Roofing – Materials and Types	3 hour
4	**Module 4**	**8 hours**
4.1	Building Area: Definition of terms, Classification of Buildings based on Occupancy (NBC, KMBR)	2 hour
4.2	Site Planning and Building rules: Selection of Site - Site Plan, Preparation for Buildings - Relevance of NBC, KMBR & CRZ Norms	2 hour
4.3	Exterior and Interior Open Spaces, Floor Area Ratio as per KMBR, General provisions regarding site and building requirements.	1 hour
4.4	Smart built-environment: Intelligent Buildings and Green Buildings, Energy Efficiency, Recycling, Temperature and Sound Control, Security Systems.	1 hour
4.5	Basic Infrastructure Services: MEP, HVAC, Elevators, Escalators and Ramps (Civil Engineering aspects only), Fire Safety in buildings.	2 hour
5	**Module 5**	**8 hours**
5.1	Basic Principles of Surveying: Definition, objectives, and fundamental principles (accuracy, precision, working from whole to part)	1 hour
5.2	Types of Surveying: Chain surveying, Compass surveying, Plane table surveying, Levelling, Theodolite surveying.	3 hour
5.3	Modern techniques- Total Station and GPS surveying	1 hour
5.4	Linear Distance Measurements: Direct and indirect methods - Chains, tapes, EDM devices.	1 hour
5.5	Angle and Direction Measurements: Horizontal and vertical angle measurement techniques.	2 hour

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Discuss the evolution of civil engineering from past to present, emphasizing how sustainable development goals have influenced modern civil engineering practices.
2. How do these disciplines contribute to the overall goals of sustainable development?
3. How the roles of Civil Engineers contribute to smart, clean, and safe infrastructure development.

Course Outcome 2 (CO 2):

1. Discuss the types, properties, and uses of conventional construction materials such as wood, brick, and concrete.
2. Explain the process of concrete manufacturing and discuss the properties that make concrete a widely used material in construction.
3. Discuss the properties, advantages, and applications of modern construction materials in the construction industry.

Course Outcome 3 (CO 3):

1. Compare and contrast framed structures and load-bearing wall structures.
2. Describe the conditions under which shallow foundations are preferred over deep foundations and vice versa.
3. Describe the key components of a building's superstructure, including masonry (brick and stone), columns, beams, partitions, and roofing.

Course Outcome 4 (CO 4):

1. Define the key terms related to building area and explain the classification of buildings based on occupancy as per the National Building Code (NBC) and Kerala Municipal Building Rules (KMBR).
2. Explain the relevance of NBC, KMBR, and CRZ norms in site planning.
3. Explain the civil engineering aspects of basic infrastructure services such as MEP, HVAC, elevators, escalators, ramps, and fire safety in buildings.

Course Outcome 5 (CO 5):

1. Explain the fundamental principles of surveying, including accuracy, precision, and working from whole to part.
2. Discuss the techniques for measuring horizontal and vertical angles using theodolites and total stations
3. Discuss the role of modern surveying techniques such as Total Station and GPS surveying in enhancing the accuracy and efficiency of these surveys.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B. TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24CE1T01

Course Name: INTRODUCTION TO CIVIL ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Highlight specific technological advancements or innovative solutions that have been employed to achieve sustainability goals in urban areas?
2. Provide examples of significant projects or initiatives that showcase the integration of sustainability into civil engineering practices.
3. Elaborate different types of steel used for reinforcement bars and structural sections contribute to the strength, durability, and overall performance of steel structures in construction?
4. How do the properties of bricks influence their suitability for specific applications in building construction?
5. How does the design of a roof contribute to the overall functionality of a structure?
6. Describe the key differences between shallow foundations and deep foundations, and provide one example of each type commonly used in construction.
7. Discuss the economic and environmental benefits associated with green buildings.
8. Compare the infrastructure challenges commonly faced in the development and maintenance of urban roads with those in rural areas.

9. What are the fundamental principles of surveying, and how do different surveying instruments and methods contribute to accurate measurements?

10. Discuss the objectives of surveying, and why are accuracy and precision important in this field?

PART B

Answer any one question from each module. Each question carries 14.

11. In the context of infrastructural development, particularly in the concept of Smart Cities, how do civil engineers play a pivotal role in addressing challenges related to urban air pollution management? (14)

OR

12. How has the role of civil engineers evolved over time in contributing to sustainable development, considering aspects such as environmental protection, social responsibility, and economic development? (14)

13. (a) Elaborate on the role of modern construction materials. (7.)
    (b) Discuss the sustainability aspects of using polymers in construction. (7)

OR

14. Describe the materials used, the manufacturing process, and the key properties of concrete in construction. (14)

15. (a) How do header and stretcher bonds contribute to the stability of a brick wall? (7)
    (b) What are the considerations when deciding to use a combination of bonds in a brick structure? (7)

OR

16. How do the various components work together to create a functional and safe structure? Explain with neat sketch. (14)

17. Discuss the importance of site planning in optimizing the use of available space, incorporating green spaces, and ensuring compliance with local building regulations. (14)

OR

18. (a) How does the plinth area differ from the built-up area of a structure? (4)
    (b) Discuss specific strategies for optimizing plinth area and built-up area using KBR principles. (10)

19. In leveling, explain the key features and applications of different leveling instruments? (14)

OR

20. Scrutinise modern techniques such as Total Station and GPS surveying, and compare their advantages over traditional methods. (14)

B24CE1T02	ENGINEERING MECHANICS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	2	0	2	4	2024

Preamble

The objective of this course is to introduce students to the fundamental concepts of mechanics and improve their problem-solving abilities. The course focuses on the effect of applied force systems and the geometric characteristics of rigid bodies, whether they are at rest or in motion. The course provides a framework through which students will acquire the ability to solve problems in real-world situations with precision and ingenuity.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Understand the concepts and theorems connected with rigid body mechanics and solve the problems with the system of forces acting on a rigid body (Cognitive knowledge level: Apply)
CO 2	Analyse the beams and apply the Principle of virtual work to beam members. (Cognitive knowledge level: Analyse)
CO 3	Apply the conditions of equilibrium to various practical problems using the vector approach. Develop skills in solving practical problems involving friction (Cognitive knowledge level: Apply)
CO 4	Solve problems involving rigid bodies, applying the properties of distributed areas. (Cognitive Knowledge Level: Apply)
CO 5	Utilise concepts of linear and curvilinear motions to solve problems on rigid bodies. (Cognitive knowledge level: Apply)

Mapping of Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	1			1						
CO 2	3	3	1	1	1	1		1				1
CO 3	3	3	2			1	1	1				1
CO 4	3	3	1	1	1	1						1
CO 5	2	3	1			1	1					1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	10	10	10
Understand	30	40	30
Apply	40	50	40
Analyse	20		20
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have a maximum of 2 sub - divisions.

SYLLABUS

MODULE 1 (10 hours)

Introduction to Mechanics: Idealisation of Mechanics - Rigid Body - Point force - Particle - Vector and Scalar quantities. Principles of Statics - Newton's laws of motion, Parallelogram law of Forces, Principle of transmissibility, Newton's law of Gravitation.

Force Systems: Coplanar, Collinear, Concurrent and Parallel - Components and Projections of Force - Free body diagrams - Resolution of forces - Resultant and equilibrium equations.

Moment of a Force - Varignon's Theorem – Couple - Resolution of a force into force couple system - Conditions of static equilibrium of Rigid bodies - Numerical examples using scalar approach.

MODULE 2 (9 hours)

Support reactions of beams: Degree of freedom - 2-dimensional and 3-dimensional (concept only). Types of Supports- Types of load- Point load, uniformly distributed load and uniformly varying load - Support reactions of Simply supported Beams - Numerical examples.

Principle of Virtual work: Real work of a force, Principle of virtual displacements - Concepts, Application and Numerical examples in beams.

MODULE 3 (7 hours)

Forces in space: Introduction to Vector approach - Elements of Vector algebra -Position vector- Resultant and Equilibrium Equations for Concurrent Forces in Space - Moment of a Force about a Point - Numerical examples.

Friction: Types of Friction, Laws of Friction, Angle of Friction, Angle of Repose, Cone of Friction, Application in bodies on horizontal or inclined plane subjected to forces - Two bodies in contact, Application to solution of ladder problems.

MODULE 4 (10 hours)

Centroid and Moment of Inertia: Centroid of Areas: Simple and Composite areas - Numerical examples. Pappus Guldinus Theorems – Centre of Gravity, Centre of mass (concept only).

Moment of Inertia of laminas - Parallel axis and Perpendicular axis theorems- Polar Moment of Inertia - Radius of Gyration, Moment of inertia of composite sections - Numerical examples. Mass moment of Inertia(concept only).

MODULE 5 (9 hours)

Dynamics of rigid bodies: Kinematics - Rectilinear motion of a particle under variable acceleration - Kinetics of particles - Newton's Laws of Motion of Translation - D'Alembert's Principle - Motion of connected bodies -Numerical examples.

Circular motion with Uniform and Variable Acceleration - Relations between Angular and Rectilinear motion.

Introduction to Mechanical Vibrations: Free vibration, Natural frequency, Time Period, Undamped free vibration of spring mass system – springs in parallel and series system.

Text Books

1. S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics, 5th Edn.
2. S.S Bhavikkatti, Engineering Mechanics, New Age International Publishers.
3. S Rajasekaran and G Sankarasubramanian, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.
4. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol.I statics, Vol. II Dynamics, Pearson Education.
5. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
6. R.K. Bansal - Engineering Mechanics - Laxmi Publications.

Reference Books

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications.
3. F.P.Beer and E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I- Statics, Vol.II-Dynamics, 9 th Edn, Tata McGraw Hill.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/ Tutorial Hours
	Total Hours	**45 Hours**
1	**Module 1**	**10 hours**
1.1	Introduction to Mechanics - Idealisation in Mechanics: - Rigid body- Point force - Particle - Vector and Scalar quantities. Principles of statics: Newton's laws of motion, Parallelogram law of forces, Principle of transmissibility, Newton's law of gravity.	2 hour
1.2	Force Systems - Coplanar, Collinear, Concurrent and Parallel -Components and Projections of Force - Free body diagrams	2 hour
1.3	Resolution of forces - Resultant and equilibrium equations	2 hour
1.4	Moment of a Force - Varignon's Theorem – Couple - Resolution of a force into force couple system.	2 hour
1.5	Conditions of static equilibrium of Rigid bodies - Numerical examples using the scalar approach.	2 hour
2	**Module 2**	**9 hours**
2.1	Support reactions of beams: Degree of freedom – 2-dimensional and 3-dimensional (concept only), Types of Supports - Types of load: Point load, Uniformly distributed load and uniformly varying load.	2 hour
2.2	Support reactions of beams- Simply supported Beams - Numerical examples.	4 hour
2.3	Principle of Virtual work - Real work of a force, Principle of virtual displacements - Concepts, Application and Numerical examples in beams.	3 hour
3	**Module 3**	**7 hours**
3.1	Forces in space: Introduction to Vector approach - Elements of Vector algebra -Position vector - Resultant and Equilibrium Equations for Concurrent Forces in Space.	1 hour
3.2	Moment of a Force about a Point – Numerical examples .	2 hour
3.3	Friction - Types of Friction, Laws of Friction, Angle of Friction, Angle of Repose, Cone of Friction.	2 hour
3.4	Application in bodies on horizontal or inclined plane subjected to forces - Two bodies in contact - Application to solution of ladder problems.	2 hour
4	**Module 4**	**10 hours**
4.1	Centroid and Moment of Inertia: Centroid of Areas: Simple and Composite Areas - Numerical examples.	3 hour
4.2	Pappus Guldinus Theorems, Centre of Gravity, Centre of mass (concept only).	1 hour

4.3	Moment of Inertia of laminas - Parallel axis and Perpendicular axis theorems - Polar Moment of Inertia - Radius of Gyration.	2 hour
4.4	Moment of inertia of composite sections - Numerical examples.	4 hour
4.5	Mass moment of Inertia(concept only).	1 hour
5	**Module 5**	**9 hours**
5.1	Dynamics of rigid bodies: Kinematics – Rectilinear motion of a particle under variable acceleration.	2 hour
5.2	Kinetics of particles - Newton's laws of Motion of Translation - D'Alembert's Principle .	1 hour
5.3	Motion of connected bodies- Numerical Examples.	2 hour
5.4	Circular motion with Uniform and Variable Acceleration-Relations between Angular and Rectilinear motion.	2 hour
5.5	Mechanical vibrations: Free vibration, Natural frequency, Time Period, Undamped free vibration of spring mass system – springs in parallel and series system.	2 hour

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1): Review the concepts and theorems connected with rigid body mechanics and analyse the components of a system of forces acting on the rigid body.

1. State and explain the principle of transmissibility of forces.
2. Concurrent forces of 1,3,5,7,9,11 N are applied to the centre of a regular hexagon acting towards its vertices, as shown in Figure 1. Determine the magnitude and direction of the resultant.

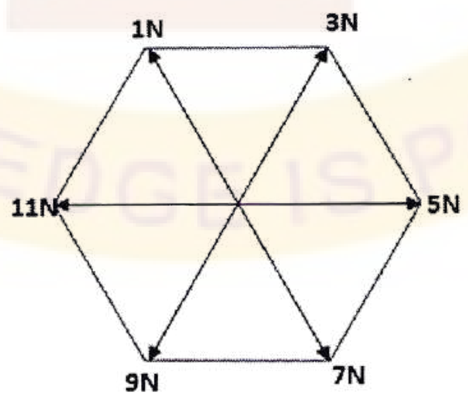


Figure 1

3. Find the resultant moment at a point O shown in Figure 2.

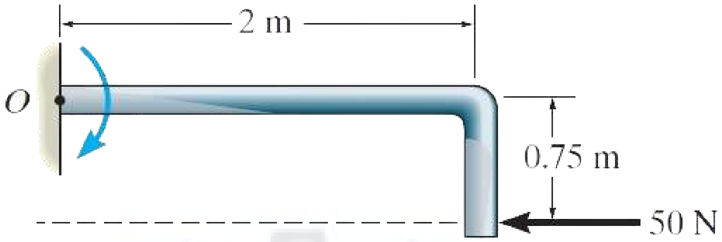


Figure 2

Course Outcome 2 (CO 2): Analyse the beam and apply the Principle of virtual work to beam members.

1. Determine the reactions at the supports A & B.

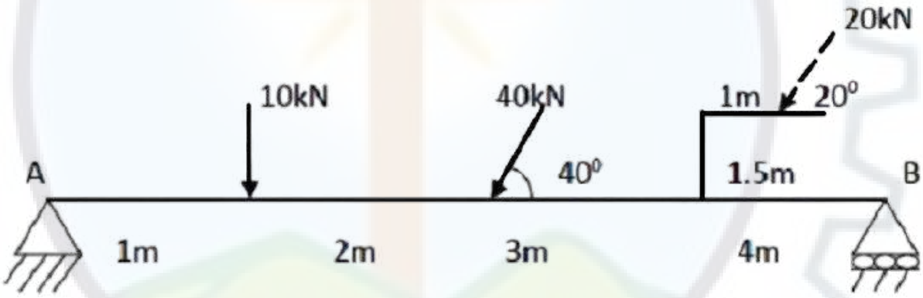


Figure 3

2. Using principle of virtual work determine the support reactions at A and B of the beam shown below.

Figure 4

3. A beam AB of span 10m is carrying a point load of 20kN at its centre. Determine the reactions at the supports, using principle of virtual work. (See Figure 5).

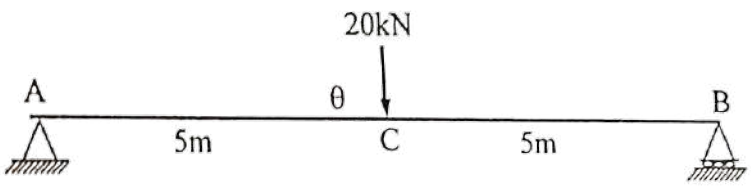


Figure 5

Course Outcome 3 (CO 3): Apply the conditions of equilibrium to various practical problems using the vector approach. Develop skills in solving practical problems involving friction

1. The three cables are used to support the 40kg flowerpot as shown in Figure 6. Determine the force developed in each cable for equilibrium.

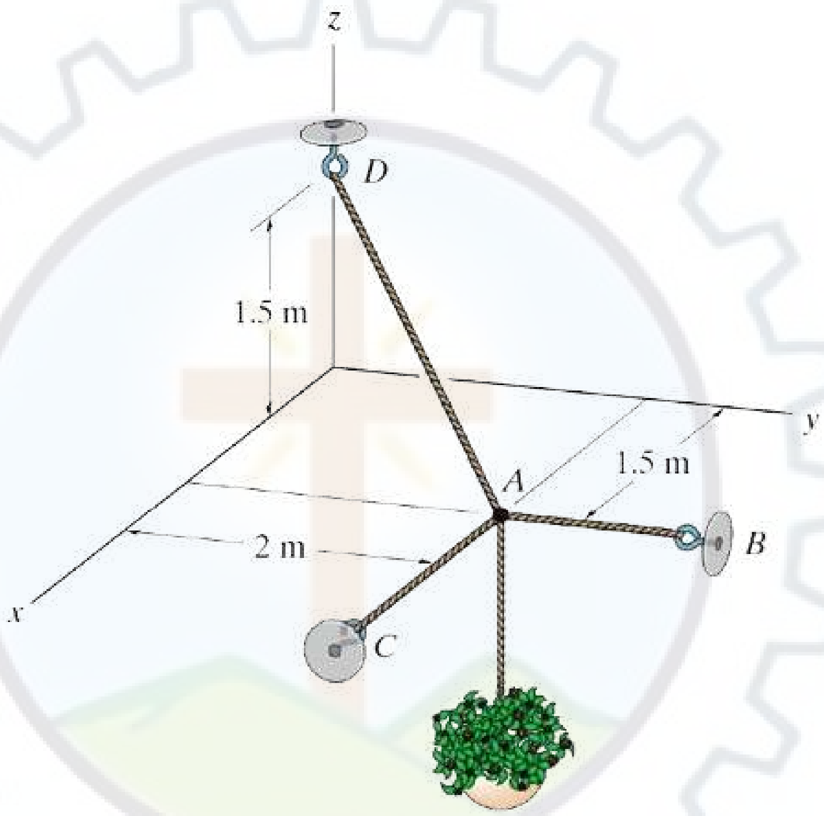


Figure 6

2. A uniform ladder of weight 100N and length 5 m is placed against a vertical wall in a position where its inclination to vertical is 30^0. A man weighing 800 N climbs the ladder. At what position will the ladder slip? The coefficient of friction for all contact surfaces is 0.2.

3. What is the value of 'P' required to cause the motion impend, the system shown in Figure 7 below. Assume coefficient of all contact surfaces as 0.2.

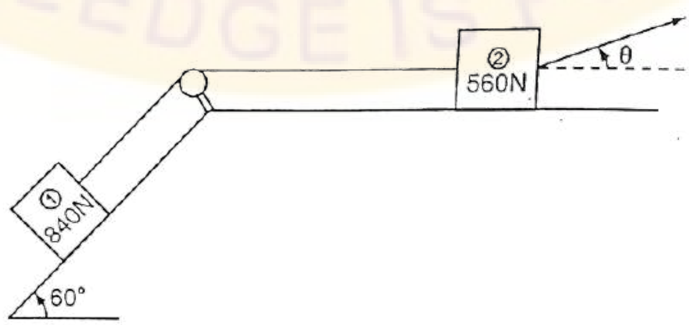


Figure 7

Course Outcome 4 (CO 4): Solve problems involving rigid bodies, applying the properties of distributed areas.

1. Locate the centroid y of the T-beam shown in Figure 8.

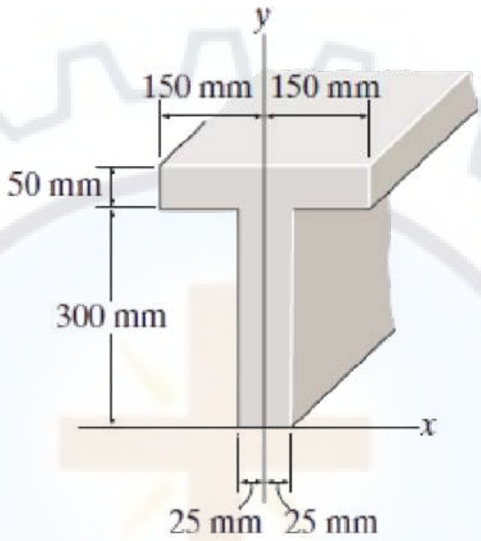


Figure 8

2. State and explain Pappus Guldinus Theorems
3. Determine the moment of inertia of the cross-sectional area of the T-beam with respect to the x axis passing through the centroid of the cross-section.

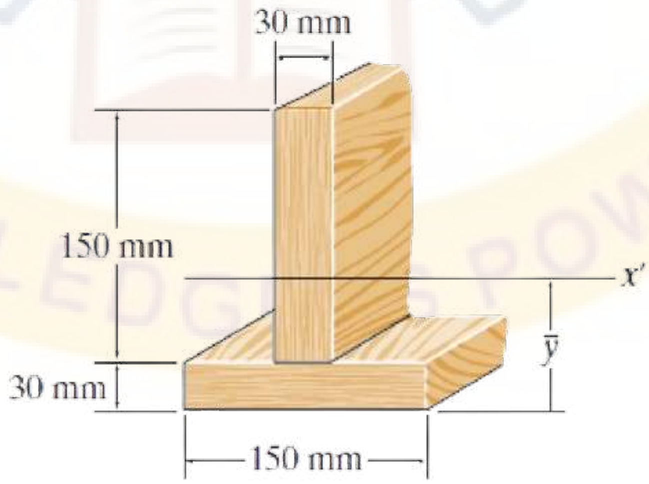


Figure 9

Course Outcome 5 (CO 5): Analyse linear and curvilinear motions of rigid bodies.

1. State and Explain D' Alemberts Principle
2. Two bodies of weights 60N and 40N are connected to the two ends of a light inextensible string, which passes over a smooth pulley. The weight 60N is placed on a smooth inclined plane of angle of inclination 10^0, while the weight 40N is hanging free in air. Determine acceleration and tension in the string.
3. A wheel rotating about a fixed axis at 20 revolutions per minute is uniformly accelerated for 70 seconds during which it makes 50 revolutions. Find the (i) Angular velocity at the end of this interval and (ii) Time required for the velocity to reach 100 revolutions per minute.

MODEL QUESTION PAPER

QP CODE: **Pages: 7**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24CE1T02

Course Name: ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Explain the concept of free body diagrams.
2. Find the magnitude of the two forces, such that if they act at right angles, their resultant is $\sqrt{10}$N. But if they act at 60^0, their resultant is $\sqrt{13}$N.
3. Explain Degrees of freedom.
4. State and explain Principle of virtual work.
5. A force of 30kN is acting in the direction of 9i+6j-2k through a point A (4,-1,7). Find the moment of the force about a point B (1,-2, 3).
6. Establish the relation between them angle of friction and angle of repose.
7. What is meant by radius of gyration of an area?
8. Discuss the generation of area by the theorems of Pappus Guldinus.
9. Explain the terms natural frequency and time period of a system.
10. State and explain the D'Alembert's principle. Write the equations of dynamic equilibrium for the motion of a lift moving downwards with an acceleration 'a' m/s^2 carrying a weight of 'W' N.

PART B

Answer any one question from each module. Each question carries 14 marks.

MODULE 1

11. Two cylinders of diameters 100 mm and 50 mm weighing 200 N and 50 N, respectively are placed in a trough as shown in Figure 1. Neglecting friction, find the reactions at contact surfaces 1,2,3 & 4. (14 Marks)

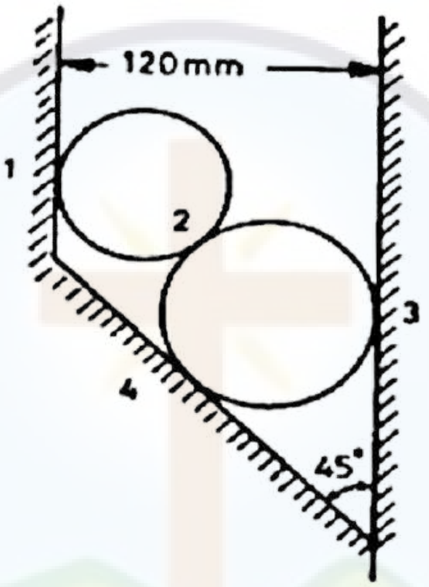


Figure 1

OR

12. A roller of radius 300mm and weight 1000N is to be pulled over a rectangular block of height 150mm as shown in Figure 2. Determine

    (a) The horizontal force required to be applied through the centre and

    (b) The required horizontal force when it is applied through the top end of vertical diameter. (14 Marks)

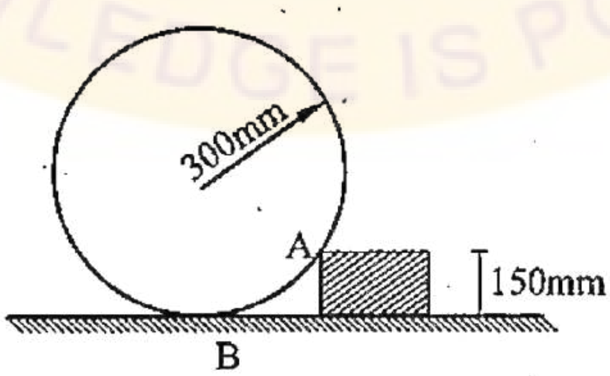


Figure 2

MODULE 2

13. (a) Find the support reactions for the beam loaded as shown in Figure 3. (9 Marks)

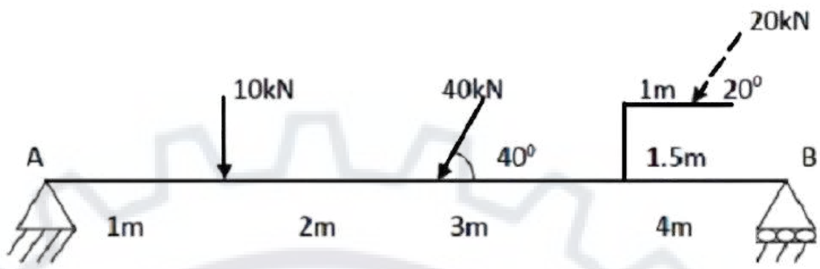


Figure 3

(b) A beam AB of span 5 metres as shown in Figure 4 is carrying a point load of 2kN at a distance 2 metres from A. Determine the beam reactions, by using the principle of the virtual work. (5 Marks)

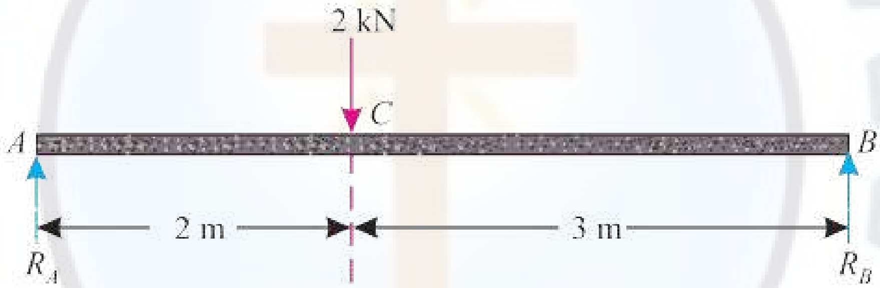


Figure 4

OR

14. (a) Find the support reactions for the beam loaded as shown in Figure 5. (7 Marks)

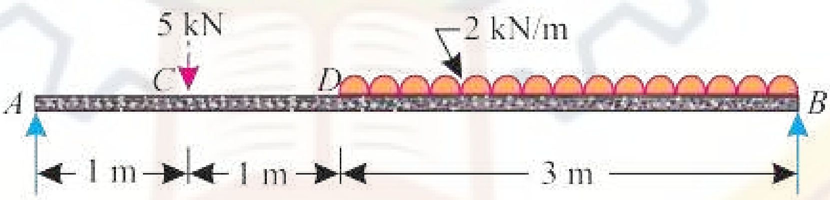


Figure 5

(b) A beam AB 10m long is hinged at A and supported on rollers over a smooth surfcae inclined at 30^0 to the horizontal at B. The beam is loaded as shown in Figure 6. Determine the reactions at A and B. (7 Marks)

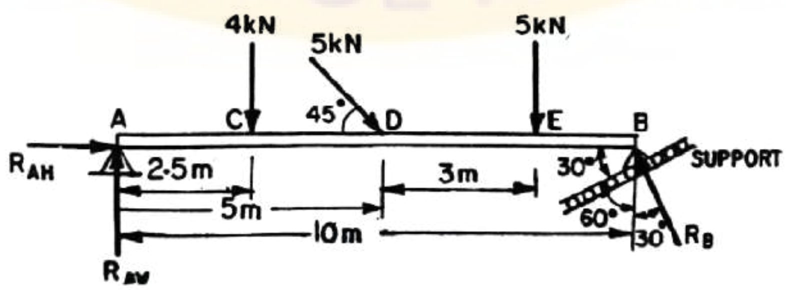


Figure 6

MODULE 3

15. A pole AO as shown in Figure 7 is supported by a ball and socket joint at its base and by cables AB and AC. Also it is subjected to forces 300N towards the negative X direction and 600N towards the positive Z direction and the forces act in a plane parallel to XZ plane. Compute the forces in the cables. (14 Marks)

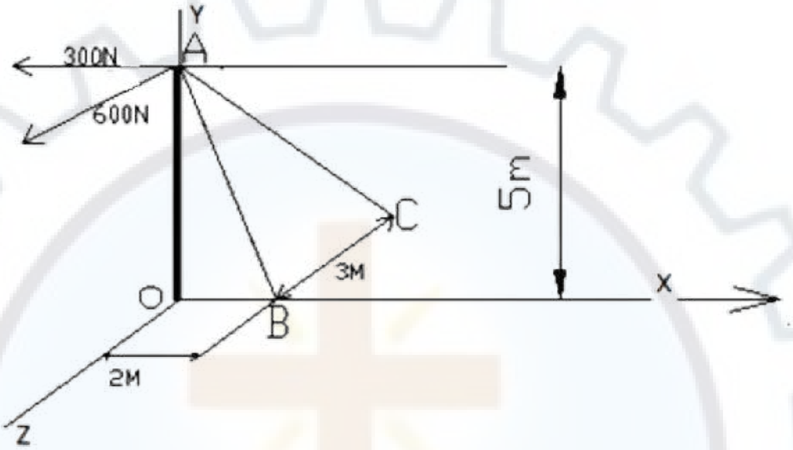


Figure 7

OR

16. (a) A rough inclined plane, rises 1 cm for every 5 cm along the inclined length. Calculate the effort required to drag a body weighing 100 N up the plane, when the effort is applied parallel to the plane (coefficient of friction is 0.25).(5 marks)

    (b) A uniform ladder of 4 m length rests against a vertical wall with which it makes an angle of 45^0. The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and the floor is 0.5. At what position along the ladder from the bottom end does the ladder slips, if a man, whose weight is one-half of that of the ladder, ascends it. (9 marks)

MODULE 4

17. (a) Locate the centroid of the plane area shown in Figure 8. (10 marks)

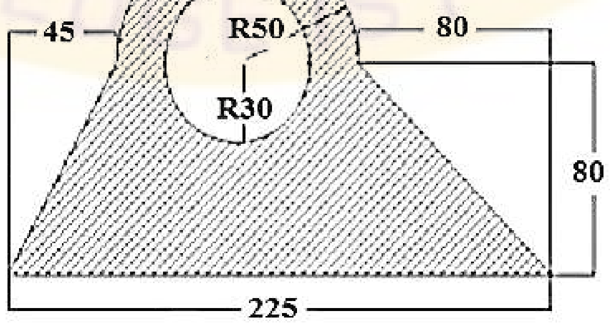


Figure 8

(b) A regular hexagon of side length "a" as shown in Figure 9 is rotated about one of the sides. Apply suitable theorem to find the volume of the solid of revolution. (4 marks)

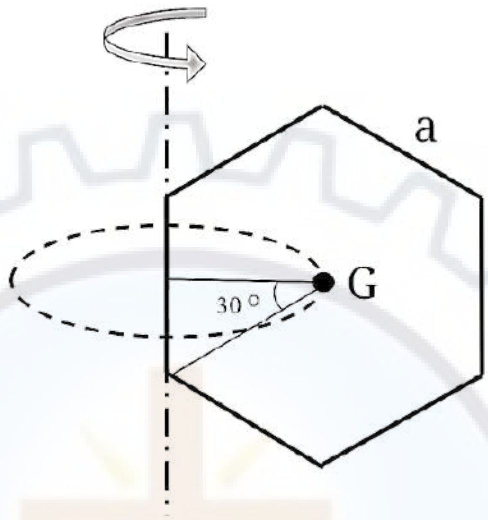


Figure 9

OR

18. Determine the moment of inertia and radius of gyration of the given area shown in Figure 10 about the horizontal centroidal axis. (14 marks)

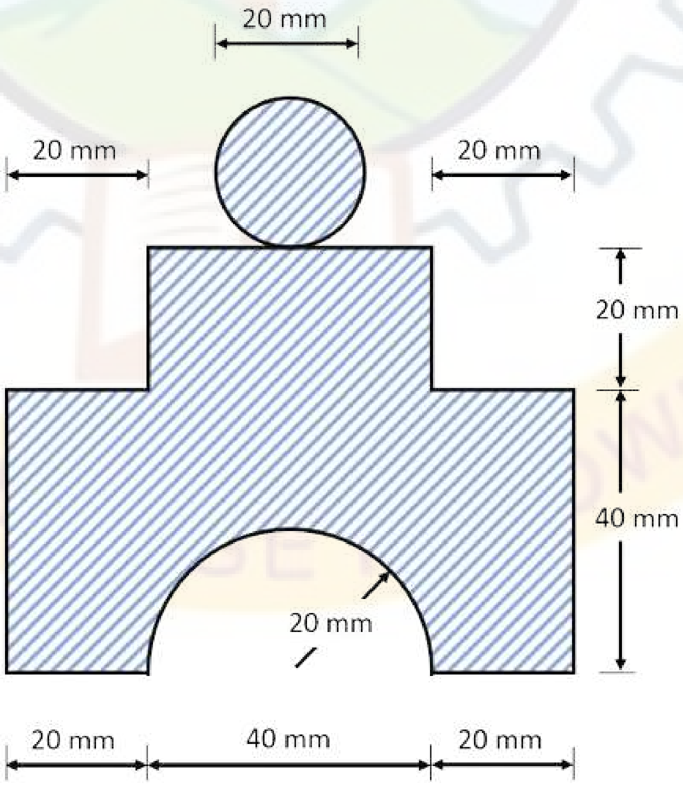


Figure 10

MODULE 5

19. (a) A car starts from rest on a curved road of 250m radius and accelerates at a constant tangential acceleration of 0.6 m/s^2. Determine the distance and the time for which that car will travel before the magnitude of the total acceleration attained by it becomes 0.75m/s^2. (7 marks)

(b) A block of mass 80 kg rests on a horizontal plane as shown in Figure 12. Find the magnitude of force P required to give the block an acceleration of a= 4 m/s^2 to the right. The coefficient of friction between the block and the plane is 0.30. (7 marks)

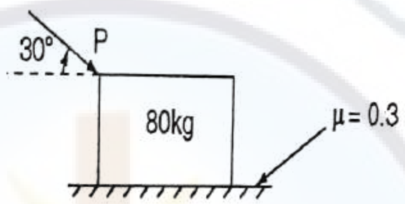


Figure 11

OR

20. (a) A mass of 60kg lies on a smooth horizontal table. It is connected to a fine string passing over a smooth guide pulley over the edge of table to a mass of 50kg. Find the tension in the string and acceleration of the system. (8 marks)

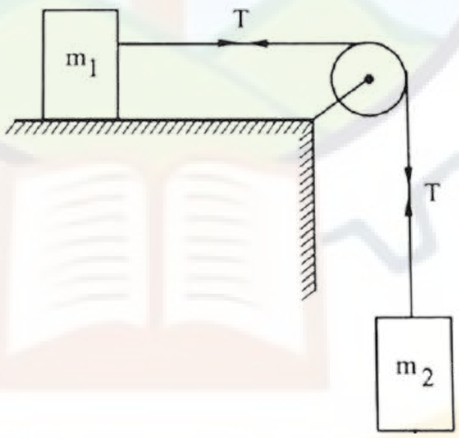


Figure 12

(b) A tray of mass 'm' is mounted on three identical springs, as shown in Figure 14. The period of vibration of the empty tray is 0.5 sec. After placing a mass of 1.5 kg on the tray, the period was observed to be 0.6 sec. Find the mass of the tray and stiffness of each spring. (6 marks)

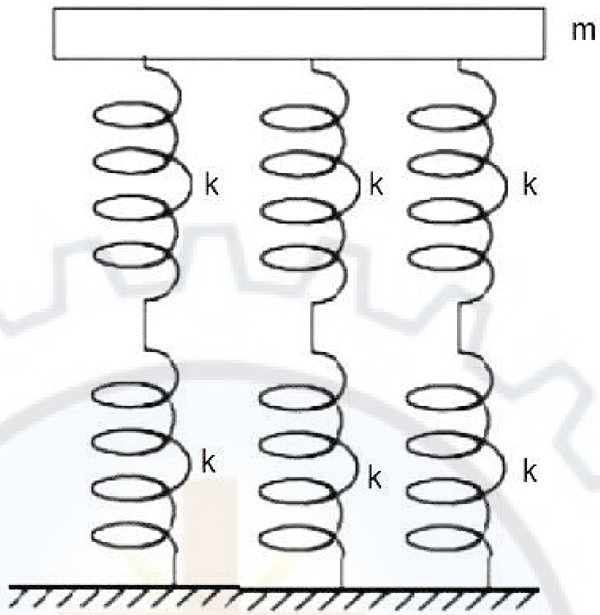


Figure 13

B24ES1T03C	GRAPHICS FOR CIVIL ENGINEERS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	1	3	4	2024

Preamble

The course outlines the fundamental principles, objectives, and technical considerations for drafting comprehensive drawings in the field of Civil Engineering. This course establishes the foundation for effectively performing technical communication through graphical representation in accordance with global standards.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Understand the concepts of engineering drawings and draw the projection of points and lines. (Cognitive knowledge level: Apply)
CO 2	Develop representation and understanding skills in the appropriate drawing levels by preparing orthographic projection of solids. (Cognitive knowledge level:Apply)
CO 3	Draw sectional views and develop surfaces of a given object(Cognitive knowledge level: Apply)
CO 4	Apply the principles of isometric projections to visualize different objects as well as the types of bonds in bricks. (Cognitive knowledge level: Apply)
CO 5	Prepare pictorial drawings using the principle of perspective projections and convert pictorial views into orthographic views (Cognitive knowledge level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											1
CO 2	3	2										2
CO 3	3	2										2
CO 4	3	2										2
CO 5	3	2										2

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember			
Understand	30	30	30
Apply	70	70	70
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

ESE will be of 3-hour duration on A4 size answer booklet and will be for 100 marks. The question paper shall contain two questions from each module. Student has to answer any one question from each module. Each question carries 20 marks and can have maximum 2 sub-divisions.

SYLLABUS

MODULE 1 (11 hours)

Introduction: Relevance of technical drawing in engineering field - Types of lines – Dimensioning - BIS code of practice for technical drawing - Lettering - Scales.

Orthographic projection of Points and Lines: Projection of points in different quadrants - Projection of straight lines inclined to one and inclined to both planes in different quadrants.

MODULE 2 (10 hours)

Orthographic projection : Projection of solids such as Square, Pentagon and Hexagonal Prisms, Pyramids, Cone and Cylinder - Projection of solids with axis inclined to one of the reference planes, inclined to both the reference planes.

MODULE 3 (11 hours)

Sections of Solids: Sections of Prisms, Pyramids, Cone, Cylinder with axis in vertical position and cut by different section planes - True shape of the sections.

Development of Surfaces: Development of surfaces of Prisms, Pyramids, Cone, Cylinder and solids cut by different section planes - Find the shortest distance between two points on the surface.

MODULE 4 (8 hours)

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Sphere, Frustum of Cone and their combinations.
Bonds in bricks: 1,1/2 brick thick English bond, 1,1/2 brick thick Flemish bond (application level).

MODULE 5 (8 hours)

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane, axis perpendicular to picture plane.

Freehand sketching: Freehand sketching of real objects.

Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.
3. P.I. Varghese, and K C John, Machine Drawing, V I P Publishers

Reference Books

1. Anilkumar, K.N., Engineering Graphics, Adhyuth narayan Publishers
2. Francis D.K. Ching, "Building construction Illustrated, 4th edition, John Wily & Sons, 2008

3. Agrawal, B. And Agrawal, C.M., Engineering Darwing, Tata McGraw Hill Publishers.

4. Duff, J.M. and Ross, W.A., Engineering Design and Visualisation, Cengage Learning.

5. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K., Engineering Graphics with AutoCAD, PHI.

6. Luzaddff, W.J. and Duff, J.M., Fundamentals of Engineering Drawing, PHI.

7. Varghese, P.I., Engineering Graphics, V I P Publishers

8. Venugopal, K., Engineering Drawing and Graphics, New Age International Publishers.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/ Tutorial Hours**
	Total Hours	**48 Hours**
1	**Module 1**	**11 hours**
1.1	Introduction: Relevance of technical drawing in engineering field - Types of lines - Dimensioning.	1 hour
1.2	BIS code of practice for technical drawing – Lettering - Scales.	2 hour
1.3	Orthographic projection of Points and Lines: Concept of principle planes of projection, different quadrants, locating points on different quadrants.	2 hour
1.4	Projection of straight lines inclined to one plane.	2 hour
1.5	Projection of straight lines inclined to both planes.	4 hour
2	**Module 2**	**10 hours**
2.1	Introduction of different solids - Orthographic projection of solids.	1 hour
2.2	Projection of solids such as Square, Pentagon and Hexagonal Prisms, Pyramids, Cone and Cylinder.	2 hour
2.3	Projection of solids with axis inclined to one of the reference planes.	2 hour
2.4	Practice problems on solids inclined to both reference planes.	5 hour

3	**Module 3**	**11 hours**
3.1	Introduction to section planes - Principle of locating cutting points and finding true shape.	2 hour
3.2	Problems on Sections of Cone and Cylinder with axis in vertical position and cut by different section planes.	2 hour
3.3	Problems on Sections of Prisms and pyramids with axis in vertical position and cut by different section planes.	2 hour
3.4	Principle of development of solids, sectioned solids.	2 hour
3.5	Problems on development of solids.	2 hour
3.6	Find the shortest distance between two points on the surface (application level).	1 hour
4	**Module 4**	**8 hours**
4.1	Principle of Isometric View and Projection, Isometric Scale, Problems on simple solids.	1 hour
4.2	Projections of Prisms, Pyramids, Cone, Cylinder, Sphere.	2 hour
4.3	Isometric problems on sphere and Frustum of cone.	1 hour
4.4	Problems on combination of different solids	2 hour
4.5	Bonds in bricks: 1,1/2 brick thick English bond.	1 hour
4.6	Bonds in bricks: 1,1/2 brick thick Flemish bond.	1 hour
5	**Module 5**	**8 hours**
5.1	Introduction to perspective projection, different planes, station point etc. - Perspective problems on prisms: axis perpendicular to the ground plane, axis perpendicular to picture plane.	2 hour
5.2	Perspective problems on pyramids: axis perpendicular to the ground plane, axis perpendicular to picture plane.	2 hour
5.3	Freehand sketching of real objects.	1 hour
5.4	Conversion of pictorial views into orthographic views.	3 hour

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Locate points in different quadrants as per given conditions.
2. Problems on lines inclined to both planes.

3. Find True length, Inclinations and Traces of lines.

Course Outcome 2 (CO 2):

1. Draw orthographic views of solids and combination solids.
2. Draw views of solids inclined to any one reference plane.
3. Draw views of solids inclined to both reference planes.

Course Outcome 3 (CO 3):

1. Draw views of solids sectioned by a cutting plane.
2. Find the true shape of the section.
3. Draw development of lateral surface of solids and also its sectioned views.

Course Outcome 4 (CO 4):

1. Draw Isometric views/projections of solids.
2. Draw Isometric views/projections of frustum of cone.
3. Draw the bonds in brick masonry.

Course Outcome 5 (CO 5):

1. Draw Perspective views of Solids with axis perpendicular to the ground plane.
2. Draw Perspective views of Solids with axis perpendicular to picture plane.
3. Draw Orthographic views of solids from given three dimensional view

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24ES1T03C

Course Name: GRAPHICS FOR CIVIL ENGINEERS

Max. Marks: 100 Duration: 3 hours

Instructions:
Retain necessary Construction lines
Show necessary dimensions
Answer any ONE question from each module
Each question carries 20 marks

MODULE I

1. One end point of a line AB is 12mm above HP and 15 mm in front of VP. The other end of the line is 50mm above HP and 42 mm in front of VP. Draw the projections of the line AB if its elevation measures 70mm. Find the true length and true inclinations of the line with the principal planes.

2. One end point P of a line 75mm long, is 10mm above HP and 20mm in front of VP. The line is inclined 45^0 to HP and its plan is inclined 35^0 to x-y line. Draw the projections of the line PQ and find out true inclination of the line with respect to VP.

MODULE II

3. A pentagonal pyramid of base edge 30 mm and axis length 60 mm is resting on VP on one of its base edges. The axis of the pyramid is inclined at 35^0 to VP and the resting base edge is inclined at 45^0 to HP. Draw the projection of the pyramid.

4. A cone of base diameter 50 mm and axis length 60 mm is resting on VP on one of its generators with the front view of the axis inclined at 40^0 to HP. Draw its projections.

MODULE III

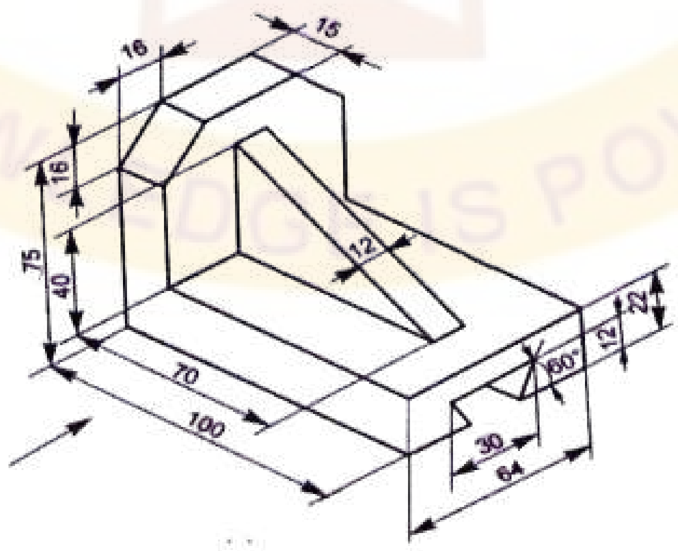
5. A cylinder with a 60 mm base diameter and 70 mm axis is resting on its base in the HP. It is cut by an auxiliary inclined plane which makes an angle of 60^0 with the HP and perpendicular to VP and passes through the top end of the axis. Draw its front view, sectional top view and true shape of the section.
6. A pentagonal pyramid, side of base 50 mm and height 80 mm rests on its base on the ground with one of its base sides parallel to VP. A section plane perpendicular to VP and inclined at 30^0 to HP cuts the pyramid, bisecting its axis. Draw the development of the truncated pyramid.

MODULE IV

7. Draw the isometric view of a pentagonal pyramid, side of base 20mm and height 50mm which rests centrally with base on a cylinder of diameter 60mm and height 40mm.
8. Brickwork bonding is important to ensure the stability of the structure and to produce a pleasing appearance. Draw neat sketches of 'English bond' and 'Flemish bond'.

MODULE V

9. A hexagonal prism 25mm side and 50mm long is lying on one of its rectangular face on the ground plane. The station point is 80mm in front of the picture plane, 65mm above the ground plane and lies in a central plane which is 70mm to the right of the axis of the prism. Draw the perspective view of the prism if one of the hexagonal faces of the prism is on the picture plane.
10. Draw the top view, front view and any one side view of the figure shown below. The front view direction is marked with a long arrow. Any missing dimension may be suitably assumed.



B24ES1L01B	PROGRAMMING LAB (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

This course introduces students to problem-solving using Python programming, offering hands-on experience with core concepts such as data types, control structures, functions, file handling, and data analysis. By engaging in practical exercises, students will develop the skills necessary to analyse complex engineering problems and implement effective solutions using Python.Upon completing this course, students will be equipped to apply Python to real-world engineering challenges, enhancing their computational thinking and technical proficiency.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Use fundamental Python constructs to solve basic computational problems (Cognitive Knowledge Level: Apply)
CO 2	Solve problems using data structures, logical conditions, and control loops enhancing their problem-solving skills (Cognitive Knowledge Level: Apply)
CO 3	Create functions and use inbuilt Python libraries to perform calculations and solve practical problems (Cognitive Knowledge Level: Apply)
CO 4	Manage and manipulate files and directories in Python (Cognitive Knowledge Level: Apply)
CO 5	Manipulate data using fundamental Python packages/libraries to perform mathematical operations and statistical analysis (Cognitive Knowledge Level: Analyse)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3									1
CO 2	3	3	3									1
CO 3	3	3	3									1
CO 4	3	3	3									1
CO 5	3	3	3	3								1

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance 15 marks

Class Work/ Assessment Viva-Voce 15 marks

Viva-Voce/ Test 20 marks

End Semester Examination (ESE) Pattern:

The following guidelines should be followed regarding the award of marks

Algorithm 20 marks

Program 30 marks

Viva-Voce 30 marks

Output 20 marks

SYLLABUS

LIST OF EXPERIMENTS

18 experiments from the following list of experiments are mandatory. At least 3 questions should be given from each set. The study and discussion of the remaining are also required.

	SET 1
1	Write a Python program to swap the values of two variables without using a third variable.
2	Write a Python program that accepts a single numeric parameter representing an angle in radians to convert into degree.
3	Implement a Python program that calculates simple interest based on user input for the principal amount, rate of interest, and time.
4	Create a Python program that takes a single character input and determines whether it is a vowel or consonant.
5	Write a Python programme to solve a quadratic equation. The inputs shall be taken from the user.
	SET 2
6	Write a Python program to find the first n prime numbers.
7	Write a Python program to check if a given year is a leap year
8	Write a Python program to read a string (word), store it in an array and check whether it is a palindrome.
9	Create a program that takes a tuple of numbers, converts it to a list, adds a new element, and then converts it back to a tuple.
10	Write a program to create a dictionary with student names as keys and their scores as values. Implement a search feature to find a student's score by name.
	SET 3
11	Write a function that returns the n^{th} Fibonacci number. Test the function with various values of n.
12	Write a program that simulates rolling a six-sided die 10 times and prints the result of each roll using the random module.
13	Create a custom module named `math_utils.py` with a function factorial(n) that returns the factorial of a number n. Import this module in a script and use the factorial() function.

14	A person needs to file his Income Tax Returns. He doesn't know if new regime or the old regime is beneficial. Please help him out by writing a Python program asking him the gross salary and possible deductions. You may use functions and Python libraries.
15	Write a Python function that takes two parameters: a list of numbers and a second parameter that can have one of three values: "asc", "desc", or "none". If the second parameter is "asc", the function should return the list of numbers in ascending order. If it is "desc", the function should return the list of numbers in descending order. If the second parameter is "none", the function should return the unaltered list.
	SET 4
16	Write a program that finds and prints the longest line in the file 'lines.txt'. The file will be kept in a prescribed directory.
17	Write a program that writes a list of dictionaries to a CSV file 'output.csv' and text file 'output.txt' both in a folder named 'data'.
18	Write a Python program that lists all the files in the current directory.
19	Write a Python program that searches for a specific word in a file and replaces it with another word. The program should save the changes to the same file. Also count the number of words replaced.
20	Reads the first 5 lines from an existing text file using the readline() method. If the file doesn't exist, handles the error using try and except, and creates a new file with the same name. Writes user input line by line into the file until the user decides to stop, ensuring the file is properly saved.
	SET 5
21	Create a NumPy array with random integers between 0 and 100 of size 5x5. Compute and print the mean, median, standard deviation, and sum of all elements. Find the row wise and column wise sum of the elements of the matrix. Perform matrix multiplication and display the result along with the multiplied ones. Find the element wise product, sum and difference find the sum of squares of all the elements row wise and display the result.
22	Read a csv file where the details of students and their marks obtained in various subjects are given. Remove the students from the list who is absent for any one of the exams where it displays 'abs' against the subject. Find the percentage of marks for each student and add it as the last column and save the updated file in a new name. Also display the names of students that scored more than 80% marks.
23	Load a CSV file containing sales data with columns for product name, quantity sold, and price. Calculate the total sales revenue for each product and identify the product with the highest revenue.

24	Generate a 10x10 matrix of random integers, extract all even numbers, and replace them with their negative values and all odd numbers to double their values. Find the minimum and maximum elements in the matrix.
25	Generate a line plot of the sine and cosine functions from 0 to 2π using Matplotlib. Give a title, label the axes and add a legend. Save the plot. Try the same for a scatter plot.

Reference Books

1. Eric Matthes, "Python Crash Course", No Starch Press
2. Cay S Horstmann, Rance D Necaise, "Python For Everyone", Wiley
3. Guttag John V, "Introduction to Computation and Programming using Python", PHI
4. Kenneth A Lambert, "Fundamentals of Python: First Programs", Cengage

B24CE1L01	CIVIL ENGINEERING LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

The Civil Workshop aims to equip students with practical skills in measurement and construction. The course covers diverse measuring techniques essential for Civil Engineering projects. Additionally, the course offers insights into plumbing layouts and various masonry techniques.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Undertake area measurements for various construction activities (Cognitive Knowledge Level: Apply)
CO 2	Apply surveying skills to assess and establish level differences in construction projects. (Cognitive Knowledge Level: Apply)
CO 3	Execute setting out for a given plan (Cognitive Knowledge Level: Apply)
CO 4	Understand and implement plumbing lines for water supply and sewage system (Cognitive Knowledge Level: Apply)
CO 5	Execute brick masonry works in English and Flemish bonds(Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3			2	1			3	1		3
CO 2	3	3	1		2	1			3	1		3
CO 3	3	3			2	1			3	1		3
CO 4	3	1	2		2	1	1		3	1		3
CO 5	2	2	1		2	1	1		3	1		3

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Class Work/ Assessment Viva-Voce	20 marks
Viva-Voce/ Test	20 marks

SYLLABUS

Course Content and Practical Schedule

LIST OF EXPERIMENTS

1	Calculate the area of a built-up space using digital distance measuring device and standard measuring tape.
2	Calculate the Carpet area and Plinth area of a building.
3	Calculate the area of a polygon by Compass traversing.
4	Calculate the area of a polygon by intersection method using a Compass.
5	Find the level difference between the given points using levelling.
6	Setting out of a building: Set out a building as per the given building plan using tape and cross staff.
7	Introduce the students to plumbing tools, different types of pipes, type of connections, traps, valves, fixtures and sanitary fittings and to establish a plumbing network for a given layout.
8	Construct a brick wall (one and one-and-half thick) in English bond.
9	Construct a brick wall (one and one-and-half thick) in Flemish bond.
10	Conduct a market study of various construction materials like brick, cement, steel and aggregates to understand the types, rates, specifications etc.

Reference Books

1. Khanna P.N, “Indian Practical Civil Engineering Handbook”, Engineers Publishers.

2. Bhavikatti. S, ”Surveying and Levelling (Volume 1)”, I.K. International Publishing House.

3. Arora S.P and Bindra S.P, " Building Construction", Dhanpat Rai Publications .
4. S. C. Rangwala, "Engineering Materials," Charotar Publishing House. Plumbing Engineering Services Design Guide by J. Paul Guyer.
5. S. K. Duggal, "Building Materials", New Age International, 2009.
6. B. N. Dutta," Estimating and Costing in Civil Engineering", UBS Publishers.
7. J.L. Meriam and L.G. Kraige, "Engineering Mechanics: Statics".
8. S. Timoshenko and D.H. Young, "Engineering Mechanics".

B24MC1T01	LIFE SKILLS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		1	0	1	2	P/F	2024

Preamble

This Course is aimed at equipping individuals with the essential competencies to navigate life's challenges with resilience and positivity. This course, embarks on a profound exploration of personal development, fostering self-awareness, meaningful connections, and the ability to navigate the complexities of both the abstract and the concrete aspects of life. It aims to enhance employability by providing practical insights and hands-on experiences that will empower one to apply these principles effectively in one's personal and professional endeavors.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Empower individuals with the knowledge and practical skills needed to navigate life challenges and to cope with emotions and stress. (Cognitive Knowledge Level: Apply)
CO 2	Develop a profound understanding of themselves and others, leading a fulfilling professional life by embracing a holistic approach to well being. (Cognitive Knowledge Level: Analyzes)
CO 3	Provide a solid foundation in leadership principles and team dynamics. (Cognitive Knowledge Level: Apply)
CO 4	Basic understanding of financial concepts for financial well being. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1			1			2			2			3
CO 2						3	1	2	2	2		2
CO 3									3			2
CO 4		1	1								3	

Assessment Pattern

Bloom's Category	**Continuous Assessment**	**End Semester Examination (% Marks)**
	Test (%Marks)	
Remember	20	20
Understand	20	20
Apply	30	30
Analyse	30	30
Evaluate		
Create		

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**
100	50	50

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (1 numbers)	25 marks
Regular assessment	15 marks

Regular assessment

Group Discussion (Marks: 9)
Create groups of about 6 students each and engage them on a GD on a suitable topic for about 20 minutes. Parameters to be used for evaluation are as follows:

1. Communication Skills: 3 marks
2. Subject Clarity: 2 marks
3. Group Dynamics: 2 marks
4. Behaviors Mannerisms: 2 marks

Presentation Skills (Marks: 6)
Identify a suitable topic and ask the students to prepare presentation (preferably a

powerpoint presentation) for about 10 minutes. Parameters to be used for evaluation are as follows

1. Communication Skills: 2 marks
2. Platform Skills: 2 marks
3. Subject Clarity/Knowledge: 2 marks

End Semester Examination Pattern

Part A: Short answer question (20 marks)
There will be one question from each MODULE (four questions in total, five marks each). Each question should be written in about maximum of 400 words. Parameters to be used for evaluation are as follows:

1. Content Clarity/Subject Knowledge
2. Presentation style
3. Organization of content

Part B: Case Study (30 marks)
The students will be given a case study with questions at the end. The students have to analyze the case and answer the question at the end. Parameters to be used for evaluation are as follows:

1. Analyze the case situation
2. Key players/characters of the case
3. Identification of the problem (both major minor if exists)
4. Bring out alternatives
5. Analyze each alternative against the problem
6. Choose the best alternative
7. Implement as solution
8. Conclusion
9. Answer the question at the end of the case

SYLLABUS

MODULE 1 (6 hours)

Overview of Life Skills:

Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress- Four A's of stress management, Gratitude Training, Coping with emotion- PATH method and relaxation techniques.

MODULE 2 (6 hours)

Life Skills for Professionals:

positive thinking, right attitude, Experience, attention to detail, having the big picture, learning skills, research skills, setting goals and achieving them, perseverance, motivation, self-motivation, and motivating others, IQ, EQ, and SQ , Collaboration, continuous learning, unlearning and relearning, cross cultural communication, social media etiquettes, Financial Literacy.
Time Management: Prioritizing tasks, setting realistic goals and managing time effectively, work life balance.
Holistic Thinking: imagination, intuition, lateral thinking, Multiple intelligence, spirituality, family bonding, living peacefully.

MODULE 3 (6 hours)

Leadership:

Leadership traits, Styles of Leadership, VUCA Leadership, Transactional vs Transformational Leaders, managing diverse stakeholders, crisis management, Effective Leaders.
Group and Team Dynamics: Group vs Team, Team Dynamics, Virtual teams, managing team performance and managing conflicts, Intrapreneurship

MODULE 4 (6 hours)

Financial Literacy:

Time value of money, power of compounding, Future value of a single cash flow, effective versus nominal rate, Future value of an annuity, present value of a single cash flow, Present value of an annuity.

Reference Books

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

2. Barun K. Mitra, “Personality Development Soft Skills”, Oxford Publishers, Third impression, 2017.

3. ICT Academy of Kerala, ”Life Skills for Engineers”, McGraw Hill Education (India) Private Ltd.,2016.

4. Caruso, D. R. and Salovey P, “The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership”, John Wiley Sons, 2004.

5. Kalyana, “Soft Skill for Managers”; First Edition; Wiley Publishing Ltd, 2015.

6. Larry James, “The First Book of Life Skills”; First Edition, Embassy Books, 2016.

7. Shalini Verma, “Development of Life Skills and Professional Practice”; First Edition; Sultan Chand (G/L) Company, 2014.

8. Daniel Goleman, ”Emotional Intelligence”; Bantam, 2006.

9. Remesh S., Vishnu R.G., ”Life Skills for Engineers”, Ridhima Publications, First Edition, 2016.

10. Butterfield Jeff, “Soft Skills for Everyone”, Cengage Learning India Pvt Ltd; 1 edition, 2011.

11. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India; 6 editions, 2015. Ace of Soft Skills: Attitude, Communication and Etiquette for Success, Pearson Education; 1 edition, 2013

12. Prasanna Chandra, “Fundamentals of Financial Management”, McGraw Hill Education (India) Private Ltd,2020

13. Edward de Bono, “Lateral Thinking”

14. Howard Gardener, “Multiple Intelligences”

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture /Tutorial Hours**
	Total Hours	24 Hours
	Module 1	6

1.1	Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making	1
1.2	Problem solving, Effective communication, interpersonal relationship, coping with stress- Four A's of stress management.	1
1.3	Gratitude Training, Coping with emotion- PATH method and relaxation techniques	1
1.4	Activity- Presentation, Group discussion	3
	Module 2	6
2.1	Life skills for professionals: positive thinking, right attitude, Experience, attention to detail, having the big picture, learning skills, research skills, setting goals and achieving them, perseverance, motivation, self-motivation, and motivating others,	1
2.2	IQ, EQ, and SQ, Collaboration, continuous learning, unlearning and relearning, cross cultural communication, social media etiquettes, Financial Literacy.	1
2.3	Time management: Prioritizing tasks, setting realistic goals and managing time effectively, work life balance.	1
2.4	Holistic Thinking: imagination, intuition, lateral thinking, Multiple intelligence, spirituality, family bonding, living peacefully.	1
2.5	Activity- Presentation, Group discussion.	2
	Module 3:	6
3.1	Leadership: Leadership traits, Styles of Leadership, VUCA Leadership, Transactional vs Transformational Leaders, managing diverse stakeholders, crisis management, Effective Leaders.	1
3.2	Group and Team Dynamics: Group vs Team, Team Dynamics, Virtual teams, managing team performance and managing conflicts, Intrapreneurship	1
3.3	Activity- Presentation, Group discussion	4
	Module 4:	6
4.1	Financial Literacy: Time value of money, power of compounding, Future value of a single cash flow.	1
4.2	Effective versus nominal rate, Future value of an annuity.	1
4.3	Present value of a single cash flow, Present value of an annuity.	1
4.4	Activity- Presentation, Group discussion	3

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. What are the life skills identified by WHO?
2. List the 4 A's of stress management.
3. Differentiate between Critical thinking and Creative thinking.

Course Outcome 2 (CO 2):

1. What are the life skills that a professional should have?
2. Explain how time management can help in work life balance.
3. What is the difference between intuition and lateral thinking?

Course Outcome 3 (CO 3):

1. How a person can grow as a leader in an organization?
2. Discuss the term "Crisis management".
3. What are the differences between a team and a group?

Course Outcome 4 (CO 4):

1. A finance company advertises that it will pay a lumpsum of Rs. 10000 at the end of 6 years to investors who deposit annually Rs. 1000. What interest rate is implicit in this offer?
2. How much should be deposited at the beginning of each year for 10 years in order to provide a sum of Rs. 50000 at the end of 10 years?
3. Suppose you deposit Rs. 10000 with an investment company which pays 8 percent interest with quarterly compounding. How much will this deposit grow in 5 years?

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24MC1T01

Course Name: LIFE SKILLS

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 5 marks.

1. Stress is the emotional or physical tension the body creates when presented with events or thoughts that cause worry, frustration, anger or nervousness. When stress exceeds the ability to cope, balance in the mind and body need to be restored. Discuss how stress management can act as an effective tool to accomplish this.

2. "The only limit to our realization of tomorrow is our doubts of today." – Franklin D. Roosevelt. Critically assess how cultivating positive thinking and maintaining a right attitude can transform professional challenges into opportunities for growth.

3. Discuss leadership styles that are effective for successful management of multicultural groups and teams.

4. Mr. Vinay plans to send his son for higher studies abroad after 10 years. He expects the cost of these studies to be Rs. 100000. How much should he save annually to have a sum of Rs. 100000 at the end of 10 years if the interest rate is 12 percent?

PART B

Read carefully the following case and answer the questions given below. Each question carries 6 marks.

1. Based on the case study given below, answer the following questions: It occurred on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh. Over 500,000 people were exposed to Methyl Isocyanate (MIC) gas and other chemicals. A runaway reaction had occurred in a storage tank of Methyl Isocyanate (MIC), which was used to manufacture a pesticide. The valves of the tank had burst, and a cloud of poisonous gas had escaped. The winds carried it to nearby shanty towns and the populous city of Bhopal, where thousands of people either died in their sleep or woke and died while fleeing. Those who survived suffered from burning eyes and lungs. Local medical facilities were not equipped for the disaster, and over the next few weeks' thousands more died. The killer gas spread through the city, sending residents scurrying through the dark streets. No alarm ever sounded a warning, so that local people were not informed the situation, and no evacuation plan was prepared. When victims arrived at hospitals breathless and blind, doctors did not know how to treat them, as UCIL had not provided emergency information. Perhaps most importantly at the time of the tragedy, the staff did not realize the gravity of the situation and even took a break for tea after the leak had been noticed, thinking they would have plenty of time to fix it. The operator in the control room did not notify his supervisor when the temperature began to rise inside the tank and the entire situation remained unattended for at least an hour. The disaster raised some serious ethical issues. The pesticide factory was built in the midst of densely populated settlements. UCIL chose to store and produce MIC, one of the deadliest chemicals (permitted exposure levels in USA and Britain are 0.02 parts per million), in an area where nearly 120,000 people lived. The MIC plant was not designed to handle a runaway reaction. When the uncontrolled reaction started, MIC was flowing through the scrubber (meant to neutralize MIC emissions) at more than 200 times its designed capacity.

   (a) Critique the communication strategy (or lack thereof) employed by UCIL during the disaster. How did the absence of timely warnings and information affect the outcome?

   (b) Assess the ethical implications of UCIL's decision to build a pesticide plant in a densely populated area. How should corporate responsibility have been exercised in this context?

   (c) As an engineer, comment on the drawback of the design which may have the reason for the tragedy.

   (d) Evaluate the leadership displayed by UCIL's management during the Bhopal disaster. How did their response, or lack thereof, impact the outcome of the crisis?

   (e) Reflect on the lessons learned from the Bhopal disaster. What key takeaways should industries and governments derive from this incident to enhance safety and prevent future catastrophes?

B24MC1T02	DESIGN THINKING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		1	1	0	1	P/F	2024

Preamble

This course gives students a comprehensive understanding of the iterative design process and its real-world applications. It covers the fundamentals of design thinking, including concept development, brainstorming, and creativity enhancement. Emphasizing customer needs identification and human-centered design principles, it explores product conceptualization and evaluation, along with prototyping techniques. Additionally, the course addresses ethical considerations and challenges within the design thinking process through diverse case studies. By the end of the course, students will gain practical insights into design thinking methodologies, preparing them to effectively tackle complex design challenges.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Exhibit/show a thorough understanding of the fundamental principles of the design thinking methodology. (Cognitive Knowledge Level: Understand)
CO 2	Utilize diverse techniques effectively to generate creative concepts, adopting innovation and ideation. (Cognitive Knowledge Level: Apply)
CO 3	Demonstrate expertise in ideating prototypes, models, and proof-of-concept iterations. (Cognitive Knowledge Level: Analyse)
CO 4	Analyze real-world challenges and develop a practical design thinking framework suitable for their professional endeavors. (Cognitive Knowledge Level: Create)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	2	1			1	1	1		1	3
CO 2	2	2	2	1			1	1	1	1	1	3
CO 3	2	2	2	1			1	1	1	1	1	2
CO 4	2	2	2	1			1	1	1		2	2

Assessment Pattern Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test (%Marks)	Case Study Presentation (Marks) (%Marks)	
Remember	25		20
Understand	25		20
Apply	25		20
Analyse	25		20
Evaluate			
Create		100	20

Mark Distribution

Total Marks	CIE Marks	ESE Marks
100	50	50

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test	25 marks
Case study Presentation	15 marks

End Semester Examination Pattern : There will be two parts; Part A and Part B. Part A contain 4 questions carrying 5 marks each. Part B contains 2 questions from each module out of which 1 to be answered and can have maximum 2 sub- divisions. Questions from Module 1&2 carries 8 marks each and Module 3&4 carries 7 marks.

SYLLABUS

MODULE 1 (5 hours)

Design Thinking Approach:

Introduction to Design Thinking; Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test; The double-diamond Model of design by British Design

Council.
Developing concepts:

Steps to develop concepts from functions; Brainstorming: Mechanism of brainstorming, Ideation; Creativity: How to increase level of creativity.

MODULE 2 (6 hours)

Design Process: Requirements: Identifying customer needs and requirements, market analysis, defining goals; Product concepts: establishing functions, task specifications.
Solution Concept: conceptualization, evaluating alternatives; embodiment design; Analysis and optimization; experiment; marketing. Human-centred design process.

MODULE 3 (6 hours)

Concepts Evaluation:: Evaluating conceptual alternatives: Pugh's Evaluation matrix, decision matrix with examples, QFD and house of quality.
Prototyping: Prototypes, Models and Proofs of concepts; What is Prototype? Why Prototype? Building models and prototypes, Rapid Prototyping; Lean startup method for prototype development; Testing prototypes and models and proving concepts.

MODULE 4 (7 hours)

Ethics in Design: Understanding obligations, code of ethics, familiarity with several code of ethics such as ASCE, ASME, IEEE, VDI etc. code of ethics and moral frameworks.
Challenges in Design Thinking: Design thinking case studies detailing the various aspects detailed above are to be discussed. The case studies are suggested to be from the below listed areas but not to be limited to: Consumer package goods; Education; Financial Services; Health care; Journalism; Non-Profit organizations; Retail; Technology; Transportation sector; Self-improvement.

Text Books

1. Yousef Haik Tamer M Shahin, "Engineering design process", Course Technology, 2010.

2. Clive L Dym, Patrick Little Elizabeth J Orwin, "Engineering Design-A Project based Introduction", Wiley, 2014.

3. Don Norman, "The Design of Everyday Things", Basic Books; 2nd edition, 2013.

4. Christian Mueller-Roterberg, "Handbook of Design Thinking: Tips and Tools for how to design thinking", 2018.

Reference Books

1. Daniel Kahneman, "Thinking Fast and Slow", Farrar, Straus Giroux, 201.

2. Rod Judkins, “The art of Creative Thinking”, Penguin Publishing Group, 2016.
3. Donella H Meadows, “Thinking in Systems”, Chelsea Green Publishing, 2008.
4. Tim Brown, “Change by Design”, HarperCollins, 2019.
5. V.N.Mittle & Arvind Mittal, ”Basic Electrical Engineering ” 2^{nd} Edition, McGraw Hill, 2006.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture /Tutorial Hours
	Total Hours	24 Hours
	Module 1	5
1.1	Design Thinking Approach: Introduction to Design Thinking; Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test	1
1.2	The double-diamond Model of design by British Design Council	1
1.3	Developing concepts: Steps to develop concepts from functions	1
1.4	Brainstorming: Mechanism of brainstorming, Ideation	1
1.5	Creativity: How to increase level of creativity	1
	Module 2	6
2.1	Design Process: Requirements: Identifying customer needs and requirements, market analysis, defining goals	1
2.2	Product concepts: establishing functions, task specifications	2
2.3	Solution Concept: conceptualization, evaluating alternatives	1
2.4	Embodiment design; Analysis and optimization; experiment; marketing	1
2.6	Human centred design process	1
	Module 3:	6
3.1	Concepts Evaluation: Evaluating conceptual alternatives: Pugh’s Evaluation matrix, decision matrix with examples.	2
3.2	Prototypes, Models and Proofs of concepts	1

3.3	What is Prototype? Why Prototype? Building models and prototypes, Rapid Prototyping	1
3.4	Lean startup method for prototype development; Testing prototypes and models and proving concepts	2
	Module 4:	7
4.1	Ethics in Design: Understanding obligations, code of ethics, familiarity with several code of ethics such as ASCE, IEEE, VDI etc. code of ethics and moral frameworks	1
4.2	Challenges in Desing thinking	1
4.3	Design thinking case studies detailing the various aspects	5

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Describe design thinking and list the different stages in a design thinking process.
2. Illustrate the double-diamond Model of design.
3. Describe how to develop concepts from functions and Mechanism of brainstorming.
4. How to increase the level of creativity and the process of forming ideas from conception to implementation?

Course Outcome 2 (CO 2):

1. How to narrow down to the best design considering the customer needs and requirements, market analysis and defining goals?
2. Illustrate the process of product concepts, forming ideas and embodiment design.
3. Explain the Human-centred design process.

Course Outcome 3 (CO 3):

1. Describe the concept evaluation using Pugh's Evaluation matrix, and decision matrix with examples.
2. Explain the ideation of prototypes, models, and proofs of concepts.
3. Illustrate the concept of Rapid Prototyping, the Lean startup method for prototype development and testing of prototypes.

Course Outcome 4 (CO 4):

1. Discuss as an engineer, how ethics play a decisive role in design.
2. Analyze the Challenges in Design thinking.
3. Design the functional structure of a shopping cart.
4. Examine the changes that can be made in the design of a bag with constraints of cost, reliability issues, production methods and environmental factors.

MODEL QUESTION PAPER

QP CODE: **Pages: 4**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24MC1T02

Course Name: DESIGN THINKING

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 5 marks.

1. Demonstrate the basic concept of brainstorming and the rules developed for brainstorming session.
2. Briefly explain what is product and solution concepts in design process.
3. Distinguish between prototypes and models.
4. Explain the importance of ethics in design.

PART B

Answer any one question from each module.

5. What do you mean by design thinking and why it is needed. How does the design thinking approach help engineers. 8

OR

6. Summarize different stages of design thinking process using appropriate examples.. 8

7. Illustrate different phases of extensive prescriptive model of design process. 8

OR

8. Identifyl the customer requirements with the help of refrigerator as example, 8

9. How concepts evaluation can be done using Pugh's evaluation matrix. Compare Pugh's evaluation matrix with the decision matrix. 7

OR

10. List the different methods in which the prototype of a product can be generated and tested. 7

11. Design a device/machine that will crush aluminum cans. The device must be fully automatic. The device should switch on automatically, crush the can automatically, eject the crushed can automatically and switch off automatically. 7

OR

12. Design a new shopping cart that can be used primarily in grocery stores. The shopping cart should solve the common problems in the available carts. There is a tendency to conserve parking space by not designating a return cart area. Leaving cart in the parking lots may lead to serious accidents and car damage. Many customers do not fill their carts when shopping; however, they do not like to carry baskets. Other customers like to sort products as they shop. 7

B24MC1L01	YOGA AND SPORTS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	1	1	1	P/F	2024

Preamble

This course enables the learners to understand how to attain physical fitness, mental well-being, and holistic growth through the combined benefits of yoga and sports. The topics covered in this course are Yoga Lifestyle Physical fitness, wellness and exercise programmes, First aid and Postures nutrition. This course helps the students to develop appreciation of physical activity as a lifetime pursuit and a means to better health.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Demonstrate the need of physical activities and Yoga for the strength, flexibility, and relaxation of mind and body. (Cognitive Knowledge Level :Apply)
CO 2	Use scientific principles of exercise and training in daily routine. (Cognitive Knowledge Level :Apply)
CO 3	Apply first aid promptly and appropriately whenever and wherever the need arises.(Cognitive Knowledge Level :Apply)
CO 4	Understand the importance of postures and nutrition (Cognitive Knowledge Level :Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1								2	3	2		2
CO 2								3	3	2		2
CO 3						2		3	3	3		2
CO 4								3	3	2		2

Mark Distribution

Total Marks	CIE Marks
50	50

Continuous Internal Evaluation Pattern

Attendance 10 marks
Regular assessment 40 marks

Marks for the regular assessment can be based on the co questions given at the end.

SYLLABUS

MODULE 1 (6 hours)

Yoga Lifestyle:

Meaning and importance of Yoga. Introduction-Asanas: Pranayama, Meditation and Yogic Kriyas. Yoga for concentration and related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana). Relaxation Techniques for improving concentration-Yog-nidra.Asanas as preventive measure.Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.Obesity: Procedure, Benefits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.Back pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.

MODULE 2 (6 hours)

Physical fitness and exercise:

Meaning and importance of physical fitness and wellness. Components of physical fitness and health related fitness. Exercise for improving speed, strength, endurance, and flexibility and co ordinative abilities.Exercises to prevent back pain, tennis elbow, shoulder injury and knee pain, Neck pain.Fitness test battery for speed, strength, endurance, flexibility.Importance of weight training.Warming up and cooling down.How to deal with every day stress.

MODULE 3 (6 hours)

First aid:

First aid and principles of first aid.First aid measure for the following: Bleeding through Nose, Snakebite, Dog Bite, Electric Shock, Burns and Drowning.Common injuries and their management: Wounds, Cuts, Sprain, Fracture and Dislocation. Cardio Pulmonary Resuscitation (CPR).How to prevent muscle cramps and its management.How to carry an injured person.

MODULE 4 (6 hours)

Postures and nutrition:

Posture and its importance.Common Postural Deformities-Knock Knee, Flat Foot, Round Shoulders, Lordosis, Kyphosis, Bow Legs and Scoliosis.Corrective Measures for Postural Deformities. Balanced diet, malnutrition and Deficiency diseases. Hydration

Text Books

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light on Yoga by B.K.S. Iyengar.
3. Health and Physical Education- NCERT (11th and 12th Classes)

Reference Books

4. Physiological aspects of sports training and performance by Jay Hoffman.
5. Periodization theory and methodology of training by Tudor O Bompa and G Grisgery Haff.
6. Essential of strength training and conditioning by Thomas Baechle E R, Roger W Earle.
7. A practice guide to emergency first aid, safety injuries, illnesses by Montreal.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture /Tutorial Hours**
	Total Hours	24 Hours
	Module 1	6
1.1	Meaning and importance of Yoga.Introduction-Asanas, Pranayama, Meditation and Yogic Kriyas.Yoga for concentration and related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana) Relaxation Techniques for improving concentration-Yog-nidra. Asanas as preventive measures.	2

1.2	Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.	1
1.3	Obesity: Procedure, Benefits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.	1
1.4	Back pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana	2
	Module 2	6
2.1	Meaning and importance of physical fitness and wellness, Components of physical fitness and health related fitness	1
2.2	Exercise for improving speed, strength, endurance, and flexibility and co ordinative abilities	1
2.3	Exercises to prevent back pain, shoulder injury and knee pain.	2
2.4	Fitness test battery for speed, strength, endurance, flexibility.	1
2.5	Importance of weight training, Warming up and cooling down.	1
	Module 3:	6
3.1	First aid and principles of first aid.First aid measure for the following: Bleeding through Nose, Snakebite, Dog Bite, Electric Shock, Burns and Drowning.	2
3.2	Common injuries and their management: Wounds, Cuts, Sprain, Fracture and Dislocation	2
3.3	Cardio pulmonary resuscitation (CPR).	1
3.4	How to prevent muscle cramps and its management.How to carry an injured person	1
	Module 4:	6
4.1	Posture and its importance.Common Postural Deformities-Knock Knee, Flat Foot, Round Shoulders.	2
4.2	Lordosis, Kyphosis, Bow Legs and Scoliosis.Corrective Measures for Postural Deformities.	2
4.3	Balanced diet, malnutrition and deficiency disease, Hydration.	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Demonstrate yoga asanas for life style problems

2. Create a PPT presentation on various yoga asanas
3. Group Activity - Group discussion about the need and benefits of physical activities and Yoga for the strength, flexibility, and relaxation of mind and body.

Course Outcome 2 (CO 2):

1. Analyze the exercise activities of at least five famous personalities and give a PPT presentation about how each one of them uses physiological principles related to exercise and training in daily routine.
2. Conduct a survey on how the following categories of people follow physiological principles related to exercise and training in daily routine.

    (a) Sports person
    (b) Working woman
    (c) Students
    (d) Ladies in the age group of 25-35, 35-45,45- 55,55-65, above 65
    (e) Gents in the age group of 25-35, 35-45,45- 55,55-65, above 65

Course Outcome 3 (CO 3):

With a role play, illustrate various first aid activities that can be followed at various situation in life. In each illustration, try to give emphasis on dos and don'ts to be followed in each situation.

Course Outcome 4 (CO 4):

Observe at least 10 students in your class and identify common postural deformities each one of them have. Also identify good posters they follow. Have a discussion with each one of them to identify whether they have already recognized it or not. Prepare a report on this including your thoughts on the diet they take and its impact on their health.

MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH CIVIL ENGINEERING

SEMESTER 2

SYLLABUS

B24MA1T02	ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		3	1	0	3	4	2024

Preamble:

This course introduces the concepts and applications of differential equations, sequence and series including power series and basic transforms such as Laplace and Fourier transforms. The objective of this course is to familiarize the prospective engineers with some advanced concepts and methods in Mathematics which include differential equations, sequence, series and transforms. The topics treated in this course have applications in all branches of engineering.

Prerequisites: Nil

Course Outcomes:

After the completion of the course the student will be able to:

CO 1	Solve homogeneous and non-homogeneous linear differential equation with constant coefficients (Cognitive Knowledge Level: Apply)
CO 2	Perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent (Cognitive Knowledge Level: Apply)
CO 3	Determine the Taylor and Fourier series expansion of functions and learn their applications. (Cognitive Knowledge Level: Apply)
CO 4	Determine the Fourier transforms of functions and apply them to solve problems arising in engineering (Cognitive Knowledge Level: Apply)
CO 5	Compute Laplace transform and apply them to solve ordinary differential equations arising in engineering (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2	1		1							1
CO 2	3	2	1		1							1
CO 3	3	2	1		1							1
CO 4	3	2	1		1							1
CO 5	3	2	1		1							1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (% Marks)	Test 2 (% Marks)	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 (Ordinary Differential Equations)

(Text 2: Relevant topics from sections 2.1, 2.2, 2.5,2.6, 2.7, 2.10, 3.1, 3.2, 3.3)

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only). Existence and uniqueness (without proof). Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients(for the right hand side of the form x^n,e^{kx},$sinax$, $cosax$ and their linear combinations) , methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficients using method of undetermined coefficients.

MODULE 2 (Sequences and Series)

(Text 1: Relevant topics from sections 9.1, 9.3, 9.4, 9.5, 9.6)

Convergence of sequences and series, convergence of geometric series and p-series (without proof), tests of convergence (comparison, limit comparison, ratio and root tests without proof); Alternating series and Leibnitz test, absolute and conditional convergence.

MODULE 3 (Fourier Series)

(Text 1: Relevant topics from sections 9.8, 9.9. Text 2: Relevant topics from sections 11.1, 11.2, 11.6)

Taylor series (without proof, assuming the possibility of power series expansion in appropriate domains), Binomial series and series representation of exponential, trigonometric, logarithmic functions (without proofs of convergence); Fourier series, Euler formula, Convergence of Fourier series (without proof), half range sine and cosine series.

MODULE 4 (Fourier Transforms)

(Text 2: Relevant topics from sections 11.7, 11.8, 11.9)

Fourier integral representation, Fourier sine and cosine integrals. Fourier sine and cosine transforms, inverse sine and cosine transform. Fourier transform and inverse Fourier transform, basic properties. The Fourier transform of derivatives. Convolution theorem (without proof).

MODULE 5 (Laplace Transforms)

(Text 2: Relevant topics from sections 6.1, 6.2 ,6.3, 6.4, 6.5)

Laplace Transform and its inverse, Existence theorem (without proof), linearity, Laplace transform of basic functions, first shifting theorem, Laplace transform of derivatives and integrals, solution of differential equations using Laplace transform, Unit step function, Second shifting theorem. Dirac delta function and its Laplace transform, Solution of ordinary differential equation involving unit step function and Dirac delta functions. Convolution theorem (without proof) and its application to finding inverse Laplace transform of products of functions.

Text Books

1. H. Anton, I. Biven, S. Davis, "Calculus", Wiley, 10^{th} edition, 2015.

2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10^{th} edition, John Wiley& Sons, 2016.

Reference Books

3. J. Stewart, "Essential Calculus", Cengage,2^{nd} edition, 2017.

4. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9^{th} Edition, Pearson, Reprint,2002.

5. Peter O Neil, "Advanced Engineering Mathematics", 7^{th} Edition, Thomson, 2007.

6. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6^{th} edition, 2003.

7. Veerarajan T,"Engineering Mathematics for first year", Tata McGraw - Hill, 2008.

8. B.S. Grewal,"Higher Engineering Mathematics", Khanna Publishers, 43 Edition, 2015.

9. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
1	**Module 1: Ordinary Differential Equations**	9
1.1	Homogenous linear equation of second order, Superposition principle, general solution.	1
1.2	Homogenous linear ODEs of second order with constant coefficients.	2
1.3	Second order Euler-Cauchy equation.	1
1.4	Non homogenous linear differential equations of second order with constant coefficient-solution by undetermined coefficients, variation of parameters.	3
1.5	Higher order equations with constant coefficients.	2
2	**Module 2: Sequences and Series**	9
2.1	Convergence of sequences and series, geometric and p-series.	2
2.2	Test of convergence (comparison, ratio and root).	4

2.3	Alternating series and Leibnitz test, absolute and conditional convergence	3
3	**Module 3: Fourier series**	9
3.1	Taylor series, Binomial series and series representation of exponential, trigonometric, logarithmic functions.	3
3.2	Fourier series, Euler formulas, Convergence of Fourier series (Dirichlet's conditions)	3
3.3	Half range sine and cosine series.	3
4	**Module 4: Fourier Transforms**	9
4.1	Fourier integral representation.	1
4.2	Fourier Cosine and Sine integrals and transforms.	2
4.3	Complex Fourier integral representation, Fourier transform and its inverse transforms, basic properties.	3
4.4	Fourier transform of derivatives, Convolution theorem	3
5	**Module 5: Laplace Transforms**	9
5.1	Laplace Transform , inverse Transform, Linearity, First shifting theorem, transform of basic functions.	2
5.2	Transform of derivatives and integrals.	1
5.3	Solution of Differential equations, Initial value problems by Laplace transform method.	2
5.4	Unit step function - Second shifting theorem.	1
5.5	Dirac Delta function and solution of ODE involving Dirac delta function.	2
5.6	Convolution and related problems.	1
	Total	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1): Solve homogeneous and nonhomogeneous linear equation with constant coefficients.

1. Find the general solution to $2x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - 3y = 0$ given that $y_1(x) = \frac{1}{x}$ is a solution.
2. Solve the initial value problem $x^2y'' - 3xy' + 4y = 0$ given that $y(1) = \pi, y'(1) = 4\pi$
3. By the method of undetermined coefficients, solve $y'' - 2y' + y = e^x cos2x$

Course Outcome 2 (CO 2): Perform various tests to determine whether a given series is convergent, absolutely convergent or conditionally convergent.

1. Find the sum of the series $\sum_{n=1}^{\infty} \frac{1}{9n^2+3n-2}$,if it is convergent.
2. Examine the convergence of $\sum_{n=1}^{\infty} \left(\frac{n}{n+1}\right)^{n^2}$

3. Determine whether the series $\sum_{n=1}^{\infty} \frac{(-1)^n n^4}{4^n}$ is absolutely convergent.

Course Outcome 3 (CO 3): Determine the power series expansion of a given function.

1. Find the Taylor's series representation of $f(x) = sin\pi x$ about $x = 1$
2. Determine the binomial series representation of $\frac{1}{\sqrt{(2+x)^3}}$
3. Find the Fourier series of the periodic function $f(x)$ of period 2, where $f(x) = \begin{cases} -1 & -1 \leq x \leq 0 \\ 2x & 0 \leq x \leq 1 \end{cases}$ and deduce that $1 + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$.

Course Outcome 4 (CO 4): Determine the Fourier transforms of functions and apply them to solve problems arising in engineering .

1. Find the Fourier integral representation of function defined by $f(x) = e^{-x}$ for $x > 0$ and $f(x) = 0$ for $x < 0$.
2. What are the conditions for the existence of Fourier Transform of a function $f(x)$?
3. Find the Fourier Transform of $f(x) = x$ for $|x| \leq 1$ and $f(x) = 0$ otherwise.

Course Outcome 5 (CO 5):Compute Laplace transform and apply them to solve ODEs arising in engineering.

1. What is the inverse Laplace Transform of $\frac{3s+2}{(s-1)(s^2+2s+5)}$
2. Find Laplace Transform of (i) $e^{-t}sin^2t$ (ii) $\delta(t-a)$
3. Solve the differential equation $y'' + 4y = f(t), y(0) = 1, y'(0) = 0$ where $f(t) = \begin{cases} 0 & \text{if } 0 \leq t \leq 4 \\ 3 & \text{if } t \geq \pi \end{cases}$

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24MA1T02

Course Name: ORDINARY DIFFERENTIAL EQUATIONS AND TRANSFORMS
Common to all branches

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Check whether x, lnx are linearly independent or not.
2. Solve $y''' + 9y' = 0$.
3. Find the rational number represented by the repeating decimal 5.373737...
4. Examine the convergence of $\sum_{k=1}^{\infty} \frac{1}{k!}$
5. Find the binomial series for $f(x) = (1+x)^{\frac{1}{3}}$ upto third degree term.
6. Obtain the half range sine series expansion of $f(x) = \pi x - x^2$ in $(0, \pi)$.
7. Find the cosine integral representation of the function $f(x) = \begin{cases} 1 & ; 0 < x < 1 \\ 0 & ; x > 1 \end{cases}$
8. Find the Fourier cosine transform of e^{-x} , $x > 0$.
9. Find the Laplace transform of $sin^2 2t$.
10. Find $L^{-1}\left\{\frac{1}{(s-1)(s-2)}\right\}$.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. (a) Solve the initial value problem $y'' + 9y = 0, y(0) = 0.2, y'(0) = -1.5$. 7

(b) By the method of variation of parameters solve $y'' + 4y = tan2x$. 7

OR

12. (a) By the method of undetermined coefficients solve $y'' + 2y' + 4y = 3e^{-x}$. 7

(b) Solve $x^2y'' + xy' + 9y = 0, y(1) = 0, y'(1) = 2.5$. 7

13. (a) Test the convergence of (i) $\sum_{k=1}^{\infty} \frac{3k^3-2k^2+4}{k^7-k^3+2}$ (ii) $\sum_{k=1}^{\infty} \frac{k^k}{k!}$. 7

(b) Check the convergence of the series $1 + \frac{1.3}{3!} + \frac{1.3.5}{5!} + \frac{1.3.5.7}{7!} + \dots$ 7

OR

14. (a) Determine whether the series $\sum_{k=1}^{\infty} \frac{1}{\sqrt{k+1}}$ is absolutely convergent or conditionally convergent. 7

(b) Test the convergence of (i)$\sum_{k=1}^{\infty} \frac{k!}{3!(k-1)!3^k}$ (ii) $\sum_{k=1}^{\infty}(\frac{4k-5}{2k+1})^k$ 7

15. (a) Expand into a Fourier series , $f(x) = e^{-x}, 0 < x < 2\pi$. 7

(b) Obtain the half range Fourier sine series of $f(x) = \begin{cases} x & ,0 < x < \frac{\pi}{2} \\ \pi - x & ,\frac{\pi}{2} < x < \pi \end{cases}$ 7

OR

16. (a) Find the Fourier series expansion of $f(x) = x^2$ in the interval $-\pi < x < \pi$. Hence show that $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$. 7

(b) Find the half range cosine series for $f(x) = (x-1)^2$in $0 \le x \le 1$. 7

17. (a) Find the Fourier transform of $f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{otherwise} \end{cases}$ 7

(b) Find the Fourier sine integral of $f(x) = \begin{cases} sinx & ,0 \le x \le \pi \\ 0 & ,x > \pi \end{cases}$ 7

OR

18. (a) Using Fourier integral representation show that $\int_0^{\infty} \frac{coswx}{1+w^2} dw = \frac{\pi}{2} e^{-x}, x > 0$. 7

(b) Find the Fourier sine transform of $f(x) = \begin{cases} k & ,0 < x < a \\ 0 & ,x > a \end{cases}$ 7

19. (a) Find the Laplace transform of (i) $tsin2t$ (ii) $e^{-t}sin3tcos2t$ 7

(b) Using convolution theorem find $L^{-1}\left\{\frac{1}{s(s^2+4)}\right\}$ 7

OR

20. (a) Find $L^{-1}\left\{\frac{4s+5}{(s+2)(s-1)^2}\right\}$ 7

(b) Use Laplace transform to solve $y'' + 2y' + 2y = 0, y(0) = y'(0) = 1$. 7

B24PH1T01B	ENGINEERING PHYSICS (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

The aim of this course is to equip students with a solid foundation in physics principles and knowledge of their engineering applications. This will enhance the students' ability to analyze and solve complex engineering problems. Ultimately, the goal is to produce graduates who are well prepared to tackle real world engineering challenges with a deep understanding of the underlying physical principles.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Analyze the phenomenon of oscillations and quantify the distinction between undamped, damped and forced oscillations. (Cognitive Knowledge Level: Apply)
CO 2	Apply laws of Physics in the design and analysis of different types of sensors. (Cognitive Knowledge level: Apply)
CO 3	Understand the different types of chemical bonds, the concept of dislocations in materials and their influence on the mechanical properties of materials. (Cognitive Knowledge level: Apply)
CO 4	Quantify architectural and acoustic characteristics of buildings, gain familiarity with the principles and applications of ultrasonic testing for flaw detection and the design of ultrasonic transducers and systems. (Cognitive Knowledge level: Apply)
CO 5	Understand the principle and structure of lasers and the working of optical fibers. (Cognitive Knowledge level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2	1	1								1
CO 2	3	1	2	1								1
CO 3	3	1		1								1
CO 4	3	2	2	1								1
CO 5	3	1	1	1			1					1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 Marks
Continuous Assessment Test (2 numbers)	25 Marks
Assignment/Quiz/Course Project	15 Marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 (7 hours)

Oscillations:

Simple Harmonic Oscillator - differential equation, solution - torsion pendulum Damped harmonic oscillator - differential equation and solution (underdamped case), comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, Q factor, Forced

Harmonic Oscillator - differential equation and its solution, Analysis of the solution - amplitude resonance

MODULE 2 (8 hours)

Sensors:

Sensors - Introduction and classification, Sensor characteristics (definition only): Static characteristics - transfer function - sensitivity, calibration - calibration error, hysteresis, resolution, output impedance; Dynamic characteristics - zero order, first order and second order sensors (qualitative ideas only)
Sensor elements (principle of working and operation): Resistive elements - Potentiometric measurement of linear and angular displacement, resistive strain gauge; Capacitive elements - capacitive sensor architectures, capacitive displacement and liquid level sensors; Inductive elements - LVDT; Hall effect sensors

MODULE 3 (8 hours)

Bonding in Materials:

Ionic, Covalent, Metallic and Van der Waals bonding; Bonding Energy.Crystalline State - crystal planes and directions - Miller indices, Defects in Crystals - zero, one and two dimensional defects, Grain Boundaries. Movement of atoms - Slip Along Atomic Planes - Dislocation Movement - edge and screw dislocations, Burger vector, Solid state Diffusion - Fick's Laws

MODULE 4 (7 hours)

Acoustics & Ultrasonics:

Acoustics - Characteristics of Sound waves - Pitch, Loudness - Decibel, Absorption coefficient, Reverberation - Reverberation time - Significance, Sabine's formula and applications. Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Applications - SONAR, NDT

MODULE 5 (6 hours)

Laser & Fibre Optics:

Optical processes - Absorption, Spontaneous emission and stimulated emission, - Einstein's relations. Principle of laser - conditions for sustained lasing - components of laser - Population inversion - energy source - Pumping, Metastable states - active medium, optical resonator. Construction and working of Ruby laser.
Optic fiber-Principle of propagation of light, Numerical aperture – Derivation Applications of fibers - Intensity modulated sensors.

Text Books

1. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
2. M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy, "A Textbook of Engineering Physics", S.Chand & Co., Revised Edition, 2019.
3. James F. Shackelford, "Introduction to Material Science for Engineers", Pearson, Eighth Edition, 2015.
4. Jacob Fraden, "Handbook of Modern Sensors - Physics, Designs, and Applications", Springer, Fourth Edition, 2010.
5. John P. Bentley, "Principles of Measurement Systems", Pearson Education Limited, Fourth Edition, 2005.

Reference Books

6. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
7. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
8. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
9. Ajoy Ghatak, "Optics", McGraw Hill Education, Sixth Edition, 2017

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/Tutorial Hours**
	Total Hours	36 Hours
	Module 1: Oscillations	7
1.1	Simple Harmonic Oscillator - differential equation, solution - torsion pendulum	3
1.2	Damped harmonic oscillator - differential equation and solution (underdamped case), comparison with undamped harmonic oscillator, logarithmic decrement, relaxation time, Q factor	2
1.3	Forced Harmonic Oscillator - differential equation and its solution, Analysis of the solution - amplitude resonance	2
	Module 2: Sensors	8

2.1	Sensors - Introduction and classification, Sensor characteristics (definition only): Static characteristics - transfer function - sensitivity, calibration - calibration error, hysteresis, resolution, output impedance; Dynamic characteristics - zero order, first order and second order sensors (qualitative ideas only)	2
2.2	Sensor elements (principle of working and operation): Resistive elements - Potentiometric measurement of linear and angular displacement, resistive strain gauge; Capacitive elements - capacitive sensor architectures, capacitive displacement and liquid level sensors; Inductive elements - LVDT; Hall effect sensors	6
	Module 3: Bonding in Materials	8
3.1	Bonding in materials - Ionic, Covalent, Metallic and Van der Waals bonding; Bonding Energy	2
3.2	Crystalline State - crystal planes and directions - Miller indices, Defects in Crystals - zero, one and two dimensional defects, Grain Boundaries	3
3.3	Movement of atoms - Slip Along Atomic Planes - Dislocation Movement - edge and screw dislocations, Burger vector, Solid state Diffusion - Fick's Laws	3
	Module 4: Acoustics & Ultrasonics	7
4.1	Acoustics - Characteristics of Sound waves - Pitch, Loudness - Decibel, Absorption coefficient, Reverberation - Reverberation time - Significance, Sabine's formula and applications	3
4.2	Ultrasonics-Production- Magnetostriction effect and Piezoelectric effect, Magnetostriction oscillator and Piezoelectric oscillator – Working, Applications - SONAR, NDT	4
	Module 5: Laser & Fibre Optics	6
5.1	Optical processes - Absorption, Spontaneous emission and stimulated emission - Einstein's relations	1
5.2	Principle of laser - conditions for sustained lasing - components of laser - Population inversion - energy source - Pumping, Metastable states - active medium, optical resonator	2
5.3	Construction and working of Ruby laser	1
5.4	Optic fibre-Principle of propagation of light, Numerical aperture – Derivation	1
5.5	Applications of fibres - Intensity modulated sensors	1

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Define SHM.
2. Define Q factor of a DHO.
3. Explain amplitude resonance.

Course Outcome 2 (CO 2):

1. List the dynamic characteristics of a sensor.
2. Explain the working of a Hall Effect sensor.
3. What is an LVDT?

Course Outcome 3 (CO 3):

1. Differentiate between covalent, metallic and Van der Waal bonding.
2. State Fick's Laws governing solid state diffusion.
3. Describe Edge dislocation.

Course Outcome 4 (CO 4):

1. Write Sabine's formula.
2. What is the change in dB level when the intensity of a source of sound is doubled?
3. Explain two methods of ultrasonic NDT.

Course Outcome 5 (CO 5):

1. Describe the principle of LASER.
2. Why are metastable levels needed in a LASER?
3. Write a note on intensity modulated sensors.

MODEL QUESTION PAPER

QP CODE: **Pages: 4**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2024

Course Code: B24PH1T01B

Course Name: ENGINEERING PHYSICS (B)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Derive the differential equation of a DHO.
2. Define Q factor. What are the factors on which it depends?
3. Differentiate between first order and second order sensors.
4. Explain transfer function, sensitivity and calibration error of a sensor.
5. Explain edge and screw dislocations.
6. State Fick's Laws of solid state diffusion.
7. Differentiate between reverberation and echo.
8. Mention any three applications of ultrasonics.
9. Explain the term population inversion.
10. Describe the principle of operation of optic fibers.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. (a) Derive the differential equation of an FHO. Obtain the expression for the amplitude of forced oscillations. 10
    (b) The amplitude of an underdamped harmonic oscillation reduces to $\frac{1}{10}^{th}$ of its initial value after 100 oscillations. Its time period is 1.15s. Calculate its relaxation time. 4

OR

12. (a) Frame and solve the differential equation of a DHO and find the solution for the overdamped case. Show graphically the variation of its displacement with time. 10
    (b) DHO of mass 2g has a force constant of 10Nm^{-1} and a damping constant of 2s^{-1}. Find the angular frequency with and without damping. 8
13. (a) Explain any six static characteristics of a sensor. 6
    (b) With the help of a neat diagram, explain the working of a Hall Effect sensor. 8

OR

14. (a) Explain the dynamical characteristics of a sensor. 6
    (b) Explain, with the help of a neat schematic diagram, the working of a resistive strain gauge. 8
15. (a) Explain the terms defects, slip and dislocation movements in crystals. 8
    (b) Explain solid state diffusion. State Fick's Laws. 6

OR

16. (a) Explain the classification of materials based on the bonding. What are the bonding energies in each case? 10
    (b) Calculate the Miller indices of a plane whose intercepts are a, b2 and con the crystallographic axes respectively in a simple cubic cell. 4
17. (a) Derive Sabine's formula and explain its applications. 10
    (b) A hall has a volume of 1000m3 and a total absorption equivalent to 100m2 of OWU. What will be the effect on its reverberation time if the audience fills the hall thereby increasing the absorption by 150m2 of OWU? 4

OR

18. (a) Explain piezoelectric effect and the working of a piezoelectric ultrasonic generator. 10
    (b) A quartz crystal of thickness 1mm vibrates at resonance. Calculate its fundamental frequency if its Young's modulus is $7.96\times10^9 Nm^{-2}$ and density is 2670 kgm^{-3}. 4
19. (a) Explain the construction and working of Ruby laser. 10
    (b) Describe shortly the main components of a laser system. 4

OR

20. (a) Derive the expression for the Numerical Aperture of an optic fiber. 10
    (b) Calculate the N.A. of an optic fiber having core index of 1.54 and cladding index of 1.5. 4

B24CY1T01B	Engineering Chemistry (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble:
To equip the students with an extensive understanding of the concepts of chemistry specifically adapted for engineering applications. Students will be introduced to application oriented topics including electrochemistry, corrosion control methods and water purification technologies. Additionally, students will acquire knowledge about topics like nanomaterials, spectroscopy, Scanning Electron Microscopy, polymers, ceramics etc. This will enable the students to develop the abilities and skills relevant for the study and practice of chemistry in their respective field of engineering.

Prerequisites: NIL

Course Outcomes:
After the completion of the course the student will be able to:

CO 1	Develop a comprehensive understanding of nanoscale materials, including their synthesis, fundamental properties and diverse applications. (Cognitive Knowledge Level: Apply)
CO 2	Understand the principles and applications of various spectroscopic techniques and microscopic techniques such as SEM. (Cognitive Knowledge Level: Apply)
CO 3	Demonstrate an inclusive understanding of the principles of electrochemistry and corrosion. Also gain knowledge about various corrosion control methods. (Cognitive Knowledge Level: Apply)
CO 4	Understand various drinking water purification and water softening techniques. Also recognize the importance of ensuring access to safe and clean drinking water for public health. (Cognitive Knowledge Level: Apply)
CO 5	Acquire knowledge about various types of polymers and ceramics, and their potential applications in the field of engineering. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	2	2	1	1	2					1
CO 2	1	2	2	1	2		2					1
CO 3	3	2	3	1	2	2	1					2
CO 4	2	3	2	1	1	3	3	2	1			3
CO 5	2	2	2	1		1	2					2

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (% Marks)	Test 2 (% Marks)	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 (7 hours)

Fundamentals of Nanomaterials

Introduction - Classification - Based on dimension and structural composition - Nanoscale materials – Introduction - Properties and applications of Quantum dots, Graphene and Carbon nanotubes (CNT) – General Properties and applications of nanomaterials - Synthesis of nanomaterials – Top-Down and Bottom-Up approaches – Physical methods of synthesis

- Mechanical milling, Laser ablation and Sputtering - Chemical methods of synthesis – Sol-Gel, co-precipitation and reduction.

MODULE 2 (8 hours)

Spectroscopic and Microscopic Techniques

Introduction - Types of spectrum - Electromagnetic spectrum - Molecular energy levels - Beer-Lambert's law – Numerical problems based on Beer-Lambert's law - Electronic spectroscopy (UV-vis) – Principle, instrumentation and applications - Types of electronic transitions - Vibrational spectroscopy (IR) – Principle and applications - Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Force constant equation for diatomic molecules - Numerical problems based on force constant - Microscopic techniques - Scanning Electron Microscope (SEM) - Principle, instrumentation, working and applications.

MODULE 3 (7 hours)

Introduction to Electrochemistry and Corrosion Science

Introduction - Reference electrodes - Calomel electrode - Construction and working - Electrochemical series - Applications – Nernst equation for single electrode and cell (Derivation not required) – Applications – Effect of temperature on emf - Numerical problems based on Nernst equation - Corrosion – Introduction - Galvanic series - Types of corrosion – Galvanic and pitting corrosion - Corrosion control methods - Cathodic protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of Copper - Electroless plating of Copper – Anodizing of Aluminium.

MODULE 4 (7 hours)

Water Quality and Treatment Techniques

Hardness - Types of hardness – Temporary and permanent hardness - Units of hardness - Degree of hardness – Numerical problems based of degree of hardness - Softening of water – Zeolite process and Ion exchange process - Principle, working and advantages - Drinking water purification technologies – Desalination - Reverse osmosis and Electrodialysis - Working, advantages and applications – Ultrafiltration - Advantages and disadvantages - UV irradiation - Advantages and disadvantages.

MODULE 5 (7 hours)

Introduction to Engineering Polymers and Ceramics

Polymers - Introduction – Thermoplastics and thermosetting plastics - Speciality polymers - Preparation, properties and applications of UPVC, Kevlar, SBR, PMMA and Epoxy resin - Self-healing polymers – Introduction, advantages, applications and examples - Biodegradable polymers – Introduction - Polylactic acid - Preparation, properties and applications - Cellulose – Structure, properties and applications - Composites – Introduction - Glass reinforced plastics - Introduction, Properties and applications – Ceramics – Introduction, properties and applications.

Text Books

1. Jain and Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company, 17^{th} edition 2015.
2. Shashi Chawla, "A Text Book of Engineering Chemistry", Dhanpat Rai and Co. (P) Limited, 2017.
3. Muhammed Arif, Annette Fernandez, Kavitha P. Nair, "Engineering Chemistry", Owl Books, 2019.
4. Ahad J., "Engineering Chemistry", Jai Publication, 2019.
5. Roy K. Varghese, "Engineering Chemistry", Crown Plus Publishers, 2019.
6. Soney C. George, Rino Laly Jose, "Text Book of Engineering Chemistry", S. Chand and Company Pvt. Ltd., 2019.
7. B. L. Tembe, Kamaluddin, M. S. Krishnan, "Engineering Chemistry (NPTEL Web Book)", 2018.

Reference Books

8. T. Pradeep, "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw-Hill, 2008.
9. B. Rogers, J. Adams, S. Pennathur, "Nanotechnology: Understanding Small Systems" , CRC Press, 2014.
10. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
11. J. Goldstein, "Scanning Electron Microscopy and Microanalysis", Springer, 2012.
12. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7^{th} Edition, 2005.
13. Samuel Glasstone, "An Introduction to Electrochemistry", East-West Press Pvt. Ltd., 2006.
14. Pietro Pedeferri, "Corrosion Science and Engineering", Springer Link, 2018.
15. Chittaranjan Ray and Ravi Jain, "Drinking Water Treatment: Focusing on Appropriate Technology and Sustainability", Springer, 2011.
16. James K. Edzwald, " Water Quality and Treatment: A Handbook on Drinking Water", McGraw-Hill, 2010.

17. Jane Kucera, “Desalination: Water from Water”, Wiley, 2019.

18. Raymond B. Seymour, Charles E. Carraher, “Polymer Chemistry: An Introduction”, Marcel Dekker Inc; 4^{th} Revised Edition,1996.

19. Fed W. Billmeyer, “Text Book of Polymer Science”, John Wiley and Sons, 1984.

20. C. Barry Carter, M. Grant Norton, “Ceramic Materials: Science and Engineering”, Springer, 2013.

21. Robert B. Heimann, “Classic and Advanced Ceramics: From Fundamentals to Applications”, Wiley, 2010.

22. P. W. Atkins, “Physical Chemistry”, Oxford University Press, 10^{th} edn., 2014.

23. B. R. Puri, L. R. Sharma, M. S. Pathania, “Principles of Physical Chemistry”, Vishal Publishing Co., 47^{th} Edition, 2017.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/Tutorial Hours**
	Total Hours	36 Hours
	Module 1 (Fundamentals of Nanomaterials)	7
1.1	Introduction - Classification - Based on dimension and structural composition.	1
1.2	Nanoscale materials – Introduction - Properties and applications of Quantum dots, Graphene and Carbon nanotubes (CNT) – General properties and applications of nanomaterials.	3
1.3	Synthesis of nanomaterials – Top-Down and Bottom-Up approaches – Physical methods of synthesis - Mechanical milling, Laser ablation and Sputtering - Chemical methods of synthesis – Sol-Gel, co-precipitation and reduction.	3
	Module 2 (Spectroscopic and Microscopic Techniques)	8
2.1	Introduction - Types of spectrum - Electromagnetic spectrum - Molecular energy levels - Beer-Lambert’s law – Numerical problems based on Beer-Lambert’s law.	3

2.2	Electronic spectroscopy (UV-vis) – Principle, instrumentation and applications - Types of electronic transitions - Vibrational spectroscopy (IR) – Principle and applications - Number of vibrational modes - Vibrational modes of CO_2 and H_2O – Force constant equation for diatomic molecules - Numerical problems based on force constant.	4
2.3	Microscopic techniques - Scanning Electron Microscope (SEM) - Principle, instrumentation, working and applications.	1
	Module 3 (Introduction to Electrochemistry and Corrosion Science)	7
3.1	Introduction - Reference electrodes - Calomel electrode - Construction and working - Electrochemical series - Applications – Nernst equation for single electrode and cell (Derivation not required) – Applications – Effect of temperature on emf - Numerical problems based on Nernst equation.	3
3.2	Corrosion – Introduction - Galvanic series - Types of corrosion – Galvanic and pitting corrosion - Corrosion control methods - Cathodic protection - Sacrificial anodic protection and impressed current cathodic protection.	2
3.3	Electroplating of Copper - Electroless plating of Copper – Anodizing of Aluminium	2
	Module 4 (Water Quality and Treatment Techniques)	7
4.1	Hardness - Types of hardness – Temporary and permanent hardness - Units of hardness - Degree of hardness – Numerical problems based of degree of hardness.	2
4.2	Softening of water – Zeolite process and Ion exchange process - Principle, working and advantages.	2
4.3	Drinking water purification technologies – Desalination - Reverse osmosis and Electrodialysis - Working, advantages and applications – Ultrafiltration - Advantages and disadvantages - UV irradiation - Advantages and disadvantages.	3
	Module 5 (Introduction to Engineering Polymers and Ceramics)	7
5.1	Polymers - Introduction – Thermoplastics and thermosetting plastics - Speciality polymers - Preparation, properties and applications of UPVC, Kevlar, SBR, PMMA and Epoxy resin.	3
5.2	Self-healing polymers – Introduction, advantages, applications and examples - Biodegradable polymers – Introduction - Polylactic acid - Preparation, properties and applications - Cellulose – Structure, properties and applications.	2
5.3	Composites – Introduction - Glass reinforced plastics - Introduction, Properties and applications – Ceramics – Introduction, properties and applications.	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. What are nanomaterials? Give two properties.
2. Comment on the structure of graphene.
3. How nanomaterials are synthesized by reduction?

Course Outcome 2 (CO 2):

1. How spectroscopy is classified based on the nature of interacting species?
2. What are the limitations of Beer-Lambert's law?
3. Why electromagnetic lenses are used in SEM?

Course Outcome 3 (CO 3):

1. How equilibrium constant is determined using electrochemical series?
2. Give any two differences between electrochemical series and galvanic series.
3. Write the representation and reduction reaction of calomel electrode.

Course Outcome 4 (CO 4):

1. Define two units of hardness?
2. Explain the regeneration of ion exchange resins.
3. How water is sterilized using UV irradiation? Give two advantages.

Course Outcome 5 (CO 5):

1. Give the structure and two properties of Kevlar.
2. Comment on the advantages of self-healing polymers.
3. What are ceramics? Give two properties.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24CY1T01B

Course Name: ENGINEERING CHEMISTRY (B)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Give any three applications of nanomaterials.
2. Differentiate SWNT and MWNT.
3. State Beer-Lambert's law. Give the mathematical expression.
4. Explain how vibrational spectroscopy is used to distinguish inter and intra molecular H-bonding?
5. What are reference electrodes? Give two examples.
6. How corrosion is prevented by sacrificial anodic protection?
7. Discuss the chemistry behind the removal of temporary hardness by boiling.
8. Define degree of hardness.
9. Comment on the behaviour of thermoplastics and thermosetting plastics on heating.
10. Draw the structure of cellulose.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. (a) How nanomaterials are classified based on dimension and structural composition? Give examples. 8

    (b) What are quantum dots? Give its properties and applications. 6

OR

12. (a) Describe laser ablation and sol-gel methods for the synthesis of nanomaterials. 8

    (b) What is graphene? Give its properties and applications. 6

13. (a) Explain the various electronic transitions with examples. 8

    (b) Illustrate the vibrational modes of CO_2 and H_2O. 6

OR

14. (a) Explain the instrumentation and working of SEM. 8

    (b) A solution of thickness 2 cm transmits 40% of the incident light. Calculate the concentration of the solution, if $\epsilon = 6000\ Lmol^{-1}\ cm^{-1}$. 6

15. (a) Give the principle of electroless plating. How electroless plating of copper is carried out? 8

    (b) Define electrochemical series. Explain any four applications. 6

OR

16. (a) Explain the construction and working of calomel electrode with a neat sketch. 8

    (b) What is corrosion? Explain how iron undergoes pitting corrosion? 6

17. (a) What are ion exchange resins? Explain ion exchange process for the removal of hardness of water. How exhausted resins are regenerated? 10

    (b) What is Reverse osmosis? How desalination of sea water is achieved through reverse osmosis? 4

OR

18. (a) Explain the working, advantages and applications of Electrodialysis. 8

    (b) Calculate the temporary, permanent and total hardness of water sample which contains $CaSO_4$ = 30 mg/L, $MgSO_4$ = 35 mg/L, $Ca(HCO_3)_2$ = 50 mg/L and $Mg(HCO_3)_2$= 40 mg/L. 6

19. (a) Explain the synthesis, properties and applications of Kevlar and PMMA. 10

    (b) What are self-healing polymers? Give examples. 4

OR

20. (a) Explain the synthesis, properties and applications of UPVC and SBR. 10

    (b) List any two properties and applications of ceramics. 4

B24ES1T04	BASIC ELECTRICAL AND MECHANICAL ENGINEERING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	2	0	2	4	2024

Preamble

The objective of this course is to provide an insight and inculcate the essentials of Electrical and Mechanical Engineering discipline to the students of Civil Engineering. This course aims to provide comprehensive knowledge about the fundamental principles and concepts of electrical and mechanical systems. It also enables Civil Engineers to understand the electrical and mechanical systems within various Civil Engineering applications and during construction. Completing the course, students gain the necessary knowledge for more advanced courses and practical applications.

Prerequisites

Nil

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Understand the essential circuit components and the fundamental circuit laws governing electrical circuits. (Cognitive Knowledge Level: Understand)
CO 2	Recall the basics of electromagnetism and the fundamentals of electrical machines and three-phase systems. (Cognitive Knowledge Level: Remember)
CO 3	Apply the basic knowledge of household wiring components and analyze electrical wiring layout for small residential buildings. (Cognitive Knowledge Level: Apply)
CO 4	Illustrate the working of IC engines and hydraulic machines. (Cognitive Knowledge Level: Apply)
CO 5	Explain the basic principle of power transmission elements and material handling devices. (Cognitive Knowledge Level: Analyse)
CO 6	Describe the fundamentals of power plants engineering and air conditioning systems. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1		1	1	1	1	1	1	1
CO 2	3	3	2	1		1	1	1	1	1	1	1
CO 3	3	2	2	1		1	1	1	1	1	1	1
CO 4	3	1	1				1			1		1
CO 5	3	1	2			1				1		1
CO 6	2	1	1			1	1			1		1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	20	20	20
Understand	30	30	30
Apply	50	50	50
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Continuous Assessment Test (2 numbers)	25 marks
Assignment/Quiz/Course Project	15 marks

End Semester Examination Pattern

There will be two parts: Part I – Basic Electrical Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carry 50 marks each. For the end semester examination, part I contains 2 parts - Part A and Part B. Part A contains 5 questions carrying 4 marks each (not exceeding 2 questions from each module). Part B contains 2 questions from each module, out of which one needs to be answered. Each question carries 10 marks and can have a maximum of 2 subdivisions. The pattern for the end-semester examination for part II is the same as that of part I. However, students should answer parts I and 2 in separate answer booklets.

SYLLABUS

MODULE 1 (7 hours)

DC Electric Circuits: Passive components - R, L, and C, Sources - current and voltage sources, Resistances in series and parallel, current and voltage division rule, Ohm's Law, Kirchoff's Laws (Numerical problems).
Alternating Current Fundamentals: Generation of single-phase voltage - frequency, time period, average value, RMS value (sine wave concept only), Form and peak factors-Phasor representation of R,L,C, RL, RC, and RLC circuits - concept of impedance, power - active, reactive, and apparent, power factor (Numerical problems).

MODULE 2 (8 hours)

DC Machines and Transformers: Faraday's laws, Lenz's law, statically and dynamically induced EMF. DC Generator- construction and working principle, types, applications. DC motor - working principle, types of DC motors, applications. Transformer (single-phase only) - Construction, types-Working principle. Construction, types
Three-Phase AC Systems: Generation of three-phase voltages - phase sequence, Y-Δ connection (balanced only), relation between line and phase quantities, three-phase power, Single line diagram of a power system from generation to distribution.

MODULE 3 (8 hours)

Electrical wiring design: Electrical wiring system in domestic building - types of wiring, cables, Conduits, Switches and Outlets, switch boards, and distribution boards. Common power ratings of domestic gadgets, Codes and standards- Salient features of NEC, NBC and IE rule, NEC Symbols used in electrical wiring layout. Electrical lay out (single line diagram) for low- class domestic installation. Electrical load calculation- connected load method (Numerical problems).
Electrical Installation in Buildings: Protection devices - MCB, MCCB, ELCB/RCCB and RCBO- Principle of operation-Rating and Specification, fuses-working and types. Electrical hazards and safety precautions-Earthing need of earthing, types.

MODULE 4 (8 hours)

Internal Combustion Engines: Introduction, Terminologies, IC engine parts, Working of SI and CI engine, Two stroke and Four stroke engine, Air, Fuel, Cooling and Lubrication systems, CRDI and MPFI engines. Concept of hybrid engines.
Hydraulic Machines: Classification of hydraulic turbines, Working of Pelton, Francis, Kaplan turbines (Descriptions with figures only). Pumps: Classification, Working of Centrifugal and Reciprocating pumps.

MODULE 5 (8 hours)

Power Transmission Elements: Classification and applications of mechanical drives, Velocity ratio of belt drive, Length of belt, Slip in belt, Power transmitted, simple problems. Gear drive: Types, Gear Ratio, Simple, compound and epicyclic gear trains (simple descriptions only)
Material Handling: Objective, principle and selection of material handling equipment, Types of conveyors, parts and working of belt conveyors, screw conveyors and pneumatic conveyor- Hoisting machine, Elevators, Winches and Cranes – Types – Concrete Pumps -Types, Working (Descriptions only)

MODULE 6 (8 hours)

Power Plant Engineering: Hydel power plants: Layout, classifications and study of various components. Steam power plant: Layout, steam generators, study of various components. Gas turbine power plant and combined power plants, Layout. New generation power producing systems.
Air Conditioning: Units of Refrigeration, Refrigeration effect, Psychrometric properties, Psychrometric chart, Comfort conditions, window, split and centralized air condition system, Summer and Winter air-conditioning, Inverter Technology in Air conditioners, Solar Air conditioners.

Text Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering," 3rd Edition, Tata McGraw Hill.
2. J. B. Gupta, "Theory and Performance of Electrical Machines" 15th Edition, S. K. Katarina Sons.
3. M.K. Giridharan, Electrical System Design.
4. J. Benjamin, "Basic Mechanical Engineering", Pentex Books, 9th Edition, 2018
5. P. Balachandran, Basic Mechanical Engineering, Owl Books

Reference Books

1. C. L. Wadhwa, "Basic Electrical Engineering," 4th Edition, New Age International Publisher
2. V. N. Mittle, "Basic Electrical Engineering," Tata McGraw Hill.
3. V. K. Mehta Rohit Mehta, "Principles of Electrical Engineering," 6th Edition, S. Chand Co. PVT. LTD
4. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," 2nd Edition, Pearson Education.

5. D C Kulshreshtha, "Basic Electrical Engineering," 2nd Edition Tata McGraw Hill.

6. Del Toro V, "Electrical Engineering Fundamentals," 2nd Edition, New Delhi Prentice Hall of India.

7. Hughes, "Electrical and Electronic Technology", 10th Edition, Pearson Education.

8. R. K. Rajput, "Basic Electrical Engineering," 2nd Edition, Laxmi Publications PVT. LTD

9. M. Clifford, K. Simmons, "An Introduction to Mechanical Engineering Part I", CRC Press

10. Roy and Choudhary, "Elements of Mechanical Engineering", Media Promoters Publishers Pvt. Ltd., Mumbai.

11. G. S. Sawhney, "Fundamentals of Mechanical Engineering", PHI

12. M.S. Shanmugam, Palanichamy, "Basic Civil and Mechanical Engineering", McGraw Hill Education; First edition, 2018

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/Tutorial Hours**
	Total Hours	47 Hours
	Module 1	7 hours.
1.1	**DC Electric Circuits:** Passive Components - R, L, and C, sources - current and voltage sources.	1 hour
1.2	Resistances in series and parallel, current and voltage division rule (Numerical problems).	1 hour.
1.3	Ohm's Law, Kirchoff's Laws (Numerical problems).	2 hours.
1.4	**Alternating Current Fundamentals:** Representation of sinusoidal waveforms - frequency, time period, average value, RMS value.	1 hour.
1.5	Phasor representation of R, RL, RC, RLC circuits - concept of impedance, power - active, reactive and apparent, power factor (Numerical problems).	2 hours.
	Module 2	8 hours.
2.1	**Electromagnetic Induction:** Faraday's laws, Lenz's law, statically and dynamically induced EMF	1 hour
2.2	**DC Machines:**Construction and working principle - DC Generator – Types-applications	2 hours

2.3	**DC motor** Construction and working principle- Types-applications	1 hour
2.4	**Transformers (single phase only):** Working principle	1 hour
2.5	**Three-Phase AC Systems:** Generation of three-phase voltages - phase sequence.	1 hour
2.6	**Y-Δ connection** (balanced only), relation between line and phase quantities, three phase power.	2 hours
	Module 3	8 hours
3.1	**Electrical wiring design:**Electrical wiring system in domestic building - types of wiring, cables, Conduits, Switches and Outlets, switch boards, and distribution boards.	1 hour
3.2	Common power ratings of domestic gadgets, Codes and standards- Salient features of NEC, NBC and IE rule, NEC Symbols used in electrical wiring layout.	1 hour
3.3	Electrical lay out (single line diagram) for low- class domestic installation. Electrical load calculation- connected load method (Numerical problems).	2 hours
3.4	**Electrical Installation in Buildings:** Protection devices - MCB, MCCB, ELCB/RCCB and RCBO- Principle of operation, fuses-working and types	2 hours
3.5	Electrical hazards and safety precautions-Earthing & need of earthing, types, Electrical Safety & Precautions.	2 hours
	Module 4	8 hours
4.1	Introduction, Terminologies, IC engine parts	1 hour
4.2	Working of four stroke SI and CI engine, Working of two stroke SI and CI engine	2 hours
4.3	Air, Fuel, Cooling and Lubrication systems, CRDI and MPFI engines. Concept of hybrid engines.	2 hours
4.4	**Hydraulic Machines:** Classification of hydraulic turbines, Working of Pelton, Francis, Kaplan turbines (Descriptions with figures only).	2 hours
4.5	**Pumps:** Classification, Working of Centrifugal and Reciprocating pumps	1 hours
	Module 5	8 hours
5.1	**Power Transmission Elements:** Classification and applications of mechanical drives, Velocity ratio of belt drive, Length of belt, Slip in belt, Power transmitted, simple problems.	2 hours
5.2	Gear drive: Types, Gear Ratio, Simple, compound and epicyclic gear trains (simple descriptions only)	2 hours
5.3	**Material Handling:** Objective, principle and selection of material handling equipment, Types of conveyors, parts and working of belt conveyors, screw conveyors and pneumatic conveyer-	2 hours
5.4	Hoisting machine, Elevators, Winches and Cranes – Types – Concrete Pumps -Types, Working (Descriptions only)	2 hours

	Module 6	8 hours
6.1	**Power Plant Engineering:**Hydel power plants: Layout, classifications and study of various components. Steam power plant: Layout, steam generators, study of various components.	2 hours
6.2	Gas turbine power plant and combined power plants, Layout. New generation power producing systems.	2 hours
6.3	Air Conditioning: Units of Refrigeration, Refrigeration effect, Psychrometric properties, Psychrometric chart, Comfort conditions, window, split and centralized air condition system	2 hours
6.4	Summer and Winter air-conditioning, Inverter Technology in Air conditioners, Solar Air conditioners	2 hours

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Solve problems based on series and parallel circuits.
2. Solve problems based on current and voltage division rules.
3. Solve problems using Kirchoff's laws.
4. Phasor representation of R, RL, RC and RLC circuits.
5. Problems on rms and average values of periodic waveforms.
6. Problems related to power and power factor.

Course Outcome 2 (CO 2):

1. Construction and working of DC generator and DC motor.
2. Different types and applications of DC generator and DC motor.
3. Working principle of single-phase transformer.
4. Problems on three-phase line & phase quantities for a balanced load.

Course Outcome 3 (CO 3):

1. Electrical wiring system in domestic building.
2. Codes and standards.

3. Electrical lay out (single line diagram).
4. Electrical load calculation- connected load method (Numerical problems).
5. Protection devices and its principle of operation.
6. Electrical hazards and safety precautions-Earthing & need of earthing, types, Electrical Safety & Precautions.

Course Outcome 4 (CO 4):

1. Describe the working of a four-stroke diesel engine?
2. Why two stroke engines are less efficient than our stroke engine.
3. How hydraulic turbines are classified?

Course Outcome 5 (CO 5):

1. Derive an expression to determine the length of an open belt drive
2. Solve problem based on velocity ratio of a gear drive
3. What are the important components of a conveyer belt drive? Explain with figure.

Course Outcome 6 (CO 5):

1. With the aid of a neat sketch, explain the working of a thermal power plant.
2. List the advantage of a combined power plant over the steam power plant.
3. How the operation of a summer air conditioner differs from a winter air conditioner.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24ES1T04

Course Name: BASIC ELECTRICAL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 4 marks.

1. State and explain Kirchhoff's laws with examples.
2. Differentiate between statically and dynamically induced emf.
3. Derive the relation between line and phase current in a 3-phase delta-connected system.
4. Distinguish between MCB and MCCB.
5. What is the need for earthing? Describe the different types of earthing.
6. With the neat block diagram, explain the fuel system of a CI engine.
7. Illustrate the working of an epicyclic gear train.
8. Explain the principles of material handling.
9. Explain cooling and dehumidification processes.
10. Define: Specific humidity, relative humidity and dew point temperature.

PART B

Answer any one question from each module. Each question carries 10 marks.

11. For the circuit shown above, determine the current flows through all the resistors using Kirchoff's law. 10

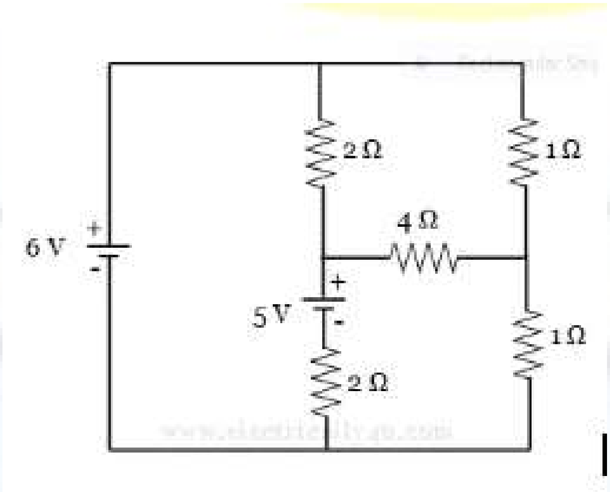


Figure 1:

OR

12. A resistance of 10Ω and inductance of 0.3H and a capacitance of 100 F are connected in series across 230V, 50Hz single-phase supply. Calculate the 10
    (a) Impedance of the circuits
    (b) Current through the circuits
    (c) Voltage across R, L, and C
    (d) Power consumed by the circuit.

13. A 3-phase, 400V, 4 wire system has a balanced star connected load with impedance Z=15+j10 Ω each. Find the line currents and the total power consumed by the load. 10

OR

14. (a) State Faraday's laws of electromagnetic induction. 4
    (b) Explain the construction and working principle of DC motor. 6

.

15. What is the role of NEC and NBC in building design? 10

OR

16. (a) Explain the different types of wiring. 5

    (b) What are the different NEC symbols used in electrical wiring layout? 5

17. Explain the working of a 4-stroke CI engine with the help of a neat diagram. 10

OR

18. With the aid of a neat sketch, describe the working of a Francis turbine. 10

19. (a) Discuss the factors to be considered while selecting a material handling equipment. 4

    (b) What are the different types of belt conveyors? Explain its important parts of a flat belt conveyor system. 6

OR

20. Two flat belt pulleys having a centre-to-centre distance of 137 cm have drive diameter of 72 cm and 36cm.(a) Determine the length of the belt if both pulleys will rotate in same direction. (b) Determine the angle of contact on the small and big pulley. (c) Calculate the belt length if the belt will be cross-connected to make the pulleys rotate in opposite directions. (e) Determine the angle of contact for opposite direction. 10

21. Explain the general layout of a hydroelectric power plant. 10

OR

22. (a) How summer air conditioners differ from winter air conditioners. 5

    (b) Explain the working of the summer air conditioner with the air of a neat sketch. 5

B24CE1T03	SURVEYING AND GEOMATICS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

The course delves into the fundamental significance of surveying, examining diverse techniques for measuring angles and distances. It offers insight into field surveying methodologies and contemporary surveying technologies, providing a comprehensive understanding of the subject's intricacies.

Prerequisites

Introduction to Civil Engineering

Course Outcomes

After the completion of the course the student will be able to:

CO 1	Comprehend the importance of surveying. Apply the concepts of leveling and contouring in various civil engineering applications (Cognitive Knowledge Level:Apply)
CO 2	Apply various engineering techniques for distance and angular measurement in surveying. (Cognitive Knowledge Level:Apply)
CO 3	Develop the concept of area and volume computation in surveying. Recognize the basic principles of traverse surveying and curves. (Cognitive Knowledge Level:Apply)
CO 4	Grasp basic knowledge regarding remote sensing, GIS and Terrain modelling.(Cognitive Knowledge Level:Apply)
CO 5	Recognize various advanced surveying techniques (Cognitive Knowledge Level:Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	1	1	1	2			2	1		1
CO 2	3	3	1	1	3	2			2	1		1
CO 3	3	3	1	1	0	2			2	1		1
CO 4	3	3	1	1	3	2	1		2	1		1
CO 5	3	3	1	1	3	2	1		2	1		1

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance 10 marks
Continuous Assessment Test (2 numbers) 25 marks
Assignment/Quiz/Course Project 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 (8 hours)

Surveying: Definition - principles – objectives and classification of surveying - primary divisions of surveying - plane surveying , geodetic surveying .
Levelling: Definition of terms - levelling instruments - temporary and permanent adjustments - methods of levelling - simple levelling , differential levelling (numerical examples) , fly levelling , profile levelling , cross sectional levelling , reciprocal levelling - reduction of levels - errors in levelling.

Contours: Definition - contour Interval - horizontal equivalent - characteristics of contour - contouring - direct and indirect methods - comparison between direct and indirect method - development of contours (numerical examples) - contour gradient - location of contour gradient on a map , location of contour gradient on the ground - uses of contours - storage capacity of a reservoir(numerical examples).

MODULE 2 (6 hours)

Theodolite Survey: Definitions of terms - temporary and permanent adjustments of theodolite - methods of measurement of horizontal and vertical angle - errors in measurements.
Combined Distance and Angular Measurement: Tacheometry - principles of stadia and tangential tacheometry (basic concepts only) - Total station – features – functions - applications.

MODULE 3 (8 hours)

Computation of Area and volume in Surveying: Computation of area - mid ordinate rule , average ordinate rule, trapezoidal rule , Simpson's rule (numerical examples) - computation of volume - trapezoidal and prismoidal formula (numerical examples)
Traverse Survey: Methods of traversing - traverse computations - balancing the traverse - Bowditch's rule, transit rule(numerical examples) - omitted measurements (a line and an angle only).
Curves: Elements of a simple curve - setting out of curves (angular methods)(numerical examples) - compound curve - reverse curve - transition curve - vertical curve (introduction only).

MODULE 4 (7 hours)

Remote sensing: Introduction - principles of remote sensing - remote sensing system and observation platforms - sensor characteristics - applications.
Geographic Information System(GIS): Components - map projections - coordinate systems - geographic and projected coordinate systems – toposheets - data types - spatial and attribute data - raster and vector data representation – applications
Terrain modeling: DEM – DTM - TIN

MODULE 5 (7 hours)

Global Positioning Systems(GPS): GNSS - components and principles of GPS – trilateration - applications of GPS -surveying with GPS - differential global positioning system – principle - concepts and function
Ground Penetrating Radar Survey: Introduction – principles of GPR - components of GPR - operating procedure of GPR – applications
Photogrammetric Survey: Terrestrial photogrammetry - aerial photogrammetry (basic concepts only) - Drone survey - introduction - features and benefits of drone survey - appli-

cations of drone survey
Hands on training on GIS software

Course Project

1. Watershed/river basin boundary delineation
2. LULC Classification using satellite images
3. LST using satellite images
4. Generate contour map from DEM

Text Books

1. S. K. Roy , “Fundamentals of Surveying”, PHI Learning Private Limited.
2. Satheesh Gopi, “Advanced Surveying: Total Station, GIS and Remote Sensing”, Pearson Education.
3. S. K. Duggal, “Surveying Vol. I”, Tata McGraw Hill Education.
4. S. K. Duggal, “Surveying Vol. II”, Tata McGraw Hill Education
5. B.C.Punmia, Ashok K. Jain, Arun K. Jain, “Surveying Vol I”,Laxmi Publications.
6. B.C.Punmia, Ashok K. Jain, Arun K. Jain, “Surveying Vol II”,Laxmi Publications.
7. K. R. Arora, “Surveying Vol. I”, Standard Book House.
8. K. R. Arora, “Surveying Vol. II”, Standard Book House.
9. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, “Remote Sensing and Image Interpretation”, Wiley Publications
10. George Joseph, “Fundamentals of Remote Sensing”, University Press, 2003
11. Kang-tsung Chang “Introduction to Geographic Information Systems”, Mc Graw Hill Education
12. Dr.E.V.Raghava Rao, Dr.S.A. Rahim, “Advanced Methods and Techniques in Drone Surveying”, Prashas Research Consulting Pvt.Ltd.

Reference Books

1. T.P.Kanatkar, V.S.Kulkarni, “Surveying and Levelling- Part I”, Pune Vidyarthi Griha Prakashan.
2. T.P.Kanatkar, V.S.Kulkarni, “Surveying and Levelling- Part II”, Pune Vidyarthi Griha Prakashan
3. C. Venkatramaiah, “Textbook of Surveying”, Universities Press (India) Private Limited 2011.

4. James M Andersen, Edward M Mikhail, "Surveying Theory and Practice", McGraw Hill Education.

5. BurroughP ,"Principles of Geographical Information systems", Oxford University Press, 1998.

6. C. J. Iliffe, "Datums and Map Projections for Remote Sensing, GIS and Surveying", Whittles Publishing, 2006.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Module 1	**8 hours.**
1.1	**Surveying:** Definition - principles – objectives and classification of surveying - primary divisions of surveying - plane surveying , geodetic surveying .	1 hour
1.2	**Levelling:** Definition of terms - levelling instruments - temporary and permanent adjustments - methods of levelling - simple levelling , differential levelling (numerical examples) , fly levelling , profile levelling , cross sectional levelling , reciprocal levelling - reduction of levels - errors in levelling.	4 hours.
1.3	**Contours:** Definition - contour Interval - horizontal equivalent - characteristics of contour - contouring - direct and indirect methods - comparison between direct and indirect method - development of contours (numerical examples) - contour gradient - location of contour gradient on a map , location of contour gradient on the ground - uses of contours - storage capacity of a reservoir(numerical examples).	3 hours.
	Module 2	**6 hours.**
2.1	**Theodolite Survey:** Definitions of terms - temporary and permanent adjustments of theodolite - methods of measurement of horizontal and vertical angle - errors in measurements.	2 hours

2.2	**Combined Distance and Angular Measurement:** Tacheometry - principles of stadia and tangential tacheometry (basic concepts only) - Total station – features – functions - applications.	4 hours
	Module 3	**8 hours**
3.1	**Computation of Area and volume in Surveying:** Computation of area - mid ordinate rule , average ordinate rule, trapezoidal rule , simpson's rule (numerical examples) - computation of volume - trapezoidal and prismoidal formula (numerical examples)	3 hours
3.2	**Traverse Survey:** Methods of traversing - traverse computations - balancing the traverse - bowditch's rule, transit rule(numerical examples) - omitted measurements (a line and an angle only).	3 hours
3.3	**Curves:** Elements of a simple curve - setting out of curves (angular methods)(numerical examples) - compound curve - reverse curve - transition curve - vertical curve (introduction only).	2 hours
	Module 4	**7 hours**
4.1	**Remote sensing:** Introduction - principles of remote sensing - remote sensing system and observation platforms - sensor characteristics - applications.	2 hours
4.2	**Geographic Information System(GIS):** Components - map projections - coordinate systems - geographic and projected coordinate systems – toposheets - data types - spatial and attribute data - raster and vector data representation – applications	4 hours
4.3	**Terrain modeling:** DEM – DTM - TIN	1 hour
	Module 5	**7 hours**
5.1	**Global Positioning Systems(GPS):** GNSS - components and principles of GPS – trilateration - applications of GPS -surveying with GPS - differential global positioning system – principle - concepts and function	3 hours
5.2	**Ground Penetrating Radar Survey :** Introduction – principles of GPR - components of GPR - operating procedure of GPR – applications	1 hour

5.3	**Photogrammetric Survey:** Terrestrial photogrammetry - aerial photogrammetry (basic concepts only) - Drone survey - introduction - features and benefits of drone survey - applications of drone survey	1 hour
5.4	**Hands on training** on GIS software	2 hours
	Total Hours	36 Hours

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Outline the objectives and principles of surveying
2. Solve problems on determination of reduced levels in surveying.
3. Solve problems on storage capacity of reservoirs

Course Outcome 2 (CO 2):

1. Discuss various features and applications of Total station
2. Outline the importance of Theodolite surveying
3. Enumerate the importance of Tacheometric surveying.

Course Outcome 3 (CO 3):

1. Problems on area and volume computation.
2. Outline the importance of Traverse surveying.
3. Discuss the importance of setting out of curves in civil engineering.

Course Outcome 4 (CO 4):

1. Outline the principles of remote sensing.
2. Enumerate the significance of GIS in surveying.

Course Outcome 5 (CO 5):

1. Enumerate the components and principles of GPS surveying
2. Discuss the importance of GPR survey and Drone survey

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24CE1T03

Course Name: SURVEYING AND GEOMATICS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Discuss the basic principles of surveying.
2. Define back sight, foresight and intermediate sight.
3. List temporary adjustments in theodolite
4. Compare the different systems of tacheometric surveying
5. Elaborate on traverse surveying.
6. List the elements of a compound curve.
7. Discuss the relevance of remote sensing in executing civil engineering projects.
8. Discuss the applications of GIS in surveying
9. Enumerate the principles of GPR survey
10. Discuss applications of drone survey.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. (a) The following consecutive readings were taken with an auto level and a 4m levelling staff on a continuously sloping ground on a straight line at a common interval of 30 m. 0.855 (on A), 1.545, 2.335, 3.115, 3.825, 0.455, 1.380, 2.055,2.855, 3.455, 0.585, 1.015, 1.850, 2.755, 3.845 (on B). The RL of A was 380.500m. Make a level field book and calculate the reduced levels of points using Height of Instrument method and apply usual checks. (10)

    (b) Explain errors in levelling. (4)

OR

12. (a) Discuss the characteristics of contours, give suitable sketches. (9)

    (b) Briefly explain the terms "Contour Interval" and "Horizontal Equivalent of Contour"? (5)

13. (a) Discuss in detail the two methods of measuring horizontal angles using a theodolite (10)

    (b) Discuss sources of errors in theodolite surveying. (4)

OR

14. (a) Discuss how to determine the tacheometric constants (5)

    (b) Describe with sketch how to measure angles and distances by total station. (9)

15. (a) A series of offsets were taken at 3m intervals in the following order from a chain line to a curved boundary 2.16, 1.53, 1.80, 1.98, 1.80, 1.59, 1.80, 2.52, 2.43, 2.40, 2.58, 2.70, 2.91, and 3.06 meters. Find the area between the chain line, curved boundary and the end offsets by Simpson's rule and trapezoidal rule. (8)

    (b) Elaborate on methods of computation of volume by

      i. Trapezoidal formula
      ii. Prismoidal formula

    (6)

OR

16. (a) Elaborate on balancing the traverse with emphasis on Bowditch's rule. (7)

    (b) Discuss transition curve and its functions. Compare methods to find out the length of transition curve. (7)

17. (a) Explain principles of remote sensing. Discuss remote sensing system and observation platform (10)

    (b) Enumerate various applications of GIS in civil engineering (4)

OR

18. (a) Describe the key components of GIS (7)

    (b) Explain the advantages and limitations of remote sensing. (7)

19. (a) Explain principles and components of ground penetrating radar survey (7)

    (b) Elaborate the features and benefits of Drone Survey. (7)

OR

20. (a) Briefly explain the concepts of aerial photogrammetry (7)

    (b) Describe components and principles of GPS (7)

B24ES1L03	MECHANICAL AND ELECTRICAL WORKSHOP	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

Preamble

The aim of this course is to train the students to identify and manage tools, materials and methods required for various engineering projects. The students will also gain practical knowledge to develop and analyze basic electrical circuits and understand the various safety measures and troubleshooting in electrical wiring. The course will expose students to a collaborative learning atmosphere where they will acquire the essential abilities for organizing, arranging, and carrying out an engineering project. The course also enables the student to familiarize various tools, measuring devices, practices and different methods of manufacturing processes employed in industry for fabricating components.

Prerequisite

Higher secondary level Physics and Mathematics.

Course Outcomes

After the completion of the course the student will be able to

CO 1	Identify electrical symbols, measuring instruments, accessories, and tools used for electrical wiring.
CO 2	Understand the substation, distribution system, and safety measures against electrical shocks and select the fuse unit for a given electrical circuit.
CO 3	Estimate and develop the electric circuits for wiring domestic and industrial buildings.
CO 4	IIdentify and use various tools in carpentry & sheet metal work and perform multiple operations for the preparation of joints using wood and fabrication using sheet metal
CO 5	Identify and use various tools in smithy, foundry, fitting and welding and to practice forging, moulding, casting, chipping, filing, cutting, drilling, etc., and prepare multiple joints and welds

Mapping of Course Outcomes With Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	3	1		3	1	1	3	3	2	3
CO 2	3	2	3	1		3	1	1	3	3	2	3
CO 3	3	3	3	3		3	1	1	3	3	3	3
CO 4	1	1							1	1		1
CO 5	1	1							1	1		1

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	70	30	1 hours

Continuous Internal Evaluation Pattern

Attendance	20 marks
Class Work/ Assessment / Viva-Voce	50 marks
End semester examination (Internally by college)	30 marks

End Semester Examination Pattern

The college will internally conduct the end semester examination. Separate ESE's will be held for Electrical workshop and Mechanical workshop, each in the form of a one hour written objective exam. The total marks for this course will be equally divided between the Electrical and Mechanical workshops.

SYLLABUS

LIST OF EXPERIMENTS

Sl.No.	Topic
1	Familiarization with electrical symbols, measuring instruments, lighting and wiring accessories, tools, and various wiring systems. Study the electric shock phenomenon, precautions, safety procedures, and earthing in electrical installations.
2	Realization of domestic wiring. Wiring of one lamp controlled by one switch and a 3-pin plug socket controlled independently. Wiring of one lamp controlled by two switches (Staircase wiring).
3	Realization of Industrial wiring - Wiring of three lamps controlled by three switches (Godown wiring). Study of fuse, MCB, ELCB, and selection of fuse rating for circuits with medium and high power.
4	Wiring of the distribution board, including the power plug, an isolator, MCB, and ELCB for 1000 W power.
5	Measurement of low-medium-high resistance using the Megger and voltmeter-ammeter method.
6	Visit the on-campus substation and familiarize with the supply system, transformer, HT Panel, and distribution system.

7	Carpentry: Study of Carpentry tools, Types of Carpentry joints: T-Lap joint, Cross lap joint / Cross halving joint, Dove tail halving joint, Mortice & Tenon Joint.
8	Sheetmetal: - Study of sheet metal tools, Forming and joint practices: Cylindrical shape, Conical shape, Rectangular Tray.
9	Smithy: - Study of different tools & forged models in Smithy shop, Forging Practices: Square prism, Hexagonal headed bolt, octagonal prism.
10	Foundry: - Study of Foundry tools, Molding practices: Bench molding, Floor molding, Core making, Casting.
11	Fitting: - Study of fitting tools in a workshop, Type of Fitting shop joints: Square Joint, V-Joint, Male and Female fitting
12	Welding: - Study of welding tools, equipment's and methods, Welding practices: Arc Welding, MIG Welding, Oxy-Acetylene Gas Welding
13	Conventional Machines: Study and demonstration of conventional machines like Shaping and Slotting machine, Lathe, Milling machine, Grinding machines & Radial drilling machine
14	Advanced Manufacturing Methods: Study and demonstration of CNC machines and 3D printing

Reference Books

1. H Cotton, Advanced Electrical Technology, Reem Publications, 2011.
2. Suresh Kumar K.S, Electrical Circuit and Networks, Pearson Education, New Delhi, 2009.
3. EW. Golding, Electrical Measurements and Measuring Instruments, 5^{th} ed. Reem Publications, 2011.
4. Chapman, W. A. J, 2007, Workshop Technology - Parts 1 & 2, 4^{th} ed., New Delhi, India, CBS Publishers & Distributors Pvt. Ltd.
5. O'Bren, A. (Editor), 2001, Welding Handbook . 9^{th} ed., Miami, American Welding Society.
6. Anderson, J., 2002, Shop Theory, New Delhi, India, Tata McGraw Hill.
7. Douglass, J. H., 1995, Wood Working with Machines, Illinois, McKnight & McKnight Pub. Co.
8. Tuplin, W. A., 1996, Modern Engineering Workshop Practice, Odhams Press.
9. Jain, P. L., 2009, Principles of Foundry Technology, 5^{th} ed., New Delhi, India, Tata McGraw Hill
10. S.K. Hajra Choudhury, Workshop Technology Vol II, Media Promoters & Publishers.

B24CE1L02	ENGINEERING MECHANICS LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

This course provides students with hands-on experience and a clear understanding of fundamental principles in engineering mechanics. Emphasizing the effects of applied force systems and the geometric properties of rigid bodies, both at rest and in motion, the laboratory sessions aim to reinforce theoretical concepts. By the end of the course, students will be equipped to recognize and solve similar problems encountered in real-world engineering situations.

Prerequisite

Engineering mechanics, Engineering Physics

Course Outcomes

After the completion of the course the student will be able to

CO 1	Identify and analyze different force systems by applying fundamental principles of mechanics (Cognitive Knowledge Level: Apply)
CO 2	Understand and compute the mechanics of static friction forces.(Cognitive Knowledge Level: Apply)
CO 3	Identify and analyze internal forces within statically determinate beams.(Cognitive Knowledge Level: Apply)
CO 4	Construct free-body diagrams and calculate the forces acting on rigid bodies in static equilibrium. (Cognitive Knowledge Level: Apply)
CO 5	Understand and evaluate the center of gravity and the mass moment of inertia. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2						1	2	2		2
CO 2	3	2						1	2	2		2
CO 3	2	2						1	2	2		2
CO 4	2	2						1	2	2		2
CO 5	2	2						1	2	2		2

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	10 marks
Class Work/ Assessment Viva-Voce	20 marks
Viva-Voce/ Test	20 marks

SYLLABUS

LIST OF EXPERIMENTS

1	Verification of triangle law & parallelogram law of forces
2	Verification of the equilibrium condition of a force system using the force table apparatus
3	To find out forces in Jib and Tie
4	WDetermination of the coefficient of static friction between two given material surfaces in an inclined plane.
5	Verification of the support reactions of a simply supported beam.
6	The study of the systems of pulleys and free body diagram
7	To calculate the force in the member of a truss.
8	Determination of moment of inertia of a disc
9	Determination of moment of inertia of a given fly wheel

Text Books

1. Francesco Costanzo, Gary Gray, and Michael E. Plesha - Engineering Mechanics: Statics & Dynamics

2. Shames, I. H., Engineering Mechanics - Statics and Dynamics, Prentice Hall of India.
3. R. C. Hibbeler and Ashok Gupta, Engineering Mechanics, Vol. I Statics, Vol II Dynamics, Pearson Education.

References

1. Merriam J. L and Kraige L. G., Engineering Mechanics - Vols. 1 and 2, John Wiley.
2. Tayal A K, Engineering Mechanics – Statics and Dynamics, Umesh Publications
3. . Bhavikkatti, S.S., Engineering Mechanics, New Age International Publishers
4. F.P.Beer abd E.R.Johnston (2011), Vector Mechanics for Engineers, Vol.I-Statics, Vol.II-Dynamics,9th Ed, Tata McGraw Hill
5. Rajasekaran S and Sankarasubramanian G, Engineering Mechanics - Statics and Dynamics, Vikas Publishing House Pvt Ltd.

B24PH1L01B & B24CY1L01B	ENGINEERING PHYSICS LAB (B) & ENGINEERING CHEMISTRY LAB (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

PART I
ENGINEERING PHYSICS LAB (B)

Preamble

This course is designed to complement and enhance the students' understanding of fundamental principles in physics through hands-on experimentation and practical application. The primary aim of this laboratory course is to provide students with an experience that bridges the gap between theoretical concepts and real-world challenges. By actively engaging in experiments, students will develop crucial skills in observation, measurement, analysis, problem-solving and team work. These skills are essential in preparing students to tackle complex engineering problems in their future career.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Develop analytical / experimental skills and impart prerequisite hands-on experience for engineering laboratories. (Cognitive Knowledge Level: Apply)
CO 2	Understand the need for precise measurement practices for data recording. (Cognitive Knowledge Level: Apply)
CO 3	Understand the principle, concept, working and applications of relevant technologies and compare results with theoretical calculations. (Cognitive Knowledge Level: Apply)
CO 4	Develop technical skills associated with the usage of modern scientific tools. (Cognitive Knowledge Level: Apply)
CO 5	Develop basic communication skills through working in groups in performing the laboratory experiments and interpreting the results. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1			1	1			1	2		1
CO 2	3	1			1				1	2	1	1
CO 3	3	1			1				1	2	1	1
CO 4	3	1			2				1	3		1
CO 5	3	1			1	1		3	3			1

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
50	35	15	30 minutes

Continuous Internal Evaluation Pattern

Attendance — 10 marks
Class Work/ Assessment Viva-Voce — 25 marks
End semester examination (Internally by the college)/ Test — 15 marks

End Semester Examination Pattern

The college will internally conduct an end semester examination in the form of a 30 minutes written objective examination.

SYLLABUS

LIST OF EXPERIMENTS

1	DSO - Measurement of Frequency and Amplitude.
2	LCR Circuit – Calculation of Q Factor.
3	Measurement of strain using strain gauge and wheatstone bridge.
4	Ultrasonic Diffractometer - measurement of wavelength.

5	Optic Fiber - Measurement of Numerical Aperture.
6	Melde's String - Measurement of Linear Density.
7	Deflection magnetometer-Moment of a magnet- tan A position.
8	Optic Fiber - Measurement of Bending Loss.

Reference Books

1. S.L. Gupta and Dr. V. Kumar, "Practical Physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009.
2. M.N. Avadhanulu, A.A. Dani and Pokely P.M, "Experiments in Engineering Physics", S.Chand & Co, 2008.
3. S. K. Gupta, "Engineering physics practicals", Krishna Prakashan Pvt. Ltd., 2014 .
4. P. R. Sasikumar, "Practical Physics", PHI Ltd., 2011.
5. D.R Mehta, "Laboratory Manual Physics", D.K Publishing House.

PART II
ENGINEERING CHEMISTRY LAB (B)

Preamble

The aim of this course is to develop a scientific approach and to bridge the gap between theoretical chemistry and the applications of chemistry in the field of engineering. This course is designed to familiarize the students with experimental skills through hands-on training, and the students will demonstrate an understanding of the practical applications of these skills while carrying out the research projects in their respective branch of engineering.
.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Understand and practice fundamental techniques in chemistry to generate experimental skills. (Cognitive Knowledge Level: Apply)
CO 2	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments. (Cognitive Knowledge Level: Apply)
CO 3	Acquire the ability to understand different methods of chemical synthesis and instrumental techniques to solve various engineering problems. (Cognitive Knowledge Level: Apply)
CO 4	Function as a team member, communicate effectively and engage in further learning while carrying out the experiment. (Cognitive Knowledge Level: Apply)
CO 5	Understand the importance of chemistry in the curriculum and how it addresses the social, economical and environmental problems. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2		1	1	1							2
CO 2	2	2	2	2	1							2
CO 3	2	2	2	1	2							2
CO 4	2								3	3	2	3
CO 5	2	1				2	3					3

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
50	35	15	30 minutes

Continuous Internal Evaluation Pattern

Attendance	10 marks
Class Work/ Assessment Viva-Voce	25 marks
End semester examination (Internally by the college)/ Test	15 marks

End Semester Examination Pattern

The college will internally conduct an end semester examination in the form of a 30 minutes written objective examination.

SYLLABUS

LIST OF EXPERIMENTS
(MINIMUM FOUR EXPERIMENTS ARE MANDATORY)

1	Calibration of pH meter and determination of pH of a solution.
2	Estimation of sodium ions by flame photometry.
3	Estimation of chloride ion in a water sample by Mohr's method.
4	Synthesis of Urea-formaldehyde resin.
5	Estimation of hardness by EDTA.
6	Anodization of Aluminium.
7	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} ions in the solution.
8	Synthesis of iron oxide nanoparticles.

Reference Books

1. G. Svehla, B. Sivasankar, "Vogel's Qualitative Inorganic Analysis", Pearson, 2012.
2. R. K. Mohapatra, "Engineering Chemistry with Laboratory Experiments", PHI Learning, 2017.
3. Muhammed Arif, "Engineering Chemistry Lab Manual", Owl publishers, 2019.
4. Roy K. Varghese, "Engineering Chemistry Laboratory Manual", Crown plus Publishers, 2019.
5. Soney C. George, Rino Laly Jose, "Lab Manual of Engineering Chemistry", S. Chand & Company Pvt Ltd., New Delhi, 2019.
6. S. M. Ashraf, "A Laboratory Manual of Polymers" I. K. International Publishing House Pvt. Ltd., 2008
7. Anu Tresa Sunny, Prajitha Velayudhan, Sabu Thomas, "Colloidal metal Oxide Nanoparticles: Synthesis, Characterization and Applications", Elsevier Science, 2019.
8. V. F. Henley, "Anodic Oxidation of Aluminium and its Alloys", Elsevier Science, 2013.

B24MC1T03	PROFESSIONAL COMMUNICATION AND ETHICS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	0	1	3	P/F	2024

Preamble

This course aims to provide the students with the vital skills needed to excel in listening, reading, writing, and speaking. Whether conveying technical ideas or non-technical information, mastering these communication elements is crucial for aspiring professionals. The goal is to equip students with the ability to comprehend and successfully articulate ideas while also honing their persuasive communication skills. The course also aims to create in students awareness on ethics and human values.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Expand vocabulary and linguistic proficiency pertinent to the field of engineering (Cognitive Knowledge Level: Apply)
CO 2	Examine, comprehend, and succinctly describe a range of textual material. (Cognitive Knowledge Level: Apply)
CO 3	Produce clear, technically sound documents and presentations that follow all required conventions. (Cognitive Knowledge Level: Apply)
CO 4	Manifest acute ethical awareness and effectively apply ethical principles in practical engineering scenarios. (Cognitive Knowledge Level: Apply)
CO 5	Analyze and address global ethical issues, showcasing an understanding of their roles as ethical leaders and contributors to technological development. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	1	2	3	1	2	
CO 2						3	1	3	3	2	2	
CO 3						3	1	3	3	3	3	
CO 4	3	3	2	2	2	2	2	3	2	2	2	2
CO 5	2	2	2	2	2	2	2	3	2	2	2	3

Assessment Pattern

Bloom's Category	Continuous Assessment	End Semester Examination (% Marks)
	Test (% Marks)	
Remember	30	30
Understand	40	40
Apply	30	30
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks
100	50	50

Continuous Internal Evaluation Pattern

Attendance	10 marks
Regular assessment	15 marks
Series test (one test, conducted for 50 marks and reduced to 25)	25 marks

Regular assessment

Project report presentation and technical presentation through PPT	4 marks
Listening Test	2 marks
Group discussion/mock job interview	4 marks
Resume submission	2 marks
Assignment/Case study	3 marks

End Semester Examination Pattern

Total Marks: 50, Time: 2 hours. There will be two parts; Part A and Part B. Part A contain 4 questions carrying 5 marks each. Part B contains one question from each module in two sets of which students should answer one from each set. Each question can have a maximum of 2 sub-divisions and carry 15 marks each.

SYLLABUS

MODULE 1 (9 hours)

Communication Process

Modes, Verbal and Non-Verbal Communication, Verbal Aptitude- Misspelled Words, synonyms, paraphrasing, sentence completion using appropriate words, subject-verb agreement, Reading-Strategies for Effective Reading, types, Listening-Active and Passive Listening, Barriers, Taking notes while listening Activity- Worksheets, Exercises, Synthesizing and deriving conclusions from technical articles videos, and podcasts

MODULE 2 (9 hours)

Professional discipline

Public Speaking- Technical Talks- Formal and Informal Letters- Emails- Resume Preparation, Video Profile- GD Vs Debate-Dynamics of Professional Presentation (Individual and Group)- Format of Report, Proposal and Minutes.
Activity- Public Speaking, Podcast preparation, Resume preparation, Video profile creation, Company profiling, Group discussion, Technical Proposal, Structured Flow Analysis using AI.

MODULE 3 (9 hours)

Fundamentals of Ethical Engineering

Introduction to Human Values - Morals, Ethics, and Integrity - Academic and Work Ethics - Service Learning and Civic Virtue - Respect, Peaceful Living, Caring, and Sharing - Values of Honesty, Courage, Cooperation, Commitment, Empathy, and Self-Confidence - Senses of Engineering Ethics - Moral Autonomy and Ethical Theories - Moral Issues and Dilemmas in Engineering.

MODULE 4 (9 hours)

Professional Responsibility in a Global Context

Engineering as Social Experimentation - Responsible Experimentation and Codes of Ethics - Customs, Religion, and their Role in Engineering Ethics - Collegiality, Loyalty, and Conflict Management - Confidentiality, Conflicts of Interest, and Occupational Crime - Rights and Responsibilities in Engineering - Global Ethical Issues: Multinational Corporations, Environmental Ethics, Business Ethics, and Computer Ethics - Engineers as Leaders, Expert Witnesses, and Contributors to Technological Development.

Text Books

1. Ashraf Rizvi, "Effective Technical Communication", 2^{nd} Edition, McGraw Hill Education, 2017.

2. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice", 2^{nd} Edition, Oxford University Press, 2011

3. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.

4. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, New Delhi,2006.

Reference Books

5. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.

6. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6^{th} edition, 2015.

7. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4^{th} edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.

8. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.

9. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics-Concepts and cases, Wadsworth Thompson Learning, United states,2005.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**Topic**	**No of Lecture/Tutorial Hours**
	Total Hours	36 Hours
	Module 1 (Communication Process)	9
1.1	Modes, Verbal and Non-Verbal Communication,	1
1.2	Verbal Aptitude- Misspelled Words, synonyms, paraphrasing,	1
1.3	Sentence completion using appropriate words, subject verb agreement,	1
1.4	Reading-Strategies for Effective Reading, types .	1

1.5	Listening-Active and Passive Listening, Barriers, Taking notes while listening.	1
1.6	Activity- Public Speaking, Podcast preparation, Resume preparation, Video profile creation, Company profiling, Group discussion, Technical Proposal.	4
	Module 2 (Professional discipline)	9
2.1	Public Speaking- Technical Talks- Formal and Informal Letters	1
2.2	Emails- Resume Preparation, Video Profile, GD Vs Debate	1
2.3	Dynamics of Professional Presentation (Individual and Group).	1
2.4	Format of Report, Proposal and Minutes.	1
2.3	Activity- Public Speaking, Podcast preparation, Resume preparation, Video profile creation, Company profiling, Group discussion, Technical Proposal.	5
	Module 3 (Fundamentals of Ethical Engineering)	9
3.1	Introduction to Human Values - Morals, Ethics, and Integrity	1
3.2	Academic and Work Ethics - Service Learning and Civic Virtue - Respect, Peaceful Living, Caring, and Sharing.	2
3.3	Values of Honesty, Courage, Cooperation, Commitment, Empathy, and Self-Confidence.	2
3.4	Senses of Engineering Ethics - Moral Autonomy and Ethical Theories.	2
3.5	Moral Issues and Dilemmas in Engineering.	2
	Module 4 (Professional Responsibility in a Global Context)	9
4.1	Engineering as Social Experimentation - Responsible Experimentation and Codes of Ethics.	1
4.2	HCustoms, Religion, and their Role in Engineering Ethics - Collegiality, Loyalty, and Conflict Management	2
4.3	Confidentiality, Conflicts of Interest, and Occupational Crime.	1
4.4	Rights and Responsibilities in Engineering - Global Ethical Issues.	1
4.5	Multinational Corporations, Environmental Ethics, Business Ethics, and Computer Ethics.	2
4.6	Multinational Corporations, Environmental Engineers as Leaders, Expert Witnesses, and Contributors to Technological Development.	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Analyze how different modes of communication impact the overall message.
2. Identify and use appropriate verbal communication skills in various contexts..
3. Identify different types of reading and apply suitable strategies accordingly
4. Recognize and overcome barriers to effective listening.

Course Outcome 2 (CO 2):

1. Demonstrate confidence and competence in public speaking.
2. Compose well-structured written communications.
3. Participate effectively in group discussions and debates, showcasing critical thinking and communication skills.

Course Outcome 3 (CO 3):

1. Understand the format and structure of professional reports and proposals.
2. Summarize and organize information effectively in meeting minutes.
3. Adapt presentation style based on the context and audience.

Course Outcome 4 (CO 4):

1. Explain the role of professional ethics in technological development
2. Explain the need for environmental ethics in engineering projects
3. How civic virtue and integrity contribute to application of ethical principles

Course Outcome 5 (CO 5):

1. Explain how ethical issues in the workplace affect the development of a company.
2. Show how occupational crimes are resolved by keeping the rights of employees
3. Explain the necessity of code of conduct for digital ethics

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24MC1T03

Course Name: PROFESSIONAL COMMUNICATION AND ETHICS

Max. Marks: 50 Duration:2 hours

PART A

Answer all questions. Each question carries 5 marks.

1. Find out which pair of words ’can be filled-up in the blanks in the sentence in the same sequence to make the sentence grammatically correct and meaningfully complete.
   (a) He was ...... not to ...... done the exercise himself.
   a) expected, be b) required, being c) needed, get d) supposed, have
   (b) A committee has been………….to………….the transformation of the city into an international finance center.
   a) Constituted, convert b) appointed, oversee c) inducted, change d) converged, evaluate
2. Highlight the differences between a group discussion (GD) and a debate.
3. Briefly explain morals, values, and ethics.
4. Provide an explanation on conflicts of interest with an example.

PART B

Answer any one question from each set. Each question carries 15 marks.

5. (a) “In today’s world, being a good listener is more important than being a good Speaker.” Enumerate (7)

(b) Help your friend by suggesting and explaining methods to improve his/her reading skills.. (8)

OR

6. (a) Compare and contrast the formats of a proposal and a report (7)

   (b) Discuss the challenges and benefits of delivering a presentation in a group setting (8)

7. (a) Exemplify a comprehensive review of integrity and respect for others. (8)

   (b) Explain how caring and sharing differ or exhibit similarities. (7)

OR

8. (a) Explain in detail about professional rights and employee rights. (8)

   (b) Explain the necessity of code of conduct for digital ethics. (7)

B24MC1L02	IDEA LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	P/F	2024

Preamble

This course enables the students to understand the concepts of design, development and documentation tools under various domains in engineering. The various topics covered in this course are concepts of 2D and 3D design, cutting, routing, engraving, milling, slicing, printing and fabrication. Students will be exposed to PCB design and populating. They will learn Microcontroller programming, embedded system design and technical documentation. This course helps students to analyse real-life problems and find solutions using multidisciplinary engineering.

Prerequisite

Nil

Course Outcomes

After the completion of the course the student will be able to

CO 1	Create 2D and 3D models using appropriate tools. (Cognitive Knowledge Level : Analyse)
CO 2	Design and fabricate circuits using PCB Design and fabrication mechanisms.(Cognitive Knowledge Level : Analyse)
CO 3	Develop project using appropriate Micro controller Programming.(Cognitive Knowledge Level : Apply)
CO 4	Build a product for some applications using design and fabrication technologies.(Cognitive Knowledge Level : Create)
CO 5	Create electronic documentation for the system/project using appropriate tools .(Cognitive Knowledge Level : Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	2	1	3		2				1	1		
CO 2	1		1		1						1	1
CO 3	2	2	2	2	2	1	1	1	2	2	2	2
CO 4	1	2	3	2	3	2	3	3	3	3	3	3
CO 5						1				3		

Mark Distribution

Total Marks	CIE Marks	ESE Marks (Internal) Micro Project
100	50	50

Continuous Internal Evaluation Pattern

Attendance	10 marks
Class Work/ Assessment	30 marks
Viva-Voce/ Test	10 marks

End Semester Evaluation Pattern:

Micro project Demonstration	20 marks
Micro Project Presentation	20 marks
Micro Project Report	10 marks

Note: The microproject has to be completed by the students as a group of a maximum of four students.

SYLLABUS

LIST OF EXPERIMENTS

Complete at least six experiments and one micro project from the given list.

1	Prepare a 2D and 3D model using any standard tool.
2	Use the 2D model to engrave and cut the acrylic sheet using laser cutter. Assemble the laser-cut parts to fabricate the final model.
3	Use the 2D model for the fabrication of a model by using CNC milling.
4	Use a 3D model to engrave the pattern using CNC milling on the acrylic/wood/-plastic block.
5	Use the 3D design for the fabrication of a model by using a 3D printer. Use a slicing software and generate the corresponding G-codes.
6	Write a program to read the input port pins of a micro controller and write the same to the output pins. Use a development board.
7	Write a program to read a sensor (temperature) and display it.
8	Write a program in Arduino IDE for Arduino development board to design a temperature controller. Control the speed of a fan based on the room temperature. Display the temperature on an LCD display.

9	Design a system to display the data send from the embedded system on a GUI in another Embedded system or PC (Wired – UART, I2C, SPI. Wireless – Bluetooth, Wifi)
10	Complete a Microproject. Prepare a technical report using latex for the temperature controller system in the standard template of the university.

Reference Books

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

2. 3D Printing and Design, Dr. SabrieSoloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.

3. The Big Book of Maker Skills: Tools and Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.

4. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top Selling Product. Sean Michael Ragan(Author).Weldon Owen;2017.ISBN-13:978-1681881584.

5. Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 978- 352137374 .

6. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press. ISBN: 9780521809269 .

7. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill. ISBN-13: 978-1259587542 .

8. Encyclopedia of Electronic Components (Volume 1, 2 and 3). Charles Platt. Shroff Publishers. ISBN-13: 978-9352131945, 978-9352131952, 9789352133703.

9. Building Scientific Apparatus. 4th edition. John H. Moore, Christopher C. Davis, Michael A. Coplan and Sandra C. Greer. Cambridge University Press. ISBN-13: 978-0521878586.

10. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633 .

11. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13: 978-1260019193.

12. Pro GIT. 2nd edition. Scott Chacon and Ben Straub. A press. ISBN-13: 9781484200773.

13. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer.

14. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer,2010 .

15. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and Distributors, 5th Edition, 2002.

MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH CIVIL ENGINEERING

SEMESTER 3

SYLLABUS

SEMESTER 3

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA2T03A	COMPLEX VARIABLES AND APPLICATIONS OF PDE	3-1-0-3	4	4
B	B24CE2T01	MECHANICS OF SOLIDS	3-1-0-3	4	4
C	B24CE2T02	FLUID MECHANICS & HYDRAULICS	3-1-0-3	4	4
D	B24CE2T03	FUNCTIONAL PLANNING OF BUILDINGS	2-1-0-2	3	3
E	B24HU2T02	ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS	2-1-0-2	3	3
G	B24CE2L03	SURVEYING LABORATORY	0-0-3-3	3	2
H	B24CE2L04	HYDRAULICS LABORATORY	0-0-3-3	3	2
I	B24MC2T04	UNIVERSAL HUMAN VALUE AND CONSTITUTIONAL RIGHTS	2-0-0-2	2	P/F
J	B24MC2T05	ENERGY CONSERVATION AND ENVIRONMENTAL SUSTAINABILITY	2-0-0-2	2	P/F
M		MINOR	3-1-0-3	4	4
TOTAL				**32**	**22**

MINOR COURSES

COURSE NO.	COURSES
B24CEM32	WATER AND AIR QUALITY
B24CEM33	TRAFFIC SAFETY

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24MA2T03A	COMPLEX VARIABLES AND APPLICATIONS OF PDE	3	1	0	3	4	2024

Preamble

This course introduces basic ideas of partial differential equations which are widely used in the modelling and analysis of a wide range of physical phenomena and has got application across all branches of engineering. It is also possible to understand the basic theory of functions of complex variable and also its integration and conformal transformation.

Prerequisites: A basic course in partial differentiation and complex numbers.

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Solve Non linear and linear partial differential equations (Cognitive Knowledge Level : Apply)
CO 2	Solve one dimensional wave equation and heat equation using partial differential equations (Cognitive Knowledge Level : Apply)
CO 3	Make use of Cauchy-Riemann equations to understand complex functions, its continuity differentiability (Cognitive Knowledge Level : Apply)
CO 4	Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula (Cognitive Knowledge Level : Apply)
CO 5	Develop power series expansion of an analytic function (Cognitive Knowledge Level : Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1		1							1
CO 2	3	2	1		1							1
CO 3	3	2	1		1							1
CO 4	3	2	1		1							1
CO 5	3	2	1		1							1

Assessment Pattern

Complex Variables and Applications of PDE			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1: Partial Differential Equations (9 hours)

Partial differential equations, Formation of partial differential equations – elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equations - Equations solvable by direct integration, Linear equations of the first order-Lagrange's linear equation, Non-linear equations of the first order - Charpit's method, Solution of equation by method of separation of variables.

MODULE 2: Applications of Partial Differential Equations (9 hours)

One dimensional wave equation - vibrations of a stretched string, solution of the wave equation using method of separation of variables, D'Alembert's solution of the wave equation, One dimensional heat equation, solution of the heat equation.

MODULE 3: Complex Variable – Differentiation (9 hours)

Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations , harmonic functions, finding harmonic conjugate, Conformal mappings - mappings $w = z^2$, $w = e^z$, linear fractional transformation $w = \frac{1}{z}$, fixed points.

MODULE 4: Complex Variable – Integration (9 hours)

Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method-indefinite integration and substitution of limit, second evaluation method-use of a representation of a path, Contour integrals, Cauchy integral theorem on simply connected domain, Cauchy Integral formula.

MODULE 5: Complex Variable – Series representation (9 hours)

Taylor's and Maclaurin series. Laurent's series (without proof), zeros of analytic functions, singularities, poles, removable singularities, essential singularities, Residues.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44^{th} edition, 2018.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2016.

Reference Books:

1. Peter V. O'Neil, Advanced Engineering Mathematics, Cengage, 7th Edition, 2012

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1 (Partial Differential Equations)**	**9 hours**
1.1	Partial differential equations, Formation of partial differential equations – elimination of arbitrary constants-elimination of arbitrary functions, Solutions of a partial differential equation, Equations solvable by direct integration	3
1.2	Linear equations of the first order - Lagrange's linear equation Non-linear equations of the first order - Charpit's method	4
1.3	Boundary value problems, Method of separation of variables	2
2	**Module 2 (Applications of Partial Differential Equations)**	**9 hours**
2.1	One dimensional wave equation - vibration of a stretched string	1
2.2	Solution of wave equation using method of separation of variables, Fourier series solution of boundary value problems involving wave equation, D'Alembert's solution of the wave equation	4
2.3	One dimensional heat equation	1
2.4	Solution of the heat equation, using method of separation of variables, Fourier series solutions of boundary value problems involving heat equation	4
3	**Module 3 (Complex Variable – Differentiation)**	**9 hours**
3.1	Complex function, limit, continuity, derivative, analytic functions, Cauchy-Riemann equations.	4
3.2	Harmonic functions, finding harmonic conjugate	2
3.3	Conformal mappings - mappings of w= z^2, w = e^z, w=$1/z$.	3

4	**Module 4 (Complex Variable – Integration)**	**9 hours**
4.1	Complex integration, Line integrals in the complex plane, Basic properties, First evaluation method, second evaluation method, use of representation of a path	4
4.2	Contour integrals, Cauchy integral theorem (without proof) on simply connected domain .Cauchy Integral formula (without proof)	2
4.3	Cauchy Integral formula	2
4.4	Cauchy Integral formula for derivatives of an analytic function	1
5	**Module 5 (Complex Variable – Series representation)**	**9 hours**
5.1	Taylor series and Maclaurin series	2
5.2	Laurent's series(without proof)	3
5.3	Zeros of analytic functions, singularities, poles, removable singularities, essential singularities	2
5.4	Residues	2
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Understand the concept and the solution of partial differential equation.

1. Form the partial differential equation given $z = f(x + it) + g(x - it)$.
2. Solve $\frac{\partial^2 z}{\partial y^2} = \sin(xy)$.
3. Solve $(y - z)\, p + (x - y)\, q = z - x$.
4. Solve $2zx - px^2 - 2qxy + pq = 0$.
5. Solve $\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y}$ where $u(0, y) = 8e^{-3y}$ by the method of separation of variables.

Course Outcome 2 (CO2): Analyse and solve one dimensional wave equation and heat equation.

1. Write all possible solutions of one dimensional wave equation.
2. Find the steady state temperature distribution in a rod of length 10 cm with ends are kept at 20^0C and 80^0C .
3. Obtain a general solution for the one dimensional heat equation.
4. A string is stretched between the fixed points $(0, 0)$ and $(l, 0)$ and released at rest from the initial deflection given by $f(x) = \begin{cases} \frac{2k}{l}x \ , & \text{when } 0 < x < \frac{l}{2} \\ \frac{2k}{l}(l-x) \ , & \text{when } \frac{l}{2} < x < l \end{cases}$
5. A rod of length l with insulated sides is initially at a uniform temperature u_0 .Its ends are suddenly cooled to 0°C and are kept at that temperature. Find the temperature function $u(x, t)$.

Course Outcome 3 (CO3): Understand complex functions, its continuity differentiability with the use of Cauchy-Riemann equations.

1. Find the real and imaginary parts of the function $5z^2 - 12z + 3 + 2i$.
2. Check whether the function $\frac{x+iy}{x^2+y^2}$ is analytic.
3. Determine the analytic function whose real part is $e^{2x}(x\cos 2y - y\sin 2y)$.
4. Find the fixed points of $(a + ib)z^2$.
5. Find the image of $1 \leq |z| \leq 2$, $\frac{\pi}{6} \leq \theta \leq \frac{\pi}{3}$ under the mapping $w = z^2$.

Course Outcome 4 (CO4): Evaluate complex integrals using Cauchy's integral theorem and Cauchy's integral formula.

1. Evaluate $\int_0^{1+i}(x - iy)\, dz$ along the straight line path from 0 to $1 + i$.
2. Find the value of $\int_C \frac{z^2+1}{z^2-1}\, dz$ where C is $|z - 4 - 2i| = 6.5$.
3. Evaluate $\oint_C \frac{\sin z}{z+4iz}\, dz$ where C is $|z| = 1$ in counter clockwise direction.
4. Integrate $\oint_C \frac{\sinh 2z}{(z-\frac{1}{2})^4}\, dz$ in counterclockwise direction around the unit circle.
5. Evaluate $\oint_C \frac{\cos(\pi z^2)+\sin(\pi z^2)}{(z-1)(z-2)} dz$ where C is $|z| = 3$ using Cauchy's integral formula.

Course Outcome 5 (CO5): Understand the series expansion of complex function about a singularity and apply residue theorem to compute several kinds of real integrals.

1. Find the Maclaurin series expansion of $\frac{z+2}{1-z^2}$.
2. Find all singular points and residue of the function $\csc z$.
3. Find the Laurent series of $\frac{-2z+3}{z^2-3z+2}$ valid in (i) $1 < |z| < 2$ (ii) $|z| > 2$.
4. Find the poles and residues of the function $\frac{1}{z^4-1}$.
5. Expand $f(z) = \frac{z+1}{z-1}$ as a Taylor series about $z = -1$.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24MA2T03A

Course Name: COMPLEX VARIABLES AND APPLICATIONS OF PDE (CE,ME,EE,EC)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Find the partial differential equation of all spheres of fixed radius having their centres in the xy-plane.
2. Solve $\frac{\partial^2 z}{\partial x \partial y} = \frac{x}{y} + a$.
3. Find the steady state temperature distribution in a rod of length 10 cm with ends are kept at $20^0 C$ and $80^0 C$.
4. A tightly stretched elastic string of length l fixed at end points is initially at its rest position. If each of its points is displaced by giving a velocity, find its initial conditions and boundary conditions.
5. Test the continuity at $z = 0$ of $f(z) = \begin{cases} \frac{\mathrm{Re}(z)}{1-|z|}\ , & z \neq 0 \\ 0\ , & z = 0 \end{cases}$
6. Show that an analytic function with constant real part is constant.
7. Evaluate $\oint_{-\pi i}^{\pi i} \cos z \, dz$.
8. Find the Maclaurin series of $\frac{1}{1+z^2}$.
9. Find the zeros and their order of the function $f(z) = (1 - z^4)^2$.
10. Find the residue at poles for the function $f(z) = \frac{\sinh z}{z^4}$.

PART B

Answer any one question from each module. Each question carries 14 marks

11. (a) Form the partial differential equation by eliminating the arbitrary functions from $z = yf(x) + xg(y)$. 7

(b) Solve $(y + zx)\,p - (x + yz)\,q = x^2 - y^2$. 7

OR

12. (a) Solve $q + xp = p^2$. 7

(b) Using method of separation of variables, solve $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} = 0$. 7

13. (a) A string is stretched between the fixed points $(0, 0)$ and $(l, 0)$ and released at rest from the initial deflection given by

$$f(x) = \begin{cases} \frac{2k}{l}x\ , & \text{when } 0 < x < \frac{l}{2} \\ \frac{2k}{l}(l - x)\ , & \text{when } \frac{l}{2} < x < l \end{cases}$$ 7

(b) A rod of length l with insulated sides is initially at a uniform temperature u_0 .Its ends are suddenly cooled to 0°C and are kept at that temperature. Find the temperature function $u(x, t)$. 7

OR

14. (a) A tightly stretched homogeneous string of length l with its fixed ends at $x = 0$ and $x = l$ executes transverse vibrations. Motion starts with zero initial velocity by displacing the string into the form $f(x) = k(x - x^2)$. Find the deflection $u(x, t)$ at any time t. 7

(b) Derive the solutions of one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ using variable separable method. 7

15. (a) Check whether $f(z) = iz\bar{z}$ is analytic . 7

(b) Find the image of $x > 1,\ y > 0$ under the transformation $w = 1/z$. 7

OR

16. (a) Show that$u = x^3 - 3xy^2 - 5y$ is harmonic. Also find the corresponding harmonic conjugate function. 7

(b) Find the image of $|z| \leq 2$, $\frac{\pi}{6} < \arg z < \frac{\pi}{3}$ under the mapping $w = z^2$. 7

17. (a) Evaluate$\oint_C (z + \frac{1}{z})dz$ where C is the unit circle traversed counterclockwise. 7

(b) Evaluate$\oint_C \frac{5z+7}{z^2+2z-3}\,dz$ where C is taken counterclockwise around the circle
(i) $|z - 2| = 2$
(ii) $|z + i| = 1$. 7

OR

18. (a) Integrate counterclockwise around the unit circle $\oint_C \frac{\sin 2z}{z^4}\,dz$. 7

(b) Evaluate $\int (z^2 + 3z)dz$ along the circle $|z| = 2$ from $(2, 0)$ to $(0, 2)$ in counter clockwise direction. 7

19. (a) Expand $f(z) = \frac{z}{(z+1)(z+2)}$ as a Laurent series about $z = -2$ in $0 < |z + 2| < 1$. 7

(b) Determine and classify the singular points for $f(z) = \frac{\sin z}{(z-\pi)^2}$ and $g(z) = e^{\frac{-1}{z}}$ 7

OR

20. (a) Find the poles and residues of the function $\frac{1}{z^4-1}$. 7

(b) Expand $f(z) = \frac{z-1}{z^2}$ as a Taylor series about $z_0 = 1$. 7

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T01	MECHANICS OF SOLIDS	3	1	0	3	4	2024

Preamble

The course covers basic principles of mechanics of solids, focusing on stress, strain, and deformation in structural elements. Topics such as member behaviour under axial loads, bending, torsion, and column stability are covered, enabling students to understand how materials respond to different forms of loading. By the end of the course, students will be able to analyse and solve problems concerning the behaviour of structures under various loading conditions.

Prerequisites: Engineering Mechanics

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Apply the principles of mechanics to estimate stresses and deformations in engineering structures. (Cognitive knowledge level: Apply).
CO 2	Analyse composite bars under axial loads and compute strain energy for bars subjected to axial and shear stresses. (Cognitive knowledge level: Apply).
CO 3	Calculate and draw shear force and bending moment diagrams (Cognitive knowledge level: Apply).
CO 4	Evaluate the flexural and shear stresses in beams utilizing the principles of simple bending theory (Cognitive knowledge level: Apply).
CO 5	Analyse circular shafts and assess the stability of short and long columns under different boundary conditions. (Cognitive knowledge level: Apply).

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	2				1	1		1
CO 2	3	3	2	1	2				1	1		1
CO 3	3	2	3	1	2				1	2		1
CO 4	3	2	3	1	2				1	2		1
CO 5	3	3	2	2	3	1	1		1	1		1

Assessment Pattern

Mechanics of Solids			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	10	10	10
Understand	40	40	40
Apply	50	50	50
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

SYLLABUS

MODULE 1 (9 hours)

Concepts of stress and strain: Stress and strain – Types – Stress-strain relation - Hooke's law - Stress-strain diagram of mild steel - Elastic Constants – Relationships between elastic constants - Axially loaded bars with prismatic and non-prismatic cross section – stress, strain and deformation.

Analysis of stress and strain on oblique sections: Stresses on inclined sections for uniaxial and biaxial stress fields. Principal stresses and principal planes in 2D problems-maximum shear stress. Mohr's circle of stress for 2D problems.

MODULE 2 (8 hours)

Behaviour of Composite Bars Under Axial and Thermal Loads: Composite bars - Stress, strain and deformation under axial load - Temperature effects in simple and composite bars.

Strain Energy and Stress Analysis in Axially Loaded Bars: Strain energy - Strain energy in bars carrying axial loads - Stress in bars due to sudden and impact loads - Strain energy due to shear stress.

Stress Distribution in Thin Cylindrical and Spherical Vessels: Thin Cylinders: Stresses in thin cylinders and spheres due to internal pressure.

MODULE 3 (8 hours)

Analysis of Bending Moments and Shear Forces in Beam: Bending Moment & Shear force: Types of support and load – Classification of beams based on support - Concept of bending moment and shear force - Relationship between 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 loading - Point load, UDL and UVL - Point of contraflexure.

MODULE 4 (10 hours)

Bending Stress, Shear Stress and Deflection in Beams : Theory of simple bending – Assumptions and limitations - Bending stress in beams - Moment of resistance - Shear stress in beams - Strain energy due to bending in beams. Differential equation for calculating the deflection of beams.

MODULE 5 (10 hours)

Torsion of circular shafts: Torsion of solid and hollow circular shafts - Power transmitted by solid and hollow Circular shafts - Strain energy due to torsion.

Behaviour of column under axial load: Direct and bending stresses in short columns - Kern of a section - Buckling and stability - Euler's buckling/crippling load for columns with different end conditions - Slenderness ratio - limitation of Euler's formula - Rankine's formula.

Text Books

1. R. K. Bansal, A Text book of Strength of Materials, Laxmi Publications (P) Ltd, 6th Edn, 2018.
2. H. J. Shah and S. B. Junnarkar, Mechanics of Structures Vol - I, Charotar Publishing House, 32nd Edn, 2016.
3. B. C. Punmia, Ashok K. Jain, Arun Kumar Jain, Mechanics of Materials, Laxmi Publications (P) Ltd, 2017.

Reference Books

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall International Series.
2. James M Gere, S.P. Timoshenko, Mechanics of Materials, CBS Publishers and Distributors, New Delhi.
3. R.C. Hibbeler, Mechanics of Materials (edn.10), Pearson.
4. S. Ramamrutham and R. Narayanan, Strength of Materials, Dhanpat Rai Publishing Co (P) Ltd.
5. Rattan, Strength of Materials, McGraw Hill Education India.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Stress and strain – types – Stress-strain relation - Hooke's law - Stress-strain diagram of mild steel - Elastic Constants – Relationships between elastic constants	2
1.2	Stress, strain and deformation - Axially loaded bars with prismatic and non-prismatic cross section	2
1.3	Analysis of stress and strain on oblique sections - Stresses on inclined sections for uniaxial and biaxial stress fields	2

1.5	Principal stresses and principal planes in 2D problems - maximum shear stress	2
1.6	Mohr's circle of stress for 2D problems	1
2	**Module 2**	**8 hours**
2.1	Analysis of composite bars	2
2.2	Temperature effects in simple and composite bars	2
2.3	Strain energy - Strain energy in bars carrying axial loads - Stress in bars due to sudden and impact loads	2
2.4	Strain energy due to shear stress	1
2.5	Stresses in thin cylinders and spheres due to internal pressure	1
3	**Module 3**	**8 hours**
3.1	Types of support and load – Classification of beams based on support - Relationship between load, shear force and bending moment	1
3.2	Shear force and bending moment diagrams of cantilever beams	2
3.3	Shear force and bending moment diagrams of simply supported beams	2
3.4	Shear force and bending moment diagrams of overhanging beams - Point of contraflexure	3
4	**Module 4**	**10 hours**
4.1	Theory of simple bending – Assumptions and limitations	2
4.2	Bending stress in beams - Moment of resistance	3
4.3	Shear stress in beams	3
4.4	Strain energy due to bending in beams	1
4.5	Differential equation for calculating the deflection of beams	1

5	**Module 5**	**10 hours**
5.1	Torsion of solid and hollow circular shafts	2
5.2	Power transmitted by solid and hollow circular shafts	2
5.3	Strain energy due to torsion	1
5.4	Direct and bending stresses in short columns, Kern of a section	2
5.5	Buckling and stability, Slenderness ratio, Euler's buckling/crippling load for columns with different end conditions	2
5.6	Buckling load with Rankine's formula	1
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. What is stress? In what way does the shear stress differ from direct stress?
2. Sketch the stress-strain curve of mild steel and mark the salient points.
3. A bar of 20 mm diameter is subjected to a pull of 50 kN. The measured extension over a gauge length of 20 cm is 0.1 mm and the change in diameter is 0.0035 mm. Calculate the Poisson's ratio, Modulus of elasticity, Shear modulus, and Bulk modulus.
4. An element in a stressed material has tensile stress of 500 MN/m^2 and a compressive stress of 350 MN/m^2 acting on two mutually perpendicular planes and equal shear stresses of 100 MN/m^2 on these planes. Find the principal stresses and position of principal planes. Find also the maximum shearing stress.

Course Outcome 2 (CO 2):

1. Define the terms (i) Resilience (ii) Proof resilience and (iii) Modulus of resilience.
2. Explain the effect of temperature change on a composite bar made of two materials.
3. A steel bar ABCD consists of three sections: AB is of 20 mm diameter and 200 mm long; BC is 25 mm square and 400 mm long and CD is of 12 mm diameter and 200 mm long. The bar is subjected to an axial compressive load which induces a stress of 30 MN/m^2 on the largest cross-section. Determine total decrease in length of the bar. E = 210 GPa
4. A railway track is laid so that there is no stress in the rails at 9°C. The rails are 40 m long. Take $\alpha = 12 \times 10^{-6}$ per °C and $E = 2 \times 10^5$ N/mm^2. Calculate the following:

(i) The stress on the rails at 40°C if there is no allowance for expansion.

(ii) The stress in the rails at 40°C if there is an expansion allowance of 5 mm per rail.

(iii) The expansion allowance if the stress in the rail is to be zero when the temperature is 40°C.

(iv) The maximum temperature to have no stress in the rails if the expansion allowance is 15 mm per rail.

Course Outcome 3 (CO 3):

1. What are the main types of supports? Distinguish between roller and hinged supports.

2. Explain point of contraflexure.

3. A 12 m long beam simply supported at the ends carries a point load of 40 kN at 3 m from the left end and a uniformly distributed load of 10 kN/m on the right half of the span. Draw the shear force and bending moment diagrams indicating principal values.

4. A beam 8 m long rests on two supports, one at the right end and the other 2 m from its left-hand end. The beam carries a uniform load of 15 kN/m over its entire length and a concentrated load of 80 kN at the middle of the supports of 6 m span. Draw the bending moment and shear force diagrams and determine the position and amount of maximum bending moment.

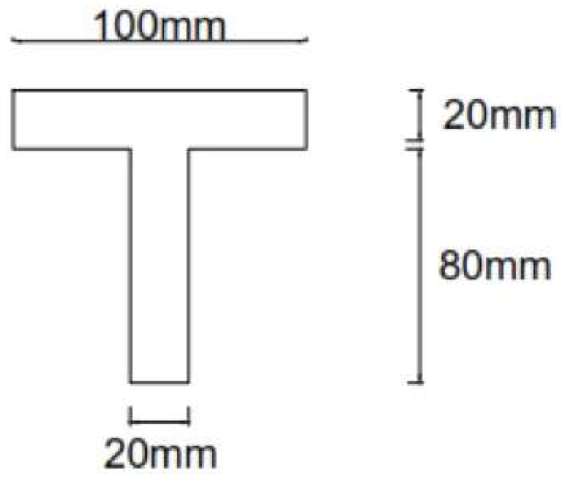
Course Outcome 4 (CO 4):

1. Derive the relation between slope, deflection, shear force, bending moment, and rate of loading.

2. Show that the maximum shear stresses in a rectangular cross-section is 1.5 times the average stress.

3. A timber beam 150 mm x 200 mm is used as a simply supported beam of span 3m. Find the maximum uniformly distributed load that can be applied in addition to a concentrated load of 5 kN acting at the mid-span, if the maximum bending stress and shear stress in the beam are not to exceed 15 N/mm^2 and 2 N/mm^2 respectively. Neglect the self-weight of the beam.

4. A cast iron beam is of T section as shown in the figure. The beam is simply supported on a span of 8m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses.



Course Outcome 5 (CO 5):

1. Define slenderness ratio of a column. What is its importance?
2. Define Kern of section.
3. Find the Euler crushing load for a hollow cylindrical cast iron column 20 cm external diameter and 25 mm thick if it is 6 m long and is hinged at both ends. Take $E = 1.2 \times 10^5\,\mathrm{N/mm^2}$. Compare the load with the crushing load as given by the Rankine's formula, taking $\alpha_c = 550\,\mathrm{N/mm^2}$ and $\alpha = \frac{1}{1600}$.
4. The external and internal diameters of a hollow shaft are 50 mm and 40 mm respectively. Find the maximum power that can be transmitted by the shaft at 600 rpm, if the permissible shear stress is $100\,\mathrm{N/mm^2}$ and the permissible rate of twist is 3° per meter. Take modulus of rigidity of shaft material, $G = 1 \times 10^5\,\mathrm{N/mm^2}$

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T01

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Explain the terms stress and strain. What are the different types of stresses and strains?
2. Define the terms (i) Principal planes, (ii) Principal stresses.
3. Explain strain energy, resilience, and proof resilience.
4. Explain the effect of temperature change on a composite bar made of two materials.
5. Derive the relationship between intensity of load, shear force (SF), and bending moment (BM).
6. What is meant by the point of contraflexure? Illustrate with an example.
7. Explain the concept of pure bending with an example.
8. Show that the maximum shear stress in a rectangular cross-section is 1.5 times the average stress.
9. Define Kern of a section.
10. What is slenderness ratio? State its significance.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. A steel bar ABCD consists of three sections: AB is of 20 mm diameter and 200 mm long; BC is 25 mm square and 400 mm long; and CD is of 12 mm diameter and 200 mm long. The bar is subjected to an axial compressive load which induces a stress of 30 MN/m^2 on the largest cross section. Determine the total decrease in length of the bar when the load is applied. $E = 210$ GPa.

OR

12. A point is subjected to a tensile stress of 50 N/mm^2 and 10 N/mm^2, acting on two mutually perpendicular planes. A shear stress of 20 N/mm^2 is acting on these planes. Determine the principal stresses and the maximum shear stresses and its planes.

13. A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 100°C, there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised by 200°C. Take $E_s = 2.1 \times 10^5$ N/mm^2, $\alpha_s = 11 \times 10^{-6}/°C$, $E_c = 1 \times 10^5$ N/mm^2 and $\alpha_c = 18 \times 10^{-6}/°C$.

OR

14. (a) Calculate the minimum wall thickness of a thin cylinder 1 m in diameter if it is to withstand an internal pressure of 2 N/mm^2 and hoop stress is not to exceed 40 N/mm^2. Also find the change in diameter. $E = 210$ GPa; Poisson's ratio = 0.3.

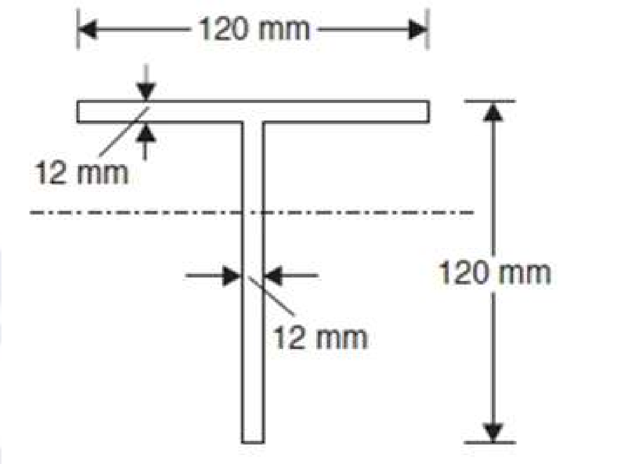
    (b) A rod 12.5 mm in diameter is stretched 3.2 mm under a steady load of 10 kN. What stress would be produced in the bar by a weight of 700 N falling through 75 mm before commencing to stretch, the rod being initially unstressed? $E = 210$ GPa.

15. Draw the SFD and BMD for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate the maximum B M on the section.

OR

16. A beam of length 10 m is placed over simple supports such that the beam overhangs by 2 m at the left side and by 3 m at the right side. The beam carries concentrated loads of 50 kN and 80 kN at the left and right ends respectively. In addition, it carries a uniformly distributed load of 20 kN/m in between the supports. Sketch the shear force and bending moment diagrams indicating all salient features.

17. A cast iron beam of T-shaped cross-section as shown, carries a udl of 1.5 kN/m over the entire span of 8 m. Determine the maximum tensile and compressive stress and draw the bending stress distribution diagram.



OR

18. A simply supported beam AB of 5 m span is carrying a uniformly distributed load of 20 kN/m. The beam is made up of a rectangular cross section of dimensions 300 mm $\times$ 450 mm.
i) Draw the bending stress distribution at the critical section for bending.
ii) Draw the shear stress distribution considering the critical section for shear.
iii) Also calculate bending stress and shear stress on a layer located 50 mm above the neutral axis on the cross section at the mid-point of the beam.

19. Find the Euler's crippling load for a hollow cylindrical cast iron column of 15 cm external diameter and 25 mm thick if it is 6 m long and is hinged at both ends. Compare this load with the crushing load as given by Rankine's formula, taking $\sigma_c =$ 550 N/mm^2 and Rankine's constant as $\frac{1}{1600}$. For what length of the column would these two formulae give the same crushing load? Take $E = 8 \times 10^4$ N/mm^2.

OR

20. Determine the diameter of a solid shaft which will transmit 112.5 kW of power at 200 rpm. Also determine the length of the shaft if the twist must not exceed 1.5 degrees over the entire length. The maximum shear stress is limited to 55 N/mm^2. Take $G = 0.8 \times 10^5$ N/mm^2.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T02	FLUID MECHANICS & HYDRAULICS	3	1	0	3	4	2024

Preamble

The course delves into the fundamental concepts of fluid mechanics, hydraulics of pipes, and open channels. The aim of the course is to enable the students to apply the concepts in analysing and solving real-world problems related to fluid flow and hydraulic structures.

Prerequisites: Engineering Mechanics

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Apply the fundamental concepts to identify types and characteristics of fluid flow, and to estimate fluid pressure and associated forces in practical situations. (Cognitive knowledge level: Apply).
CO 2	Use the principles of buoyancy and flotation to evaluate the stability of floating bodies, and apply fundamental hydrodynamic concepts to explain fluid motion. (Cognitive knowledge level: Apply).
CO 3	Apply the principles of fluid kinetics and Bernoulli's equation to analyse flow and compute energy losses and flow characteristics in pipe systems. (Cognitive knowledge level: Apply).
CO 4	Understand the concepts of open channel flow to examine flow types and velocity distribution, calculate discharge using standard flow equations and identify. (Cognitive knowledge level: Apply).
CO 5	Apply the principles of open channel flow to analyse specific energy and hydraulic jump characteristics. (Cognitive knowledge level: Apply).

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3										1
CO 2	3	3		1			1					1
CO 3	3	3										1
CO 4	3	3		1			1					1
CO 5	2	3					1					1

Assessment Pattern

Fluid Mechanics & Hydraulics			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts: Part A and Part B. Part A contain 10 questions, with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module, of which students should answer any one. Each question carries 14 marks and can have a maximum of 2 sub-divisions.

SYLLABUS

Module 1: Fundamentals of Fluid Properties and Fluid Statics (9 hours)

Fluid properties (mass density, specific weight, viscosity, specific gravity), Classification of Fluids. Fluid statics-variation of pressure in a fluid, measurement of fluid pressure using piezometers and manometers, U-tube manometers - Numerical Problems
Forces on immersed plane placed vertical and inclined positions. Hydrostatic force on curved surfaces – Practical application of total pressure on spillway gates.

Module 2: Buoyancy, Floatation, and Fundamentals of Hydrodynamics (9 hours)

Buoyancy and Floatation: Buoyant force, Principle of floatation, stability of floating and submerged bodies, metacentre and metacentric height, analytical and experimental determination of metacentric height - Numerical Problems

Hydrodynamics - Methods of describing fluid motion, Lagrangian and Eulerian methods, velocity and acceleration, types of fluid flow, description of fluid flow - streamline, pathline and streakline; continuity equation in one, two and three dimensions - Numerical Problems.

Module 3: Fluid Kinetics and Pipe Flow Analysis (9 Hours)

Fluid kinetics - forces considered in describing fluid motion, Derivation of Bernoulli's equation by integration of Euler's equation along a streamline, Applications of Bernoulli's equation - Venturimeter, Pitot tube and Orificemeter;

Pipe flow- computation of major and minor losses in pipes, hydraulic gradient line and total energy line, pipes in series - equivalent pipe, flow through parallel pipes.

Module 4: Open Channel Flow and Flow Measurement (9 Hours)

Open channel flow – comparison between pipe flow and open channel flow, velocity distribution in open channels, types of channels, type of flow, geometric elements of channel section, uniform flow computations (Chezy's equation, Kutter's and Manning's formula); Most economical sections – rectangular, triangular and trapezoidal channels, condition for maximum discharge and maximum velocity through circular channels, conveyance and section factor

Flow measurement in channels – notches and weirs – Discharge equations of rectangular weir, triangular weir, trapezoidal and Cipoletti weir, submerged weir, broad crested weir.

Module 5: Flow Transitions in Open Channels – Specific Energy, Critical Flow, and Hydraulic Jump (9 Hours)

Specific energy - specific energy diagram and discharge diagram, Critical flow and its computation. Gradually varied flow, Dynamic equation of gradually varied flow - Rapidly varied flow - Hydraulic jump - conjugate or sequent depths, expression for sequent depths and energy loss for a hydraulic jump in horizontal rectangular channels, types uses and characteristics of hydraulic jump.

Text Books:

1. Modi P. N. and S. M. Seth, Hydraulics & Fluid Mechanics, S.B.H Publishers, New Delhi, 2002.
2. R. K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd.
3. Subramanya K., Theory and Applications of Fluid Mechanics, Tata McGraw-Hill, 1993.
4. Subramanya K., Flow in Open channels, Tata McGraw-Hill, 2009.

Reference Books:

1. Streeter. V.L. Fluid Mechanics, Mc Graw Hill Publishers.
2. Bruce R Munson, Donald F Young. Fundamentals of Fluid Mechanics, John Wiley & sons, 2011.
3. Arora. K.R. Fluid Mechanics, Hydraulics and Hydraulic Machines, Standard Publishers, 2005.
4. Kumar. D.N. Fluid Mechanics and Fluid power Engineering, S. K. Kataria & sons, 2013.
5. Jain A. K., Fluid Mechanics, Khanna Publishers, Delhi, 1996.
6. Narayana Pillai, N. Principles of Fluid Mechanics and Fluid Machines, University Press, 2011.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Subtopics / Concepts	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Fluid properties (mass density, specific weight, viscosity, specific gravity), Classification of Fluids.	2
1.2	Fluid statics - fluid pressure and variation of pressure in a fluid, Pressure head	1
1.3	Measurement of fluid pressure using piezometers and manometers, U-tube manometers - Numerical Problems	3

1.4	Forces on immersed plane placed vertical and inclined Positions - Numerical Problems	2
1.5	Hydrostatic force on curved surfaces – Practical application of total pressure on spillway gates	1
2	**Module 2**	**9 hours**
2.1	Buoyancy and Floatation: Buoyant force, Principle of floatation, stability of floating and submerged bodies	2
2.2	Metacentre and metacentric height, analytical and experimental determination of metacentric height - Numerical Problems	3
2.3	Hydrodynamics - Methods of describing fluid motion, Lagrangian and Eulerian methods, velocity and acceleration	2
2.4	Types of fluid flow, description of fluid flow - streamline, pathline and streakline; continuity equation in one, two and three dimensions - Numerical Problems	2
3	**Module 3**	**9 hours**
3.1	Fluid kinetics - forces considered in describing fluid motion, Derivation of Bernoulli's equation by integration of Euler's equation along a streamline	2
3.2	Applications of Bernoulli's equation - Venturimeter, Pitot tube and Orificemeter - Numerical Problems	2
3.3	Pipe flow - computation of major and minor losses in pipes	2
3.4	Hydraulic gradient line and total energy line, pipes in series - equivalent pipe, flow through parallel pipes - Numerical Problems	3
4	**Module 4**	**9 hours**
4.1	Open channel flow – comparison between pipe flow and open channel flow, velocity distribution in open channels	2
4.2	Types of channels, type of flow, geometric elements of channel section, uniform flow computations (Chezy's equation, Kutter's and Manning's formula) - Numerical Problems	2

4.3	Most economical sections – rectangular, triangular and trapezoidal channels, condition for maximum discharge and maximum velocity through circular channels, conveyance and section factor - Numerical Problems	2
4.4	Flow measurement in channels – notches and weirs – Discharge equations of rectangular weir, triangular weir, trapezoidal and Cipolletti weir, submerged weir, broad crested weir - Numerical Problems	3
5	**Module 5**	**9 hours**
5.1	Specific energy - specific energy diagram and discharge diagram, Critical flow and its computation - Numerical Problems	3
5.2	Gradually varied flow, Dynamic equation of gradually varied flow	2
5.3	Rapidly varied flow - Hydraulic jump - conjugate or sequent depths, expression for sequent depths and energy loss for a hydraulic jump in horizontal rectangular channels	2
5.4	Types, uses and characteristics of hydraulic jump	2
Total		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1): Understand and describe the type, characteristics or properties of fluid flow and to apply the fundamental concepts in estimating fluid pressure and forces.

1. Differentiate gauge pressure, atmospheric pressure, and absolute pressure.
2. Determine the total pressure on a circular plate of diameter 1.5 m placed vertically in water with the center of the plate 3 m below the free surface. Find the center of pressure.
3. A square aperture in the vertical side of a tank has one diagonal vertical and is completely covered by a plane plate hinged along one upper side of the aperture. The diagonals of the aperture are 2.4 m long and the tank contains a liquid of specific gravity 1.2. The center of the aperture is 1.8 m below the free surface. Calculate the thrust exerted on the plate by the liquid and the position of the center of pressure.

Course Outcome 2 (CO 2): Apply the concepts of Buoyancy and Floatation to understand the hydrodynamics of fluid flow.

1. State the stability conditions of floating bodies.
2. Show that a cylindrical buoy of 1 m diameter and 2 m height weighing 10 kN will not float vertically in seawater of density 1030 kg/m^3. Find the force necessary in a vertical chain attached at the center of the base of the buoy that will keep it vertical.
3. Derive the continuity equation in 3-dimensional Cartesian coordinates.
4. An unsteady velocity field is given by $u = t^2 + 3y$ and $v = 4t + 5x$. Calculate the acceleration at the point (5, 3) at time $t = 2$ units.

Course Outcome 3 (CO 3): Understand and apply the concepts of Fluid kinetics and flow through pipes

1. Giving the assumptions, derive Bernoulli's Equation from Euler's equation of motion.
2. A venturimeter 20 cm × 10 cm is provided in a vertical pipeline to measure the flow of oil of relative density 0.9. The difference in elevations of the throat section and entrance section is 30 cm, with the flow being vertically upwards. The oil-mercury differential U-tube manometer shows a gauge deflection of 10 cm. Calculate the discharge of oil and the pressure.
3. A pipeline of 600 mm diameter is 1.5 km long. To increase the discharge, another pipe of the same diameter is introduced in parallel to the first pipe, for the second half of the length. If $f = 0.04$ and the head at the inlet is 300 mm, calculate the increase in discharge. Neglect minor losses.

Course Outcome 4 (CO 4): Analyse and compute the flow through open channels.

1. The flow in a 2.2 m wide rectangular channel is measured by a rectangular weir with crest length 1 m and height 0.6 m. Find the discharge in the channel when the head over the weir is 0.3 m. Take $C_a = 0.62$. Consider end contractions and velocity of approach.
2. Explain the characteristics of velocity distribution in open channels.
3. Define the terms hydraulic depth and hydraulic radius.

Course Outcome 5 (CO 5): Analyse various types of flow in open channels

1. Derive the dynamic equation of gradually varied flow in a channel, stating the assumptions involved.
2. A rectangular channel 8 m wide carries a discharge of 15 m^3/s. If the depth of flow is 1.2 m determine:
   i) specific energy of water flowing through the channel,
   ii) critical depth and critical velocity, and
   iii) Froude number.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T02

Course Name: FLUID MECHANICS & HYDRAULICS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Define specific gravity. How is it different from specific weight?
2. An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil. Determine the total pressure on the plate.
3. How will you determine the metacentric height of a floating body experimentally? Explain with the help of a neat sketch.
4. Differentiate streamline, streakline, and pathline.
5. Explain the use and principle of a Pitot tube.
6. Explain hydraulic gradient line and total energy line with a sketch.
7. Obtain the hydraulic depth and hydraulic mean depth of a triangular channel.
8. What is a Cipolletti weir? Give its significance.
9. Differentiate between:
   i) Gradually varied flow and rapidly varied flow.
   ii) Subcritical flow and supercritical flow.
10. Explain the classification of hydraulic jump based on the Froude number.

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE 1

11. a) Differentiate gauge pressure, atmospheric pressure and absolute pressure. (4)

    b) A U-tube manometer is used to measure the pressure of water in a pipeline which is in excess of atmospheric. The left limb is connected to the pipeline and right limb is open to atmosphere. The free surface of mercury in the right limb is in level with the centre line of the pipe and the level difference of mercury in the limbs of the manometer is 20 cm. Compute the water pressure in the pipeline. If the pressure of water is increased by 50%, compute the manometric reading. (10)

OR

12. a) Obtain the expressions for total pressure and centre of pressure of a lamina placed in fluid in vertical position. (7)

    b) A rectangular opening 2m wide and 1m deep in the vertical side of a tank is closed by a sluice gate of the same size. The gate can turn about the horizontal centroidal axis. The head of water above the upper edge of the gate is 1.5m. Determine (i) the total pressure on the sluice gate and (ii) the torque on the sluice gate. (7)

MODULE 2

13. A rectangular pontoon 10 m long, 7 m broad and 2.5 m deep weighs 700 kN. It carries an empty boiler of 5 m diameter and 590 kN weight on its upper deck. The centre of gravity of the boiler and the pontoon are at their respective centres along a vertical line. Find the metacentric height. Weight density of sea water is 10.104 kN/m^3. (14)

OR

14. a) Derive the continuity equation in 3D Cartesian coordinates. (8)

    b) Find the acceleration at (1, 2, 3) after 1 sec for a 3D flow given by $u = yz + t$, $v = xz - t$, $w = xy$. (6)

MODULE 3

15. Gasoline (specific gravity 0.82) flows at a rate of 215 l/s in upward direction through an inclined venturimeter fitted to a 300 mm diameter pipe. The venturimeter is inclined at 60° to vertical and its 150 mm diameter throat is 1.2 m from the entrance along its length. Pressure gauges inserted at the inlet and throat show pressures of 0.141 N/mm^2 and 0.077 N/mm^2 respectively. Compute the coefficient of discharge of the venturimeter. If instead of pressure gauges, the entrance and throat are connected to two limbs of a mercury u-tube manometer, determine the manometric reading. (14)

OR

16. A pipeline with diameter 80 cm and length 3000 m connects two open reservoirs of water which have their surface elevations of 100 m and 70 m above a datum. In order to increase the flow rate between the reservoirs by 20%, it is decided to lay an additional pipe of same diameter in parallel to the first one. The second pipeline is to be originated from the upper reservoir and is to be connected at some suitable point. Determine the point of connection, assuming the friction factor as 0.04 for both the lines. Neglect minor losses.

MODULE 4

17. a) Explain the characteristics of velocity distribution in open channels. (4)

    b) A lined canal $n = 0.014$ is of trapezoidal section with one side vertical and other with a slope of 1.5H:1V. If the channel is to deliver 9 m^3/s when laid on a slope of 0.0002, calculate the dimensions of the efficient section that requires minimum lining. (10)

OR

18. a) A trapezoidal channel discharging water at the rate of 10 m^3/s is to be designed for the most economical section. Find the bottom width of the channel and depth of water. The side slope is 60°. Take bed slope as 1 in 750 and Chezy's constant as 66. (10)

    b) Explain the characteristics of velocity distribution in open channels. (4)

MODULE 5

19. a) Stating the assumptions underlying it, derive the dynamic equation of gradually varied flow. (10)

    b) A rectangular channel 2 m wide carries a discharge of 6 m^3/s. Calculate the critical depth and specific energy at critical depth. (4)

OR

20. a) Explain the specific energy diagram. (5)

    b) In a hydraulic jump occurring in a horizontal rectangular channel, the initial and sequent depths are 0.2 m and 1.2 m respectively. Estimate the discharge per unit width and the energy loss. (9)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T03	FUNCTIONAL PLANNING OF BUILDINGS	2	1	0	2	3	2024

Preamble

This course introduces students to the fundamental concepts of building planning, focusing on design fundamentals, performance factors, and functionality. Students learn about building services, sustainability, and Kerala building rules. Through this course, students apply their knowledge to create buildings that are safe, efficient, sustainable, and meet the needs of their occupants.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Apply building planning, site selection, and aesthetics principles to design functional and visually appealing buildings. (Cognitive knowledge level: Apply).
CO 2	Apply lighting, ventilation, acoustics, and thermal comfort principles to create healthy, comfortable, and functional indoor environments. (Cognitive knowledge level: Apply).
CO 3	Prepare detailed building plans and working drawings for residential and commercial buildings in compliance with Kerala Building Rules. (Cognitive knowledge level: Apply).
CO 4	Explain the integration of electrical, plumbing, HVAC, vertical transportation, and fire safety systems in buildings. (Cognitive knowledge level: Understand).
CO 5	Apply sustainable engineering concepts and intelligent building technologies to develop green and intelligent buildings. (Cognitive knowledge level: Apply).

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2			2				1			
CO 2	3	2			2	1		1		1		
CO 3	3	2	3		2							1
CO 4	3			2		1	1				1	
CO 5	3	2			2		3		1			1

Assessment Pattern

Functional Planning Of Buildings			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember			
Understand	40	40	40
Apply	60	60	60
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have a maximum of 2 sub - divisions.

SYLLABUS

Module 1: Building Planning and Aesthetics (6 hours)

Building Planning, Site selection, Principles of planning: Aspect, Prospect, Grouping, Economy, Roominess, Circulation, Flexibility, Furniture requirements, Elegance, Sanitation.
Fundamentals of building physics: Orientation-Factors affecting orientation, building form & internal layout, Building Envelope Essentials: Factors to Consider.
Aesthetics: Elements of aesthetics - Harmony, Colors, Mass, Balance, Space, Decoration, Proportion, Patterns, Symmetry.

Module 2: Building Performance Factors (6 hours)

Natural Lighting - Daylight factor, Principles of effective natural lighting, Artificial Lighting - Illumination requirements.
Ventilation - Functional requirements of ventilation system, Systems of ventilation.
Acoustics in functional planning-Basic concepts: sound, noise, and acoustical comfort, sound absorption materials, Acoustical considerations for offices, hospitals, industrial buildings, auditoriums and small lecture halls.
Thermal Comfort - Factors affecting thermal comfort.
Climate- climatic zones in India, orientation and shape of buildings.

Module 3: Functional requirements of buildings (10 hours)

Functional requirements of buildings – Different functional units of a building- Requirements as per KBR regarding Exterior and interior open space, Area and Height limitations, Parking, Parts of building - Staircase, Door, Passage, Sanitation, Lighting, Ventilation, Setback, clearance from electric lines. Requirement as per KBR for High rise building regarding Staircase, Parapets, Fire escape staircase, Ducts, Access, Open spaces, lift, Safety plan.
Preparation of line sketches and working drawings of residential buildings and commercial buildings as per area and functional requirements. Preparation of site plan as per Kerala Building Rules.
NBC - classification of building - Guidelines for residential, commercial and high-rise building.

Module 4: Building Services (8 hours)

Integration of Services in Buildings - Electrical system components and typical electrical layout diagram, Plumbing design criteria and water supply layout for a residential building, Typical details of sewage disposal arrangements for residential buildings.
HVAC and vertical transportation-Basic concept of HVAC load calculation (ASHRAE standards), functioning of elevators and escalators.
Fire Safety - Causes of fire and mechanism of fire spread in buildings - Fire alarm system and means of escape - Firefighting installations.

Module 5: Sustainable and Smart Buildings (6 hours)

Innovative Concepts of Functionality - Sustainable Engineering - Concept of green building, Green materials and equipment, green building certification - GRIHA - Intelligent building

- Dimensions of intelligent building, Building Automation system - Design issues related to building automation and its effect on functional efficiency - components and functions, modern security system, inter-communication, monitoring devices, Intelligent lighting system, Case studies of green and intelligent buildings.

Textbooks:

1. Balagopal & T. S. Prabhu, *Building Drawing & Detailing*, Spades Publishers and Distributors, Calicut.
2. Wayne Forster and Dean Hawkes, *Energy Efficient Buildings: Architecture, Engineering, and Environment*, W.W. Norton Company Inc., 2002.
3. Monojit Chakraborti, *Civil Engineering Drawing Including Architectural Aspects*, Kolkata: Bhaktivendanta Book Trust, 2013.
4. Ketki Rangwala Dalal, *Essentials of Civil Engineering*, Charotar Publishing House, Gujarat.
5. Satish Chandra Agarwala, *Architecture and Town Planning*, J.C. Kapur for Dhanpat Rai & Sons Publishers.
6. *Building Technology and Valuation*, Technical Teachers Training Institute.
7. Dr. B. C. Punmia, Er. Ashok K. Jain, Dr. Arun K. Jain, *Building Construction*, Lakshmi Publication Pvt. Ltd., New Delhi.
8. Marshall Long, *Architectural Acoustics*, Second Edition, Academic Press, Waltham, USA, 2014.

References:

1. B. P. Varma, *Civil Engineering Drawing and House Planning*, Khanna Publishers, Delhi.
2. Pritchard, D. C., *Lighting*, Longman Scientific & Technical, Harlow, 1995.
3. Bureau of Energy Efficiency, India, *Design Guidelines for Energy Efficient Multi-Storey Buildings*, 2014.
4. M. V. Chitawadagi, S. S. Bhavikatti, *Building Planning and Drawing*, Dreamtech Press, 2019.
5. F. Hall, *Building Services and Equipment: Volume 1*, Routledge Publishers, 2016.
6. SP 7:2016, *National Building Code of India 2016 (NBC 2016)*, Volume-1 and Volume-2.
7. SP 41, *Handbook on Functional Requirements on Building – Other than Industrial Buildings.*
8. *Kerala Municipal Building Rules*, 2019.
9. David T. Allen, David R. Shonnard, *Sustainable Engineering*, Pearson Publishers, 2011.

Course Project:

1. Prepare the plan for a single-storey residential building on a plot of size 16 m × 25 m. Draw the site plan and layout at a scale of 1:100, a typical sectional view, and elevation.

2. Design a two-storey commercial building (office space) on a plot of size 20 m × 30 m. Prepare the following drawings: Site plan, Ground floor layout, First floor layout, Typical sectional view, and Elevation.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**6 hours**
1.1	Building Planning, Site selection	1
1.2	Principles of planning: Aspect, Prospect, Grouping, Economy, Roominess, Circulation, Flexibility, Furniture requirements, Elegance, Sanitation	2
1.3	Fundamentals of building physics: Orientation-Factors affecting orientation, building form & internal layout, Shading & Daylight, Building Envelope Essentials: Factors to Consider.	2
1.4	Aesthetics: Elements of aesthetics-Harmony, Colors, Mass, Balance, Space, Decoration, Proportion, Patterns, Symmetry.	1
2	**Module 2**	**6 hours**
2.1	Natural Lighting - Daylight factor, Principles of effective natural lighting, Artificial Lighting - Illumination requirements.	1
2.2	Ventilation - Functional requirements of ventilation system, Systems of ventilation.	1

2.3	Acoustics in functional planning-Basic concepts: sound, noise, and acoustical comfort, sound absorption materials, Acoustical considerations for offices, hospitals, industrial buildings, auditoriums and small lecture halls.	2
2.4	Thermal Comfort - Factors affecting thermal comfort.	1
2.5	Climate- climatic zones in India, orientation and shape of buildings.	1
3	**Module 3**	**10 hours**
3.1	Functional requirements of buildings – Different functional units of a building	1
3.2	Requirements as per KBR regarding Exterior and interior open space, Area and Height limitations, Parking, Parts of building - Staircase, Door, Passage, Sanitation, Lighting, Ventilation, Setback, clearance from electric lines.	2
3.3	Requirement as per KBR for High rise building regarding Staircase, Parapets, Fire escape staircase, Ducts, Access, Open spaces, lift, Safety plan.	2
3.4	Preparation of line sketches and working drawings of residential buildings and commercial buildings as per area and functional requirements.	3
3.5	Preparation of site plan as per Kerala Building Rules.	1
3.6	NBC- classification of building - Guidelines for residential, commercial and high-rise building.	1
4	**Module 4**	**8 hours**
4.1	Integration of Services in Buildings - Electrical system components and typical electrical layout diagram,	2
4.2	Plumbing design criteria and water supply layout for a residential building, Typical details of sewage disposal arrangements for residential buildings.	2
4.3	HVAC and vertical transportation-Basic concept of HVAC load calculation (ASHRAE standards), functioning of elevators and escalators.	2

4.4	Fire Safety-Causes of fire and mechanism of fire spread in buildings -Fire alarm system and means of escape - Firefighting installations.	2
5	**Module 5**	**6 hours**
5.1	Innovative Concepts of Functionality - Sustainable Engineering-Concept of green building, Green materials and equipment, green building certification-GRIHA	2
5.2	Intelligent building- Dimensions of intelligent building, Building Automation system- Design issues related to building automation and its effect on functional efficiency -components and functions	2
5.3	Modern security system, inter-communication, monitoring devices, Intelligent lighting system, Case studies of green and intelligent buildings	2
Total Hours		**36 hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Apply building planning, site selection, and aesthetics principles to design functional and visually appealing buildings. (Cognitive knowledge level: Apply).

1. What are the key factors to consider when selecting a building site, and how do they impact the design of the building?
2. How do orientation, affect the performance of a building?
3. What are the essential factors to consider when designing a building envelope, and how do they impact the building's energy efficiency?

Course Outcome 2 (CO2): Apply lighting, ventilation, acoustics, and thermal comfort principles to create healthy, comfortable, and functional indoor environments. (Cognitive knowledge level: Apply).

1. What is the daylight factor, and how is it used to evaluate natural lighting in buildings?
2. Describe the factors affecting thermal comfort in buildings.
3. An auditorium is being designed for a university. How would you apply acoustical considerations to ensure optimal sound quality and acoustical comfort for the audience?

Course Outcome 3 (CO3): Prepare detailed building plans and working drawings for residential and commercial buildings in compliance with Kerala Building Rules. (Cognitive knowledge level: Analyse).

1. What are the area and height limitations as per Kerala Building Rules (KBR)?
2. Explain the requirements of exterior and interior open spaces as per KBR
3. Draw the site plan of a residential building with setbacks to urban area to plot of size 12 m x 22 m.

Course Outcome 4 (CO4): Explain the integration of electrical, plumbing, HVAC, vertical transportation, and fire safety systems in buildings. (Cognitive knowledge level: Understand).

1. Draw an electrical layout for one bed room residential building showing at least four components.
2. Explain the components of a fire alarm system and means of escape in buildings, including the requirements for fire safety.
3. Explain the basic concept of HVAC load calculation as per ASHRAE standards, including the factors that affect HVAC load

Course Outcome 5 (CO5): Apply sustainable engineering concepts and intelligent building technologies to develop green and intelligent buildings. (Cognitive knowledge level: Apply).

1. What is an intelligent building and its key dimensions?
2. Describe the process of green building certification, including the criteria and requirements.
3. Describe the modern security systems used in intelligent buildings, including intercommunication and monitoring devices

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T03

Course Name: FUNCTIONAL PLANNING OF BUILDINGS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Enlist various factors to be considered in selecting a site for residential building?
2. Describe the factors affecting orientation in building design.
3. Define daylight factor in natural lighting.
4. List the types of sound absorption materials.
5. How do the planning of a public building differ from planning of a residential building?
6. State the importance of site plan in submission drawings.
7. Enumerate the components of a fire alarm system?
8. Describe the requirements for sewage disposal arrangements in residential buildings?
9. Describe the benefits of using intelligent lighting systems in buildings.
10. List the benefits of using green materials in building design.

PART B

Answer any one question from each module. Each question carries 14 marks

11. Explain the principles of building planning, including aspects, prospect, grouping, economy, roominess, circulation, flexibility, furniture requirements, elegance, and sanitation.

OR

12. Explain the elements of aesthetics in building design, including harmony, colors, mass, balance, space, decoration, proportion, patterns, and symmetry.

13. Describe the different systems of ventilation, including natural, mechanical, and hybrid systems.

OR

14. An industrial facility is experiencing high noise levels due to machinery and equipment. What acoustic solutions can be implemented to reduce noise levels and improve worker safety?

15. Fig. - l shows a line plan of load bearing residential building. Draw developed plan with suitable scale. Show all dimensions and table the parts.
Data: 1) Plinth height 0.75 m. 2) Assume Chajjas projection 450 mm. 3) Wall thickness 300 mm for external and 230 mm for internal walls. 4) Assume suitable data if required.

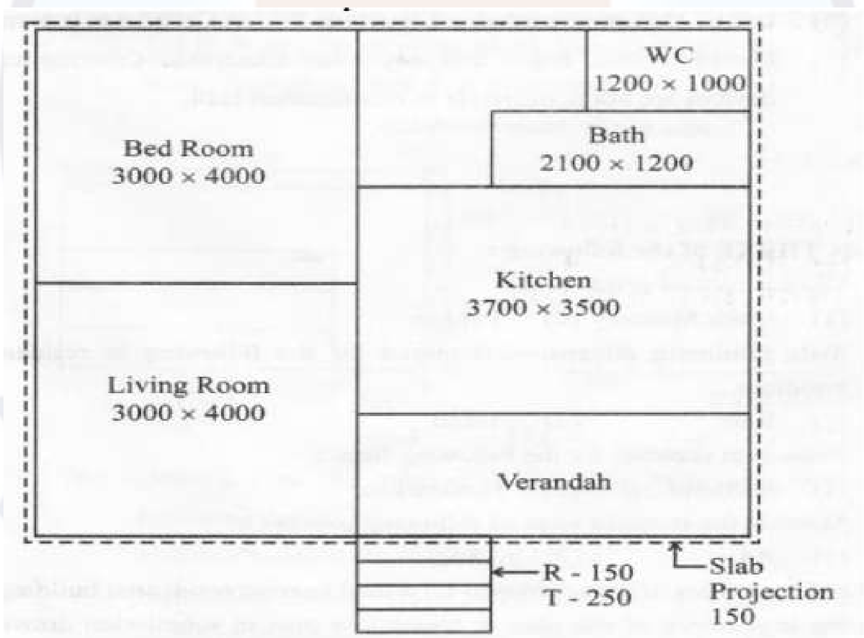


Fig.-1

OR

16. Enumerate the basic principles underlying building byelaws and also limitations for the built-up area.

17. Explain the basic concept of HVAC load calculation as per ASHRAE standards and its importance in building design.

OR

18. Discuss the components of an electrical system in a building, including the typical electrical layout diagram.

19. Describe the process of green building certification, including the benefits and requirements.

OR

20. Discuss a case study of an intelligent building, including its design features and benefits.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24HU2T02	ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS	2	1	0	2	3	2024

Preamble

In today's rapidly evolving world, engineers must go beyond technical expertise and develop entrepreneurial, managerial, and business acumen to drive innovation and create impact. This course equips students to identify opportunities, develop scalable business models, and apply modern management and marketing strategies. Through activity-based learning, case studies, and real-world problem-solving, students will gain practical insights into leadership, business analysis, and intellectual property rights (IPR), preparing them for startups, corporate leadership, and innovation-driven industries.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand key principles and functions of management to grasp modern managerial roles (Cognitive Knowledge Level: Understand)
CO 2	Explain the fundamentals of managing people and processes through effective staffing, motivation, leadership, and control strategies. (Cognitive Knowledge Level: Understand)
CO 3	Apply modern marketing strategies and digital transformation to build sustainable businesses. (Cognitive Knowledge Level: Apply)
CO 4	Understand the basics of idea pitching, managing finances and using modern marketing tools.(Cognitive Knowledge Level: Understand)
CO 5	Understand Intellectual Property Rights (IPR) and legal frameworks to protect innovation and navigate startup challenges.(Cognitive Knowledge Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						1		1	1	1	2	2
CO 2						1		1	2	2	2	2
CO 3											3	2
CO 4											2	2
CO 5						1	1			1	2	2

Assessment Pattern

Entrepreneurship And Management Skills For Engineers			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	40	30	30
Understand	60	50	50
Apply		20	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions (2 questions from each module), of 3 marks each and the student should answer all the questions. Part B contains 2 questions from each module of which student should answer anyone. Each question can have a maximum of 2 sub-divisions and carry 14 marks.

SYLLABUS

Module 1: (6 Hours)

Functions of Management: Introduction to Management: Definitions and scope - Core Functions - Levels of Management - Evolution of Management Thought: Scientific Management (F.W. Taylor), Administrative Management (Henri Fayol), Modern Approaches - Planning and Types of Plans - Organizational Structures: Departmentalization.

Module 2: (7 Hours)

Manpower Planning, Leadership & Control: Staffing - Motivation Theories – Leadership - Understanding Negotiation in Leadership: Types of Negotiation – Barriers to effective communication - Activity-based learning.

Module 3: (8 Hours)

Entrepreneurial Thinking & Business Design: Entrepreneurial Mindset: Growth mindset, risk-taking, and decision-making - Finding a Good Business Idea - How to prepare an Empathy canvas, Value proposition canvas and Idea canvas - Digital Business Models: Freemium, Subscription, Platform-based - Business Model Canvas: Develop and visualise the business model.

Module 4: (6 Hours)

Startup Pitching, Marketing & Financials: Startup Financials: Revenue models, cost structure, funding stages, valuation basics - Investor Pitching: Structure of a pitch deck, communicating value, funding strategy - Digital branding, social media, performance marketing - Growth Strategies: Network effects, influencer marketing, CRM tools.

Module 5: (9 Hours)

Intellectual Property Rights (IPR) and Legal Framework Overview of Intellectual Property Rights (IPR) - Product patents, Process patents- Prerequisites for filing a patent: Novelty, Inventive step, Industrial applicability -Provisional vs Complete application - Common mistakes to avoid before filing - Anatomy of a Patent Document - Overview of databases - Legal Aspects of Startups- Business Registrations and Legal structures – Compliance & Regulatory Requirements.

Reference Books:

1. Ricky W. Griffin, Jean M. Phillips & Stanley M. Gully, Organizational Behavior: Managing People and Organizations, Cengage Learning, 12th Edition, 2019.
2. Stephen P. Robbins & Timothy A. Judge, Organizational Behavior, Pearson Education, 18th Edition, 2019.
3. Heidi M. Neck, Christopher P. Neck & Emma L. Murray, Entrepreneurship: The Practice and Mindset, SAGE Publications Inc., 3rd Edition, 2023.
4. Alejandro Cremades, The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know, Wiley, 2023.
5. Dr R. Radhakrishnan & Dr S. Balasubramanian, Intellectual Property Rights: Text and Cases, Excel Books, 2008.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Subtopics / Concepts	No. of Lecture/ Tutorial Hours
1	**Module 1**	**6 hours**
1.1	Introduction to Management: Definitions and scope - Core Functions: Planning, Organizing, Staffing, Directing, Controlling. - Levels of Management: Top, Middle, Lower.	1
1.2	Evolution of Management Thought: Classical approaches -F.W. Taylor, Henri Fayol - Modern Approaches: Systems approach, Contingency approach.	1
1.3	Planning: Importance and steps in planning (objectives, alternatives, evaluation, selection). Types of plans: Strategic, Tactical, Operational, Contingency.	2
1.4	Organizational Structure, Types of Organizational Structures: Functional, Divisional, Matrix, Flat vs. Tall Organizations, Impact of Structure on Business Operations.	2
2	**Module 2**	**7 hours**
2.1	Manpower Planning, Job Analysis, Recruitment vs Selection - Motivation Theories: Maslow's Hierarchy of Needs, Herzberg's Two-Factor Theory.	2

2.2	Leadership theories: Theory X and Theory Y- Leadership Styles: Autocratic, Democratic, Laissez-faire - Application and effectiveness in various organizational contexts.	2
2.3	Understanding Negotiation in Leadership: Types of Negotiation: Distributive vs. Integrative, Understanding when to compete and when to collaborate. Team building.	2
2.4	Communication Types: Formal and Informal - Barriers to effective communication. Communication distortion. Case studies.	1
Activity-Based Learning: Leadership Roll Playing Simulation: Real-life negotiation scenarios such as investor discussions or conflict resolution between co-founders to practice persuasive communication and strategic thinking.		
3	**Module 3**	**8 hours**
3.1	Entrepreneurial Mindset – Growth mindset, risk-taking, and decision-making.	2
3.2	Finding a Good Business Idea - Looking around for real-life problems people face. How to prepare an Empathy canvas, value proposition canvas and Idea canvas.	2
3.3	Planning Your Business on One Page - Use a simple chart called the Business Model Canvas.	2
3.4	How Online Businesses Make Money - Freemium Model (Free basic version, pay for extra features) - Subscription Model (Monthly/Yearly payments for continuous use) - Platform Model (Connecting buyers and sellers, like Amazon or Swiggy).	2
Activity: The students may be encouraged to make a Business model plan of their choice.		
4	**Module 4**	**6 hours**
4.1	Startup financials - Key Financial Terms: Revenue, cost, profit, cash flow, gross margin, net profit, burn rate, turnover, ask - Types of Revenue Models, cost structure, funding stages, valuation basics.	2
4.2	Investor Pitching – Structure of a pitch deck, communicating value, and funding strategy.	2

4.3	Modern Marketing – Digital branding, social media, performance marketing - Growth Strategies: Network effects, influencer marketing, CRM tools.	2
5	**Module 5**	**9 hours**
5.1	Overview of Intellectual Property Rights (IPR) - What is a patent and why does it matter - Types of patentable subject matter: Product Patents, Process Patents- Prerequisites for filing a patent: Novelty, Inventive step, Industrial applicability.	2
5.2	Provisional vs Complete application - When to file a patent (timing strategy for start-ups) - Common mistakes to avoid before filing (e.g., disclosing ideas publicly)	1
5.3	Anatomy of a Patent Document: Title, Abstract, Background, Claims, Drawings - Indian vs International Patents: Filing paths and differences (PCT vs national phase) - Overview of databases: Google Patents, USPTO, WIPO, Espacenet.	2
5.4	Business Registrations & Legal Structures - Types of business entities: Sole Proprietorship, Partnership, LLP, Private Ltd, OPC. Startup India Registration – Benefits & Eligibility.	2
5.5	Compliance & Regulatory Requirements - GST Registration, ROC Filings. Startup Taxation & Incentives. Taxes applicable to startups (Income Tax, GST, TDS, Angel Tax). Tax Benefits for Startups under Section 80-IAC & DPIIT.	2
Total		**36 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Explain the core functions of management and how they support effective organizational operations.
2. How do different levels of management (top, middle, lower) contribute to achieving business goals?
3. Explain the difference between classical and modern approaches to management thought.

Course Outcome 2 (CO 2):

1. How do Maslow's Hierarchy of Needs and Herzberg's Two-Factor theory explain employee motivation in the workplace?
2. Enumerate the key differences between Theory X, Theory Y, and Theory Z, and how they influence leadership styles.
3. How do BATNA and ZOPA help leaders make effective negotiation decisions during team conflicts or business deals?

Course Outcome 3 (CO 3):

1. Use the Business Model Canvas to design a simple online learning platform. Include key elements such as customer segments, revenue model, and value proposition.
2. Prepare an Idea Canvas for a mobile app that helps local farmers sell directly to customers. Explain how this solution fits a real-world problem.
3. Choose one digital business model (freemium, subscription, or platform-based) and apply it to a startup idea of your choice. Explain how this model supports long-term business sustainability.

Course Outcome 4 (CO 4):

1. Explain the key components of a startup pitch deck and their role in communicating value to investors.
2. Describe the difference between a revenue model and a cost structure, and why both are important in startup financial planning.
3. What is digital branding, and how can tools like social media and influencer marketing help a new business grow?

Course Outcome 5 (CO 5):

1. Discuss the key differences between product patents and process patents.
2. Explain the basic prerequisites for filing a patent.
3. List any three types of legal business structures in India and describe how choosing the right structure supports startup compliance.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24HU2T02

Course Name: ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Define the core functions of management with a brief explanation.
2. Differentiate between flat and tall organisational structures.
3. Explain the key difference between Maslow's and Herzberg's motivation theories.
4. Differentiate between distributive and integrative negotiation with one example each.
5. List any three key components of the Business Model Canvas and explain their purpose.
6. Explain the concept of a growth mindset in the context of entrepreneurship.
7. State the meaning of 'burn rate' and why it is important for startups.
8. Mention any two components of a startup pitch deck and explain their importance.
9. State the difference between a provisional and a complete patent application.
10. List any two legal compliance requirements for a startup after registration.

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE 1

11. a) Illustrate the three levels of management with suitable examples and describe the role of each in organizational decision-making. (7 Marks)

b) Discuss the different types of plans (strategic, tactical, operational, contingency) with examples, and explain how they guide managerial actions. (7 Marks)

OR

12. a) Explain the five core functions of management and discuss their importance in running a business efficiently. (7 Marks)

b) Compare the classical management theories of F.W. Taylor and Henri Fayol with modern approaches like systems and contingency theory. (7 Marks)

MODULE 2

13. a) Describe Herzberg's Two-Factor Theory and Maslow's Hierarchy of Needs. How can managers apply them to motivate employees? (7 Marks)

b) Explain the steps involved in manpower planning and differentiate between recruitment and selection with examples. (7 Marks)

OR

14. a) You are leading a startup team facing internal disagreements. Explain how different types of negotiation and leadership styles can help resolve the conflict. (7 Marks)

b) Discuss the impact of communication barriers on leadership effectiveness and provide examples of how leaders can overcome them. (7 Marks)

MODULE 3

15. a) Imagine you've identified a problem faced by college students — difficulty in finding affordable and quality food near campus. How would you use an Idea Canvas to shape a possible business solution? (7 Marks)

b) You are building a mobile app that alerts users about air quality levels in real time. Using an Empathy Canvas, explain how you would understand the daily experience of urban commuters who are your target users. (7 Marks)

OR

16. a) A team of students has developed a low-cost, portable device to detect water leakage in household plumbing systems. Using the Value Proposition Canvas, explain how this solution fits the needs of middle-income homeowners. (7 Marks)

b) A startup team has developed a low-cost solar-powered drying solution to help small-scale agricultural producers reduce post-harvest losses. Using the Business Model Canvas, outline their customer segments, key partners, and value proposition. (7 Marks)

MODULE 4

17. a) A product-based startup is working on modular housing solutions designed for quick deployment in disaster-hit regions. Describe how the team can develop a strong investor pitch focusing on revenue model, scalability, and social impact. (7 Marks)

b) A D2C (Direct-to-Consumer) skincare brand is looking to expand via digital platforms. Explain how influencer marketing and CRM tools can be integrated to build customer loyalty and drive conversions. (7 Marks)

OR

18. a) A new mobile app startup wants to attract early investors. Explain the importance of understanding financial terms such as revenue, burn rate, and valuation when preparing for funding. Use simple examples to support your answer. (7 Marks)

    b) A startup developing a wearable health monitoring device is preparing to pitch to early-stage investors. Outline the essential components that should be included in their pitch deck. (7 Marks)

MODULE 5

19. a) A startup has created a catchy logo and app interface. Explain which types of IPR they need to protect and why each is important. (7 Marks)

    b) You have developed a unique cooling technology for electric bikes. Describe the steps you would follow to file a patent in India and explain how it helps protect your innovation. (7 Marks)

OR

20. a) Compare three common legal structures available for startups in India. For a tech-based service startup, which would you recommend and why? (7 Marks)

    b) What are the key tax benefits offered under the Startup India Scheme and Section 80-IAC? How do these help early-stage startups survive financially? (7 Marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2L03	SURVEYING LABORATORY	0	0	3	3	2	2024

Preamble

The objective of the course is to impart practical experience to students by exposing them to various techniques of field surveying. The course is designed to familiarise students with conventional and advanced surveying instruments.

Prerequisites: Surveying and Geomatics

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	To develop competency in differential and profile levelling techniques
CO 2	To impart proficiency in angular and linear measurements using theodolite and tacheometry
CO 3	To familiarize students with advanced surveying instruments such as total stations
CO 4	To introduce students to modern geospatial techniques like GNSS surveying
CO 5	To integrate surveying skills through a mini project focused on contouring and topographical mapping

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	0	2	1	0	0	0	1	0	0	2
CO 2	3	2	1	2	2	0	0	0	1	0	0	2
CO 3	2	1	1	2	3	0	0	0	0	0	0	2
CO 4	2	2	1	2	3	1	1	0	0	0	0	3
CO 5	2	2	3	2	2	1	1	1	2	2	2	2

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test	:	20 marks
Viva-Voce/Test	:	15 marks
Lab Record	:	5 marks

Note:
Marks shall not be awarded for the Lab Record in the End Semester Examination. However, students having a certified Lab Record are only eligible to appear for the End Semester Examination. A weightage of 30% of the total marks shall be given for the Viva-Voce in the End Semester Examination.

End Semester Examination (ESE) Pattern

The following guidelines should be followed regarding the award of marks:

Preliminary work	:	20 marks
Implementation / Conducting the experiment	:	20 marks
Performance, result and inference (usage of equipment and troubleshooting)	:	30 marks
Viva voce	:	30 marks

COURSE CONTENT
(Any 8 Experiments Are Mandatory)

Exp. No.	List of Experiments
1	Differential levelling
2	Profile levelling and cross sectioning
3	Distance between accessible points using Theodolite (Repetition Method)
4	Distance between inaccessible points using Theodolite (Repetition Method)
5	Level difference between points using Tangential Tacheometry
6	Distance, gradient, and level difference between two inaccessible points using total station
7	Determination of height of a tall building using total station
8	Determination of area and volume of an embankment using total station
9	Setting out works
10	GNSS surveying
11	Mini project – Contouring of a given area using total station or GNSS

Reference Books:

1. Dr. B.C Punmia , Ashok Kumar Jain &Arun Kumar Jain - Surveying , Laxmi publications (P) Ltd , 2005
2. C. Venkatramaiah, Textbook of Surveying, Universities Press (India) Private Limited 2011
3. Prof. T.P.Kenetkar & Prof.S.V.Kulkarni - Surveying and Levelling , Pune Vidyarthi Griha Prakashan,2004
4. R. Agor - A Text book of Surveying and Levelling, Khanna Publishers, 2005
5. S.K.Duggal - Surveying Vol. I, Tata McGraw Hill Ltd ,Reprint 2015. 6. S.K. Duggal - Surveying Vol. II, Tata McGraw Hill Ltd, Reprint 2015

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2L04	HYDRAULICS LABORATORY	0	0	3	3	2	2024

Preamble

The Fluid Mechanics and Machines Laboratory provides students with practical experience in understanding the behavior of fluids and the operation of fluid machinery. It focuses on key principles of fluid statics and fluid dynamics.

Prerequisites: Basic understanding about the Fluid mechanics.

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Calibrate flow measuring devices, such as venturimeter, orifice meter, and notches. (Cognitive Knowledge Level: Apply)
CO 2	Determine the metacentric height and radius of gyration of floating bodies. (Cognitive Knowledge Level: Apply)
CO 3	Investigate the hydraulic characteristics of orifices under both constant head and time for emptying methods to determine their discharge coefficients. (Cognitive Knowledge Level: Apply)
CO 4	Determine the losses and hydraulic coefficients in pipe and channel flows. (Cognitive Knowledge Level: Apply)
CO 5	Develop practical skills in fluid flow measurement and test on pump and turbine, enabling students to apply theoretical knowledge in real-world hydraulic systems . (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	3			2		3	2	1	1
CO 2	3	2	1	3			2		3	2	1	1
CO 3	3	2	1	3			2		3	2	1	1
CO 4	3	2	1	3			2		3	2	1	1
CO 5	3	2	1	3			2		3	3	1	1

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test	:	20 marks
Internal Test	:	15 marks
Record	:	5 marks

End Semester Examination Pattern

The following guidelines should be followed regarding the award of marks:

Preliminary work	:	20 marks
Implementation / Conducting the experiment	:	20 marks
Performance, result and inference (usage of equipment and troubleshooting)	:	30 marks
Viva voce	:	30 marks

SYLLABUS

LIST OF EXPERIMENTS

Exp. No	Description
1	Study of taps, valves, pipe fittings, gauges, and plumbing tools to understand their function, design, and application in fluid systems.
2	Study of the hydraulic ram to understand its application in lifting water using minimal energy.
3	Measurement of metacentric height and radius of gyration in floating bodies.
4	Calibration of a venturimeter to determine the coefficient of discharge.

Exp. No	Description
5	Calibration of an orifice meter to determine the coefficient of discharge.
6	Calibration of a water meter to determine the coefficient of discharge.
7	Calibration of a triangular notch to determine the coefficient of discharge.
8	Calibration of a rectangular notch to determine the coefficient of discharge.
9	Calibration of a trapezoidal notch to determine the coefficient of discharge.
10	Determination of Chezy's and Darcy's constants for pipe flow.
11	Determination of Chezy's and Manning's coefficients for open channel flow.
12	Determination of hydraulic coefficients of orifice under time for emptying method.
13	Determination of hydraulic coefficients of orifice under constant head method.
14	Performance test on Pelton turbine.
15	Performance test on Kaplan turbine.
16	Performance test on Francis turbine.
17	Performance test on a centrifugal pump.
18	Performance test on a reciprocating pump.

13 experiments are mandatory including any one pump and a turbine.

Reference Books:

1. Yunus A. Cenegel, John M. Cimbala; Fluid Mechanics- Fundamentals and Applications, 4th edition, McGraw Hill, 2018.

2. Bansal R.K, A Textbook of Fluid Mechanics and Hydraulic Machines, 11th edition, Laxmi Publications, 2023.

3. Modi P.N and Seth S.M, Hydraulics and Fluid Mechanics Including Hydraulic Machines, Standard Book House, New Delhi, 22th Edition, 2019.

4. Graebel. W. P, Engineering Fluid Mechanics, Taylor & Francis, Indian Reprint, 2011.

5. Robert W. Fox, Alan T. McDonald, Philip J. Pritchard; Introduction to Fluid Mechanics; John Wiley & Sons, 10th Edition, 2019.

6. Franzini. J.B, Finnemore E.J, Fluid Mechanics with Engineering Applications; McGraw Hill, 10th Edition, 2001.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24MC2T04	UNIVERSAL HUMAN VALUES AND CONSTITUTIONAL RIGHTS	2	0	0	2	P/F	2024

Preamble

This course explores various dimensions of human existence, beginning with self-awareness and an understanding of essential needs such as prosperity, happiness, inner peace, and harmonious relationships. It also introduces the preamble and key features of the Indian Constitution, along with the Directive Principles of State Policy, highlighting their importance in shaping governance and promoting social welfare. By the end of the course, students will be better equipped to act responsibly, address challenges with sustainable solutions, and foster positive human relationships grounded in an understanding of human nature.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the importance of value education for holistic development and to fulfill human aspirations. (Cognitive Knowledge Level : Understand)
CO 2	Develop more awareness of themselves, and their surroundings(family, society, nature)to build harmonious and respectful relationships.(Cognitive Knowledge Level : Apply)
CO 3	Understand and appreciate the preamble and other features in the Indian Constitution to promote responsible citizenship.(Cognitive Knowledge Level : Understand)
CO 4	Understand the fundamental rights and duties enshrined in the Indian Constitution and the Directive Principles of State Policy and their role in shaping governance and social welfare. (Cognitive Knowledge Level : Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	1	2	1	1	1	2
CO 2						2	2	2	2	1	1	2
CO 3						2	2	2		2		2
CO 4						2	2	2		2		2

Assessment Pattern

Energy Conservation And Environmental Sustainability		
Bloom's Category	**Continuous Assessment Tests**	**End Semester Examination**
	Test 1 (Percentage)	**(Percentage)**
Remember	30	30
Understand	60	60
Apply	10	10
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (one test, conducted for 50 marks and reduced to 25)	:	25 marks
Assignment/Quiz/Course Project/Seminar	:	15 marks

End Semester Examination Pattern

There will be two parts, Part A and Part B. Part A contains 4 questions carrying 3 marks from each module. Part B contains 2 questions from each module out of which one is to be answered. In Part B, each question of first two modules carries 9 marks and each question of last two modules carries 10 marks.

SYLLABUS

MODULE 1: Introduction to Values (6 hours)

The Need of Value Education-Guidelines for Value Education, Self-exploration as the Process for Value Education-Two parts, Important implications of Self Exploration, Continuous Happiness and Prosperity -A Look at Basic Human Aspirations-Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)- Method to fulfill the Basic Human Aspirations.

MODULE 2: Harmony in the Human Being, Family and Society (5 hours)

Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-Harmony of the Self with the Body- Harmony in the Family – the Basic Unit of Human Interaction- Understanding Harmony in the Society.

MODULE 3: Introduction to Constitution of India(5 hours)

Definition and Historical Background of the Constitution-Salient Features of the Constitution-Preamble of the Constitution-Union and Its Territory- Meaning and Types of Citizenship-Termination of Citizenship.

MODULE 4: State Policies and Fundamental Rights (8 hours)

Definition of the State-Fundamental Rights- General Nature and Classification-Right to Equality and Right to Freedom-Right Against Exploitation- Right to Freedom of Religion-Cultural and Educational Rights- Right to Constitutional Remedies- Protection Against Conviction for Offences-Right to Information (RTI) and Its Applications-Directive Principles of State Policy- Classification of Directives-Fundamental Duties.

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2023.
2. The Teacher's Manual for a Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2023.
3. D D Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi, 26/e, 2022
4. P M Bhakshi, The constitution of India, Universal Law, 19/e, 2023

Reference Books:

1. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
2. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, New Delhi,2006.

3. Ministry of Law and Justice, The constitution of India, Govt of India, New Delhi,2019.
4. J N Pandey, The constitutional Law of India, Central Law Agency, Allahabad, 51e,2019.
5. M V Pylee, Indias Constitution, S Chand and Company, New Delhi,16e, 2016.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**6 hours**
1.1	The Need of Value Education-Guidelines for Value Education	1
1.2	Self-exploration as the Process for Value Education-Two Parts	1
1.3	Important implications of Self Exploration	1
1.4	Continuous Happiness and Prosperity -A Look at Basic Human Aspirations	1
1.5	Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)	1
1.6	Method to fulfill the Basic Human Aspirations	1
2	**Module 2**	**5 hours**
2.1	Understanding Human being as the Co-existence of the Self and the Body	1
2.2	Distinguishing between the Needs of the Self and the Body	1
2.3	Harmony of the Self with the Body	1
2.4	Harmony in the Family – the Basic Unit of Human Interaction	1
2.5	Understanding Harmony in the Society	1
3	**Module 3**	**5 hours**
3.1	Definition and Historical Background of the Constitution	1

3.2	Salient Features of the Constitution	1
3.3	Preamble of the Constitution-Union and Its Territory	1
3.4	Meaning and Types of Citizenship	1
3.5	Termination of Citizenship	1
4	**Module 4**	**8 hours**
4.1	Definition of the State- Fundamental Rights- General Nature and Classification	1
4.2	Right to Equality and Right to Freedom-Right Against Exploitation- Right to Freedom of Religion	1
4.3	Cultural and Educational Rights- Right to Constitutional Remedies	1
4.4	Protection Against Conviction for Offences	1
4.5	Right to Information (RTI) and Its Applications	1
4.6	Directive Principles of State Policy	1
4.7	Classification of Directives	1
4.8	Fundamental Duties	1

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1):

1. Explain the basic guidelines for value education. What is the need for these guidelines.
2. Explain the process of self-exploration. What is the expected result of self-exploration?
3. What are the basic human aspirations and what are the requirements to fulfill them? Support your answer with two examples.

Course Outcome 2 (CO2):

1. Distinguish between ‘animal consciousness’ and ‘human consciousness’.
2. ’Relationship is – between one Self (I1) and another Self (I2)’. Examine this statement.
3. What is the building block for harmony in the society? Explain with examples.

Course Outcome 3 (CO3):

1. Describe the historical background of the Indian Constitution.
2. Explain the salient features of the Indian constitution.
3. Summarize the importance of preamble in the implementation of constitution.

Course Outcome 4 (CO4):

1. What are fundamental rights? Examine each of them.
2. Examine the scope of freedom of speech and expression underlying the constitution.
3. Explain the concept of Union and its territory.
4. What is the Fee for seeking information from Central Government Public Authorities?
5. Explain the provision of appeal under the RTI Act.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24MC2T04

Course Name: UNIVERSAL HUMAN VALUES AND CONSTITUTIONAL RIGHTS

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 3 marks

1. Identify the solution which helps human being to transform from animal Consciousness to human consciousness.
2. What is the building block for harmony in the society?
3. Define and explain the term Constitution.
4. "The freedom of speech and expression is subject to reasonable restrictions". Explain the statement.

PART B

Answer any one question from each module

5. Explain the basic guidelines for value education. What is the need for these guidelines? (9 Marks)

OR

6. Choose any five things that you consider as human values. Write all the basic guidelines, and check if they satisfy the basic guidelines. (9 Marks)
7. Distinguish between 'animal consciousness' and 'human consciousness'. (9 Marks)

OR

8. 'Relationship is – between one Self (I_1) and another Self (I_2)'. Examine this statement. (9 Marks)

9. Summarize the various methods of acquiring Indian citizenship. (10 Marks)

OR

10. Examine the salient features of the Indian Constitution. (10 Marks)

11. Explain the meaning, significance and classification of the Directive Principles of State Policy. (10 Marks)

OR

12. Explain the fundamental duties of an Indian Citizen. (10 Marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24MC2T05	ENERGY CONSERVATION AND ENVIRONMENTAL SUSTAINABILITY	2	0	0	2	P/F	2024

Preamble

This course aims to equip students with fundamental knowledge of energy resources, the need for energy conservation, and the importance of environmental sustainability. It emphasizes the role of engineers in adopting renewable energy technologies, reducing environmental impact, and promoting sustainable development for a greener and more resilient future.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Classify various energy resources and describe the importance of energy conservation (Cognitive Knowledge Level: Understand)
CO 2	Explain the principles of renewable energy systems and their applications (Cognitive Knowledge Level: Understand)
CO 3	Recognize major environmental impacts due to energy consumption and explain basic pollution control measures. (Cognitive Knowledge Level: Understand)
CO 4	Describe sustainability concepts and apply simple strategies for environmental protection and green practices in day-to-day engineering tasks (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2					2	3	1		1		2
CO 2	2					2	3	1		1		2
CO 3	2					2	3	1		1		3
CO 4	2					3	3	1		1		3

Assessment Pattern

Energy Conservation And Environmental Sustainability		
Bloom's Category	**Continuous Assessment Tests**	**End Semester Examination**
	Test 1 (Percentage)	**(Percentage)**
Remember	30	30
Understand	50	50
Apply	20	20
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	50	50	2 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (one test, conducted for 50 marks and reduced to 25)	:	25 marks
Assignment/Quiz/Course Project/Seminar	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 4 questions carrying 3 marks each. Part B contains 2 questions from each module out of which anyone is to be answered. In part B, each question of the first two modules carries 9 marks and each question of the last two modules carries 10 marks.

SYLLABUS

Module 1: Energy Resources and Conservation (6 hours)

Types of Energy Resources: Renewable and Non-renewable (with examples), Global and Indian Energy Scenarios, Importance of Energy Conservation, Energy Policy and Planning

Energy Auditing and Efficiency Improvement Techniques - Case studies, Energy-efficient Buildings and Smart Cities

Module 2: Renewable Energy Technologies (6 hours)

Solar Energy, Wind Energy, Other Renewable Sources: Biomass and bioenergy systems, small hydropower, ocean thermal, wave, and tidal energy, Geothermal energy

Energy Storage and Smart Grid Integration: Battery technologies - Role in renewable energy conservation and stability - Decentralized generation and net metering, Advanced and Emerging Technologies: Green hydrogen - Floating solar farms - Offshore wind.

Module 3: Environmental Impact and Pollution Control (6 hours)

Pollution Types and Sources: Air pollution: industrial emissions, vehicular sources - Water pollution: domestic, industrial, agricultural waste - Soil pollution: hazardous waste, agrochemicals, Pollution Control Methods: Physical, chemical, biological techniques - Air & water treatment technologies

Climate Change and Global Warming: Greenhouse gases and carbon footprint - International agreements, Waste Management Strategies - 3Rs (Reduce, Reuse, Recycle) - waste-to-energy, Environmental Regulations in India: Environmental Protection Act, Air & Water Acts - Hazardous Waste Management Rules, Carbon Neutrality and Zero-emission Policies

Module 4: Sustainability and Green Practices (6 hours)

Principles of Sustainable Development: Intergenerational equity, resource efficiency - Link with UN Sustainable Development Goals (SDGs), Green Buildings and Infrastructure, Green Certification Systems, Carbon Credits.

Carbon Pricing and Energy Subsidies: Internal carbon pricing by organizations - Government schemes, Life Cycle Assessment (LCA): Phases of LCA: Goal definition, inventory, impact assessment - Smart Sustainable Cities and Resilient Infrastructure: Urban planning for sustainability.

TEXTBOOKS AND REFERENCES :

1. G.D. Rai, Non-Conventional Energy Sources, Khanna Publishers
2. R.R. Rao, Environmental Science and Engineering, PHI
3. Craig B. Smith, Energy Management Principles, Pergamon Press.
4. Paul O'Callaghan, Energy Management, McGraw Hill Book Co.

5. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

6. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Subtopics / Concepts	No. of Lecture/ Tutorial Hours
1	**Module 1**	**6 hours**
1.1	Types of Energy Resources (Renewable and Non-renewable), examples. Global and Indian Energy Scenario: Consumption and production trends, sector-wise demand	1
1.2	Energy Conservation: Residential, Industrial, Transport sectors – behavioural & technological interventions	1
1.3	Energy Policy and Planning: National Energy Policy, Energy Conservation Act, BEE initiatives	1
1.4	Energy Auditing: Preliminary & Detailed audits, Performance Indicators, Case Studies	2
1.5	Energy-efficient Buildings & Smart Cities: Passive design, daylighting, automation	1
2	**Module 2**	**6 hours**
2.1	Solar Energy: PV systems, solar thermal, rooftop/grid-tied applications	1
2.2	Wind Energy: Onshore/offshore systems, hybrid solar-wind systems	1
2.3	Other Renewables: Biomass, small hydro, ocean, tidal, geothermal energy	1
2.4	Energy Storage: Battery types, conservation role, stability, smart grid integration	1
2.5	Smart Grids and Net Metering: Decentralized generation	1

2.6	Advanced Technologies: Green hydrogen, floating solar farms, offshore wind	1
3	**Module 3**	**6 hours**
3.1	Pollution Types: Air, water, and soil pollution – sources and effects	1
3.2	Pollution Control: Physical, chemical, and biological treatment methods	1
3.3	Climate Change: GHGs, carbon footprint, international agreements (Kyoto, Paris)	1
3.4	Waste Management: Solid, liquid, biomedical, hazardous – 3Rs, waste-to-energy, Environmental regulations	1
3.5	Carbon Neutrality: National missions, zero-emission policies, corporate initiatives,	1
3.6	Circular Economy: Waste elimination	1
4	**Module 4**	**6 hours**
4.1	Sustainable Development: Principles, SDGs, resource efficiency	1
4.2	Green Buildings: Concepts, features, materials, passive design, renewables integration, green certifications	1
4.3	Carbon Credits: Earning, trading, CDM, voluntary carbon markets	1
4.4	Carbon Pricing and Subsidies: Internal pricing, UJALA, PM-KUSUM, FAME	1
4.5	Life Cycle Assessment (LCA): Phases, case studies	1
4.6	Smart Cities and Resilience: Urban planning	1
Students shall present a seminar based on case studies of Life Cycle Assessment (LCA) conducted on a product of their choice.		
Total		**24 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. List the major renewable and non-renewable energy sources with suitable examples.
2. Explain the significance of energy conservation in the industrial and domestic sectors.
3. Describe the importance of energy conservation in the context of the global and Indian energy scenario.

Course Outcome 2 (CO 2):

1. Describe the working principle of solar photovoltaic and solar thermal systems.
2. Compare wind energy and small hydropower systems based on availability, reliability, and applications.
3. Explain the role of energy storage and smart grid integration in ensuring renewable energy reliability.

Course Outcome 3 (CO 3):

1. Identify major sources of air and water pollution in urban areas.
2. Explain the role of battery storage and smart grid integration in enhancing the efficiency of renewable energy systems
3. Apply the concept of 3Rs to develop a basic household or institutional waste management plan.

Course Outcome 4 (CO 4):

1. Describe the concept of sustainable development and its connection with UN Sustainable Development Goals (SDGs).
2. Explain the basic features of green buildings and the benefits of green certification.
3. Describe simple green practices that can be adopted by engineers in daily professional work to promote environmental sustainability.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24MC2T05

Course Name: ENERGY CONSERVATION AND ENVIRONMENTAL SUSTAINABILITY

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 3 marks

1. List any three renewable energy sources with one example each.
2. Explain the concept of net metering in decentralized energy generation.
3. What are the major sources of air pollution in urban areas?
4. Describe any two strategies for promoting sustainability in everyday engineering practices.

PART B

Answer one full question from each module

5. a) Classify energy resources with examples. (4 marks)
   b) Explain the significance of energy conservation in the Indian context. (5 marks)

OR

6. a) Describe energy auditing and mention any two efficiency improvement techniques. (5 marks)
   b) What is the role of energy-efficient buildings in smart city development? (4 marks)

7. a) Explain the working principle of wind turbines with a neat diagram. (5 marks)
   b) Describe any two advanced renewable energy technologies. (4 marks)

OR

8. a) Discuss the types and role of energy storage systems in renewable energy. (5 marks)

   b) Explain the concept of smart grid integration. (4 marks)

9. a) What are the major environmental impacts of energy consumption? (4 marks)

   b) Explain physical, chemical, and biological methods of water pollution control. (6 marks)

OR

10. a) Describe the working of waste-to-energy technologies. (5 marks)

    b) List and briefly explain any two environmental regulations in India. (5 marks)

11. a) Define sustainable development and explain its principles. (4 marks)

    b) What are carbon credits and how do they promote sustainability? (6 marks)

OR

12. a) Explain the key phases of Life Cycle Assessment (LCA). (5 marks)

    b) What is the importance of green buildings and certification systems in achieving sustainable urban infrastructure? (5 marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEM32	WATER AND AIR QUALITY	3	1	0	3	4	2024

Preamble

This course offers an in-depth exploration of air and water quality, emphasizing pollution sources, their environmental effects, monitoring methods, and sustainable management practices aimed at improving environmental quality.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Apply effective management strategies to sustainably protect and restore surface water bodies in accordance with environmental regulations. (Cognitive Knowledge Level: Apply)
CO 2	Apply sustainable management and remediation strategies to protect groundwater resources in alignment with environmental and public health guidelines. (Cognitive Knowledge Level: Apply)
CO 3	Understand the fundamental concepts of air quality, identify key pollutants and their impacts on human health and environment. (Cognitive Knowledge Level: Understand)
CO 4	Understand appropriate air pollution sampling strategies. (Cognitive Knowledge Level: Understand)
CO 5	Apply appropriate engineering and regulatory control strategies for mitigation of air pollution. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1					2	2					1
CO 2	1					2	2					1
CO 3	1					2	2					1
CO 4	1					2	2					1
CO 5	1					2	2					1

Assessment Pattern

Water And Air Quality			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	40	40	40
Understand	30	30	30
Apply	30	30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have a maximum of 2 sub - divisions.

SYLLABUS

MODULE 1: Surface Water Quality Management (9 hours)

Introduction to Surface Water Quality – Physical, chemical and biological properties of water - Water Quality Standards and Regulations - Sources of Surface Water Pollution - Water Quality Monitoring and Sampling - Biological and Ecological Impacts of Surface Water Pollution - Water Borne Diseases - Water Quality Modeling - Water Quality Management Strategies - Mitigation and Remediation of Surface Water Pollution - Climate Change and Water Quality - Restoration of Polluted Water Bodies.

MODULE 2: Ground Water Quality Management (9 hours)

Definition and importance of groundwater - Types of groundwater (confined, unconfined, artesian) - Groundwater Quality Parameters - Sources of Groundwater Contamination - Groundwater Contamination and Transport - Groundwater Sampling and Analysis - Groundwater Quality Assessment and Indices - Groundwater Treatment and Remediation - Groundwater Management and Policy - Climate Change and Groundwater Quality - Emerging Issues in Groundwater Quality - Groundwater Pollution and Health Impact

MODULE 3: Air Quality (9 hours)

Introduction to Air Quality and Atmospheric Composition - Sources of Air Pollution - Classification of Air Pollutants and Their Characteristics - Meteorological Parameters Affecting Air Quality - Health and Environmental Impacts of Air Pollution - Air Quality Standards and Regulations - Air Quality Index - Air Quality Management and Planning - Indoor Air Quality - Sources of indoor pollutants - Air Quality Case Studies and Global Perspectives

MODULE 4: Air Pollution Sampling & Measurement (9 hours)

Principles of Air Sampling - Particulate Matter Sampling - High Volume Sampler (HVS), Respirable Dust Sampler (RDS), PM10 and PM2.5 samplers, Cascade impactors and cyclone separators - Gaseous Pollutant Sampling - Sampling of SO , NOx, CO, O , VOCs, Absorption, adsorption, and condensation techniques, Bubblers and impingers, Passive sampling methods - Indoor Air Quality Monitoring - Sampling strategies for indoor environments, Instruments for CO , VOCs, Radon, PM

MODULE 5: Control of Air Pollution (9 hours)

Control Technologies for Gaseous Pollutants-Control of SOx and NOx Emissions, Control of Volatile Organic Compounds, Control of Carbon Monoxide - Control Technologies for Particulate Matter - Settling chambers, cyclone separators, fabric filters (baghouses), electrostatic precipitators (ESPs), and scrubbers - Control Technologies for Odor and Hazardous Air Pollutants (HAPs) - Advanced Air Pollution Control Technologies

Textbooks:

1. Howard S. Peavy, Donald R. Rowe, and George Tchobanoglous, Environmental Engineering, McGraw-Hill Education, 2013.

2. Mackenzie L. Davis and David A. Cornwell, Introduction to Environmental Engineering, McGraw-Hill Education, 2014.
3. G.S. Birdie, Water Supply and Engineering, Dhanapat Rai Publishing Company, 2014.
4. J. Arceivala and Shyam R. Asolekar, Wastewater Treatment for Pollution Control and Reuse, McGraw-Hill Education, 2007.

References:

1. S.K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008.
2. Metcalf & Eddy Inc., George Tchobanoglous, H. David Stensel, Ryujiro Tsuchihashi, and
3. Franklin L. Burton, Wastewater Engineering: Treatment and Resource Recovery, McGraw-Hill Education, 2014.
4. Clair Sawyer, Perry McCarty, and Gene Parkin, Chemistry for Environmental Engineering and Science, McGraw-Hill Education, 2003.
5. Duggal K.N., Elements of Environmental Engineering, S. Chand and Co. Ltd., New Delhi, 2014.
6. WHO, Global Air Quality Guidelines, World Health Organization, 2021.
7. U.S. Environmental Protection Agency (EPA), Air Quality Index (AQI) Basics, EPA, 2020.
8. M.N. Rao and H.V.N. Rao, Air Pollution, Tata McGraw-Hill Education, 2007.
9. B.C. Punmia, Water Supply Engineering, Laxmi Publications, 2014.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Introduction to Surface Water Quality - Physical, chemical and biological properties of water	2
1.2	Water Quality Standards and Regulations-Sources of Surface Water Pollution	2
1.3	Water Quality Monitoring and Sampling-Biological and Ecological Impacts of Surface water Pollution-Water Borne Diseases	2
1.4	Water Quality Modeling-Water Quality Management Strategies-Mitigation and Remediation of Surface Water Pollution	2
1.5	Restoration of Polluted Water Bodies	1
2	**Module 2**	**9 hours**
2.1	Definition and importance of groundwater -Types of groundwater (confined, unconfined, artesian) - Groundwater Quality Parameters	2
2.2	Groundwater Contamination and Transport- Groundwater Sampling and Analysis - Groundwater Quality Assessment and Indices	3
2.3	Groundwater Treatment and Remediation- Groundwater Management and Policy- Climate Change and Groundwater Quality	2
2.4	Emerging Issues in Groundwater Quality-Groundwater Pollution and Health Impact	2
3	**Module 3**	**9 hours**
3.1	Introduction to Air Quality and Atmospheric Composition -Sources of Air Pollution	1

3.2	Classification of Air Pollutants and Their Characteristics- Meteorological Parameters Affecting Air Quality	3
3.3	Health and Environmental Impacts of Air Pollution	1
3.4	Air Quality Standards and Regulations- Air Quality Index -Air Quality Management and Planning	2
3.5	Indoor Air Quality - Sources of indoor pollutants - Air Quality Case Studies and Global Perspectives	2
4	**Module 4**	**9 hours**
4.1	Principles of Air Sampling- Particulate Matter Sampling- High Volume Sampler (HVS) Respirable Dust Sampler (RDS), PM10 and PM2.5 samplers, Cascade impactors and cyclone separators	3
4.2	Gaseous Pollutant Sampling - Sampling of SO , NOx, CO, O , VOCs, Absorption, adsorption, and condensation techniques, Bubblers and impingers, Passive sampling methods	3
4.3	Indoor Air Quality Monitoring- Sampling strategies for indoor environments, Instruments for CO , VOCs, Radon, PM	3
5	**Module 5**	**9 hours**
5.1	Control Technologies for Gaseous Pollutants-Control of SOx and NOx Emissions, Control of Volatile Organic Compounds, Control of Carbon Monoxide	3
5.2	Control Technologies for Particulate Matter- Settling chambers, cyclone separators, fabric filters (baghouses), electrostatic precipitators (ESPs), and scrubbers	3
5.3	Control Technologies for Odor and Hazardous Air Pollutants (HAPs)- Advanced Air Pollution Control Technologies	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Outline the importance of air quality and sources of air pollution
2. Enumerate the importance of air quality standards
3. Define Air Quality Index

Course Outcome 2 (CO 2):

1. Discuss the importance of particulate matter sampling and gaseous pollutant sampling
2. Elaborate the significance of indoor air quality monitoring

Course Outcome 3 (CO 3):

1. Discuss in detail various control technologies for gaseous pollutants and particulate matter
2. Enumerate the Control Technologies for Odor and Hazardous Air Pollutants

Course Outcome 4 (CO 4):

1. Outline various strategies for water quality management
2. Enumerate the significance of water quality standards

Course Outcome 5 (CO 5):

1. Enumerate various aspects of ground water contamination
2. Discuss various strategies for sustainable groundwater management

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEM32

Course Name: WATER AND AIR QUALITY

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Differentiate primary and secondary air pollutants.
2. Write a short note on photo-chemical smog.
3. Discuss principles of Air sampling.
4. Write a short note on gaseous pollutant sampling.
5. Discuss the importance of cyclone separators.
6. Write a short note on electrostatic precipitators .
7. What is meant by water quality standards?
8. Define Water quality and explain Water Quality monitoring.
9. Discuss different types of ground water.
10. Enumerate the sources of groundwater pollution.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. a) Discuss the effects of air pollutants on human health and environment. (10)
    b) Explain the significance of air quality index. (4)

OR

12. Explain any two case studies in relation with air pollution events (14)

13. Briefly explain various methods for particulate matter sampling (14)

OR

14. Explain various methods for gaseous pollutant sampling (14)

15. Explain various measures to control gaseous air pollutants. (14)

OR

16. Discuss any four control measures for particulate matter in ambient air (14)

17. What are different types and sources of water pollution? Explain various control measures. (14)

OR

18. Describe various water borne diseases (14)

19. How does groundwater pollution affect human health and the environment? (14)

OR

20. a) Write a note on common groundwater pollutants? (7)

    b) How can we prevent and address groundwater pollution? (7)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEM33	TRAFFIC SAFETY	3	1	0	3	4	2024

Preamble

Road safety is a critical aspect of transportation engineering that aims to minimize accidents, injuries, and fatalities on road networks. This course provides an in-depth understanding of road safety principles, accident analysis, enforcement strategies, and safety measures in road design. By integrating theoretical concepts with practical applications, students will gain insights into safety policies, risk assessment methods, and the role of technology in enhancing road safety. The course will equip students with the knowledge required to design safer transportation systems and implement effective accident prevention strategies.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand road safety policies, accident trends, analyse crash scientifically using models such as Haddon's matrix. (Cognitive Knowledge Level: Apply)
CO 2	Understand vehicle restraint systems, road safety legislation, enforcement strategies, and the role of speed in crashes. (Cognitive Knowledge Level: Understand)
CO 3	Understand the principles of safe road design, intersection planning, public transport safety, pedestrian and cyclist safety, and traffic calming measures. (Cognitive Knowledge Level: Understand)
CO 4	Analyse the suitability of data collection methods for safety studies, safety indicators, risk assessment techniques, and perform blackspot analysis.. (Cognitive Knowledge Level: Apply)
CO 5	Understand the role of Intelligent Transportation Systems (ITS) in road safety, safety audit principles, road crash scene management, and pre-hospital trauma care. (Cognitive Knowledge Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	2	1			1				2
CO 2	3	3	3	2	2	2		1			1	2
CO 3	3	3	3	3	2	3	2	1	2	1	1	2
CO 4	3	3	3	3	2	3	3	2	1	1		2
CO 5	3	2	2	3	3	3	2	2	1	1	1	3

Assessment Pattern

Traffic Safety			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	30	30	30
Understand	50	50	50
Apply	20	20	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 4 questions carrying 3 marks each. Part B contains 4 questions from each module out of which 2 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

MODULE 1 (9 hours)

Introduction to Road Safety: Introduction, Traffic accident statistics and trends, Road safety policy models, Safe systems approach, Vision Zero, Scientific crash analisis with Haddon's matrix

MODULE 2 (9 hours)

Vehicle Restraint Systems & Road Safety Enforcement: Vehicle Restraint systems, Road safety legislation and Enforcement, Road safety education and promotion, Role of speed in crashes

MODULE 3 (9 hours)

Safety Strategies for Road, Vehicle and User: Safety in road design, Safe intersection design principles, Signage and markings, Traffic Calming, Public transport safety, Pedestrian road safety, Cyclist road safety

MODULE 4 (9 hours)

Road Safety Data Analysis and Risk Assessment: Data collection methods for safety studies, Safety Indicators, Risk Assessment, Blackspot analysis, Hill road safety

MODULE 5 (9 hours)

Advanced Road Safety Measures and Emergency Response: Role of ITS in safety, Safety audit principles, Road crash scene management, Pre-hospital Trauma care

Textbooks:

1. George Yannis, Simon Cohen, John Hollo, Traffic Safety, CRC Press, 1st Edition, 2016.

2. A. Gupta, Road Traffic Safety and Accident Prevention, Narosa Publishing, 2018.

3. Rune Elvik, Truls Vaa, The Handbook of Road Safety Measures, Emerald Group Publishing, 2nd Edition, 2009.

4. Richard Tay, Traffic Safety, Nova Science Publishers, 2010.

Reference:

1. OECD/ITF, Towards Zero: Ambitious Road Safety Targets and the Safe System Approach, OECD Publishing, 2008.

2. World Health Organization (WHO), Global Status Report on Road Safety, WHO Press, 2018.

3. AASHTO, Highway Safety Manual (HSM), AASHTO Publications, 1st Edition, 2010.

4. TRB (Transportation Research Board), Highway Capacity Manual (HCM), National Research Council, 6th Edition, 2016.

5. Institute of Transportation Engineers (ITE), Traffic Engineering Handbook, Wiley, 7th Edition, 2016.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Introduction: Importance of road safety, accident statistics, and trends (global & national)	1
1.2	Road safety policy models: Traditional and modern approaches	2
1.3	Safe systems approach: Principles and application in road safety	2
1.4	Vision Zero: Concept, implementation, and case studies	2
1.5	Scientific crash analysis using Haddon's matrix	2
2	**Module 2**	**9 hours**
2.1	Vehicle restraint systems: Types and effectiveness (seat belts, airbags, barriers)	2
2.2	Road safety legislation: Laws, enforcement agencies, penalties	2
2.3	Road safety education and awareness campaigns	2
2.4	Role of speed in crashes: Speed limits, enforcement, speed calming measures	3
3	**Module 3**	**9 hours**
3.1	Safety in road design: Principles, factors affecting road safety	2

3.2	Safe intersection design: Roundabouts, signalized & unsignalized intersections	2
3.3	Signage and markings: Types, importance, visibility considerations	2
3.4	Public transport safety: Bus stops, transit lanes, safety measures	1
3.5	Pedestrian and cyclist safety: Infrastructure, crosswalks, bike lanes	1
3.6	Traffic calming techniques: Speed humps, chicanes, road diets	1
4	**Module 4**	**9 hours**
4.1	Data collection methods for road safety studies	2
4.2	Safety indicators: Crash rates, injury severity, exposure measures	2
4.3	Risk assessment in road safety: Identifying and mitigating risks	3
4.4	Blackspot analysis and safety challenges in hill roads	2
5	**Module 5**	**9 hours**
5.1	Role of Intelligent Transport Systems (ITS) in road safety	3
5.2	Road safety audits: Process, guidelines, and best practices	2
5.3	Road crash scene management: Emergency response and investigation	2
5.4	Pre-hospital trauma care: First aid and medical emergency management	2
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Explain the significance of road safety in the context of global and national accident statistics. How do accident trends influence policymaking?

2. Compare the Safe Systems Approach and Vision Zero in terms of their principles and implementation strategies.

3. Using Haddon's Matrix, analyze a real-world crash scenario and identify factors that contributed to the accident.

Course Outcome 2 (CO 2):

1. Describe the different types of vehicle restraint systems (seat belts, airbags, crash barriers). How do they reduce crash severity?

2. Explain the importance of road safety legislation in reducing road accidents. Provide examples of key traffic laws.

3. Analyze the relationship between vehicle speed and crash severity. How can speed management strategies help in accident prevention?

Course Outcome 3 (CO 3):

1. What are the key considerations for designing a safe intersection? Compare different intersection types in terms of safety.

2. Explain the role of road markings and signage in reducing accidents. Provide examples of effective road signs.

3. Discuss the challenges faced by pedestrians and cyclists in urban traffic systems. Suggest measures to enhance their safety.

Course Outcome 4 (CO 4):

1. Describe different data collection methods used for road safety studies. How does crash data help in risk assessment?

2. What are safety performance indicators, and how are they used in evaluating road safety?

3. Explain the concept of blackspot analysis. How can it help in identifying and mitigating high-risk locations?

Course Outcome 5 (CO 5):

1. How can Intelligent Transportation Systems (ITS) enhance road safety? Provide real-world examples.

2. Outline the key principles of road safety audits. What aspects are assessed during a road safety audit?

3. Explain the importance of pre-hospital trauma care in reducing fatalities after a road crash. What are the key elements of an effective emergency response system?

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

THIRD SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEM33

Course Name: TRAFFIC SAFETY

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. What is the Safe Systems Approach in road safety?
2. Explain Haddon's Matrix and its significance in crash analysis.
3. What are vehicle restraint systems? Give two examples.
4. How does speed influence road crashes?
5. What are the key principles of safe intersection design?
6. Define traffic calming. Mention two commonly used traffic calming measures.
7. What is blackspot analysis in road safety?
8. List two important safety indicators used in road safety studies.
9. How does Intelligent Transportation Systems (ITS) help in accident prevention?
10. What are the key components of pre-hospital trauma care in road crash management?

PART B

Answer any one question from each module. Each question carries 14 marks.

11. a) Explain the Safe Systems Approach and its importance in road safety. (7 marks)
    b) Describe the Vision Zero concept and its implementation in different countries. (7 marks)

OR

12. a) Discuss the Haddon's Matrix as a tool for crash analysis. (7 marks)

    b) Apply Haddon's Matrix to a real-world accident scenario and suggest preventive measures. (7 marks)

13. a) What are vehicle restraint systems? Explain their role in improving road safety. (7 marks)

    b) Compare the effectiveness of seat belts and airbags in reducing injury severity. (7 marks)

OR

14. a) Explain the importance of road safety legislation and enforcement in reducing accidents. (7 marks)

    b) Discuss the role of public awareness and education in improving road user behavior. (7 marks)

15. a) What are the key considerations in safe road design? Explain with examples. (7 marks)

    b) Discuss traffic calming measures and their effectiveness in accident reduction. (7 marks)

OR

16. a) Describe the principles of safe intersection design with suitable examples. (7 marks)

    b) Compare the advantages and disadvantages of at-grade and grade-separated intersections. (7 marks)

17. a) What are the various methods of data collection in road safety studies? (7 marks)

    b) Explain the importance of risk assessment in road safety management. (7 marks)

OR

18. a) Define blackspot analysis and describe its role in accident prevention. (7 marks)

    b) Discuss the challenges and solutions for hill road safety. (7 marks)

19. a) How does Intelligent Transportation Systems (ITS) contribute to road safety? (7 marks)

    b) Explain the role of real-time data and sensors in accident prevention. (7 marks)

OR

20. a) What are the key principles of road crash scene management? (7 marks)

    b) Explain the importance of pre-hospital trauma care in post-crash response. (7 marks)

MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH CIVIL ENGINEERING

SEMESTER 4

SYLLABUS

SEMESTER 4

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA2T04B	STATISTICAL ANALYSIS AND NUMERICAL METHODS	3-1-0-3	4	4
B	B24CE2T04	STRUCTURAL ANALYSIS	3-1-0-3	4	4
C	B24CE2T05	SOIL MECHANICS	3-1-0-3	4	4
D	B24CE2T06	HIGHWAY AND PAVEMENT ENGINEERING	3-1-0-3	4	4
E	B24HU2T01	BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT	3-0-0-3	3	3
F	B24CE2T07	CONSTRUCTION TECHNOLOGY & MANAGEMENT	2-1-0-2	3	3
G	B24CE2L05	MATERIAL TESTING LABORATORY - I	0-0-3-3	3	2
H	B24CE2L06	CIVIL ENGINEERING DRAFTING LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONOURS	3-1-0-3	4	4
TOTAL				**36**	**25**

MINOR COURSES

COURSE NO.	COURSES
B24CEM42	SOLID WASTE MANAGEMENT
B24CEM43	LAND USE AND URBAN PLANNING

HONOURS COURSES

COURSE NO.	COURSES
B24CEH41	STRUCTURAL FORMS AND MATERIALS
B24CEH42	NON-DESTRUCTIVE TESTING
B24CEH43	CLIMATE CHANGE AND SUSTAINABILITY
B24CEH44	CONSTRUCTION SCHEDULING & PLANNING
B24CEH45	PUBLIC TRANSPORT SYSTEMS
B24CEH46	REINFORCED SOIL AND GEOSYNTHETICS

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24MA2T04B	STATISTICAL ANALYSIS AND NUMERICAL METHODS	3	1	0	3	4	2024

Preamble

This course aims to introduce students to the modern theory of probability and statistics covering important models of discrete and continuous random variables. It also covers techniques of parameter estimation and hypothesis testing. A brief course in numerical methods familiarises students with some basic numerical techniques for finding roots of equations, evaluating definite integrals solving systems of linear equations and solving ordinary differential equations which are especially useful when analytical solutions are hard to find.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Utilize the concept, properties and important models of discrete random variables and, using them, solve suitable random phenomena. (Cognitive Knowledge Level: Apply)
CO 2	Utilize the concept, properties and important models of continuous random variables and, using them, solve suitable random phenomena.(Cognitive Knowledge Level: Apply)
CO 3	Develop statistical inferences concerning characteristics of a population based on attributes of samples drawn from the population (Cognitive Knowledge Level: Apply)
CO 4	Evaluate roots of equations, evaluate definite integrals and perform interpolation on given numerical data using standard numerical techniques (Cognitive Knowledge Level: Apply)
CO 5	Apply standard numerical techniques for solving systems of equations, fitting curves on given numerical data and solving ordinary differential equations. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	2					2		1
CO 2	3	2	2	2	2					2		1
CO 3	3	2	2	2	2					2		1
CO 4	3	2	2	2	2					2		1
CO 5	3	2	2	2	2					2		1

Assessment Pattern

Statistical Analysis And Numerical Methods			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1: Discrete probability distributions(9 hours)

Discrete random variables and their probability distributions, Expectation, mean and variance, Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution,Discrete bivariate distributions, marginal distributions, Independent random variables, Expectation -multiple random variables

MODULE 2 : Continuous probability distributions (9 hours)

Continuous random variables and their probability distributions, Expectation, mean and variance, Uniform, exponential , normal distributions , Continuous bivariate distributions, marginal distributions, Independent random variables, Expectation-multiple random variables, i.i.d random variables and Central limit theorem (without proof)

MODULE 3 :Testing of Hypothesis (9 hours)

Population and samples, Sampling distribution of the mean and proportion, Confidence interval for single mean and single proportions. Test of hypotheses: Large sample test for single mean and single proportion, equality of means and equality of proportions of two populations, small sample t-tests for single mean of normal population, equality of means.

MODULE 4 : Numerical methods -I(9 hours)

Errors in numerical computation-round-off, truncation and relative error, Solution of equations – Newton-Raphson method . Interpolation-finite differences, Newton's forward and backward difference method, Newton's divided difference method and Lagrange's method. Numerical integration-Trapezoidal rule and Simpson's 1/3rd rule (Proof or derivation of the formulae not required for any of the methods in this module)

MODULE 5 : Numerical methods -II(9 hours)

Solution of linear systems-Gauss-Seidel and Jacobi iteration methods. Curve fitting-method of least squares, fitting straight lines and parabolas. Solution of ordinary differential equations - Euler and Classical Runge-Kutta method of second and fourth order(Proof or derivation of the formulae not required for any of the methods in this module)

Text Books:

1. Jay L. Devore, Probability and Statistics for Engineering and the Sciences, 8th edition, Cengage, 2012

2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley Sons, 2016.

Reference Books:

1. Hossein Pishro-Nik, Introduction to Probability, Statistics and Random Processes, Kappa Research, 2014 (Also available online at www.probabilitycourse.com)
2. Sheldon M. Ross, Introduction to probability and statistics for engineers and scientists, 4th edition, Elsevier, 2009.
3. T. Veera Rajan, Probability, Statistics and Random processes, Tata McGraw-Hill, 2008
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36 Edition, 2010.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1 (Discrete Probability distributions)**	**9 hours**
1.1	Discrete Probability distributions	3
1.2	Binomial distribution-mean, variance, Poisson distribution-mean, variance, Poisson approximation to binomial	3
1.3	Discrete bivariate distributions, marginal distributions, Independence of random variables (discrete), Expected values	3
2	**Module 2 (Continuous Probability distributions)**	**9 hours**
2.1	Continuous random variables and probability distributions, expected value, mean and variance	2
2.2	Uniform, exponential and normal distributions, mean and variance of these distributions	4
2.3	Continuous bivariate distributions, marginal distributions, Independent random variables, Expected values, Central limit theorem.	3

3	**Module 3 (Testing of Hypothesis)**	**9 hours**
3.1	Population and samples, Sampling distribution of single mean and single proportion	1
3.2	Confidence interval for single mean and single proportions	2
3.3	Hypothesis testing basics, large sample test for single proportion, single proportion	2
3.4	Large sample test for equality of means and equality of proportions of two populations	2
3.5	t-distribution and small sample t-test for single mean and pooled t test for equality of means	2
4	**Module 4 (Numerical methods-I)**	**9 hours**
4.1	Roots of equations - Newton-Raphson	2
4.2	Interpolation-finite differences, Newton's forward and backward formula	3
4.3	Newton's divided difference method, Lagrange's method	2
4.4	Numerical integration-trapezoidal rule and Simpson's 1/3rd rule	2
5	**Module 5 (Numerical methods-II)**	**9 hours**
5.1	Solution of linear systems-Gauss-Siedal method, Jacobi iteration	2
5.2	Curve-fitting-fitting straight lines and parabolas to pairs of data points using method of least squares	2
5.3	Solution of ODE-Euler and Classical Runge-Kutta methods of second and fourth order	5
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Understand the concept, properties and important models of discrete random variables and, using them, analyse suitable random phenomena.

1. The probability that a batsman scores a century in a cricket match is $\frac{1}{3}$. Find the probability that out of 5 matches, he may score century in (i) at least 2 matches (ii) at most 2 matches (iii) no match.
2. Three balls are drawn at random without replacement from a box containing 2 white, 3 red and 4 black balls. If X denotes the number of white balls drawn and Y denotes the number of red balls drawn, find the joint probability distribution of (X, Y).
3. Of all customers purchasing automatic garage-door openers, 75% purchase a chain-driven model. Let X the number among the next 15 purchasers who select the chain-driven model.

    (a) What is the pmf of X?

    (b) If the store currently has in stock 10 chain-driven models and 8 shaft-driven models, what is the probability that the requests of these 15 customers can all be met from existing stock?

Course Outcome 2 (CO2): Understand the concept, properties and important models of continuous random variables and, using them, analyse suitable random phenomena

1. A random variable has a normal distribution with standard deviation 10. If the probability that it will take on a value less than 82.5 is 0.82, what is the probability that it will take on a value more than 58.3?
2. Assume that the time between arrivals of customers at a particular bank is exponentially distributed with a mean of 4 minutes

    a) Find the probability that the time between arrivals is greater than 5 minutes.

    b) Find the probability that the time between arrivals is between 1 and 4 minutes.
3. Verify whether X and Y are independent if $f(x, y) = 24xy$, $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq x + y \leq 1$.

Course Outcome 3 (CO3): Analyse stochastic processes using autocorrelation, power spectrum and understand multivariable probability distribution.

1. In a random sample of 500 people selected from the population of a city 60 were found to be left-handed. Find a 95% confidence interval for the proportion of lefthanded people in the city population.

2. A magazine reported the results of a telephone poll of 800 adult citizens of a country. The question posed was: "Should the tax on cigarettes be raised to pay for health care reform?" The results of the survey were: Out of the 800 persons surveyed, 605 were non-smokers out of which 351 answered "yes" and the rest "no". Out of the remaining 195, who were smokers, 41 answered "yes" and the remaining "no". Is there sufficient evidence, at the 0.05 significance level, to conclude that the two populations smokers and non-smokers differ significantly with respect to their opinions?

3. A sample of 20 items has mean 42 and SD 5. Test whether the sample is from a population with mean 45? (5 % level of significance)

Course Outcome 4 (CO4): Compute roots of equations, evaluate definite integrals and perform interpolation on given numerical data using standard numerical techniques.

1. Use Newton-Raphson method find correct to 4 decimals places, the root between 0 and 1 of the equation $x^3 - 6x + 4 = 0$.

2. A river is 80m wide. The depth y in meters at a distance x meters from one bank is given by the following table. Find approximately the area of cross section.

X	0	10	20	30	40	50	60	70	80
Y	0	5	8	10	15	12	7	3	1

3. Using Lagrange's interpolation formula, fit a polynomial to the given data

X	1	2	7	8
Y	4	5	5	4

Course Outcome 5 (CO5): Apply standard numerical techniques for solving systems of equations, fitting curves on given numerical data and solving ordinary differential equations.

1. Solve the equations using Gauss-Seidel method:

$$\begin{aligned} x + 2y + z &= 3 \\ 2x + 3y + 2z &= 5 \\ 3x - 5y + 5z &= 2 \\ 3x + 9y - z &= 4 \end{aligned}$$

2. Obtain the value of y at $x = 0.2$ using Runge-Kutta method of fourth order for the differential equation: $\frac{dy}{dx} = 1 + y^2$, with $h = 0.2$, $y(0) = 0$

3. Write the normal equations for fitting the curve $y = a + bx$.

MODEL QUESTION PAPER

QP CODE: **Pages: 4**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24MA2T04B

Course Name: STATISTICAL ANALYSIS AND NUMERICAL METHODS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Determine the binomial distribution for which the mean is 4 and the variance is 3.
2. Suppose $E(X) = 5$ and $E[X(X-1)] = 25$. Find $E(X^2)$.
3. Derive the mean and variance of the exponential distribution.
4. The lifetime of a particular variety of bulbs is a random variable with mean 1200 hours and standard deviation 250 hours. Use the Central Limit Theorem to find the probability that the average lifetime of 60 bulbs exceeds 1250 hours.
5. For the population of individuals who own an iPhone, $p = 0.25$ is the proportion that has a given app. For a random sample of size $n = 4$, find the mean and standard deviation of the sampling distribution of the population proportion.
6. If the mean age of 64 men engaged in an occupation is 52.4 years with standard deviation 10.2 years, construct the 90% confidence limits for the mean age of all men in that occupation.
7. Use the trapezoidal rule to evaluate $\int_0^1 x^3\,dx$ considering five subintervals.
8. Write the formula for finding $\sqrt{5}$ using Newton-Raphson's Method.
9. Using Euler's method, find $y(0.2)$ if $y' = x + y, \quad y(0) = 1$.
10. Obtain the value of y at $x = 0.1$ using the Runge-Kutta method of second order for the differential equation $y' = -y, \quad y(0) = 1$.

PART B

Answer any one question from each module. Each question carries 14 marks.

MODULE 1

11. (a) A car hire firm has 2 cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 2. Calculate the proportion of days on which (i) neither car is used (ii) some demand is refused. (7)

(b) Suppose that 20% of all copies of a particular textbook fail a certain binding strength test. Let X denote the number among 15 randomly chosen copies that fail the test. Using the table of Binomial distributions or by direct calculation. 1) Find the probability that at most 8 will fail the test. 2) Find the probability that exactly 8 will fail the test. 3) Find the probability that at least 8 will fail the test. 4) Find the probability that failure is between 4 and 7 (inclusive). (7)

OR

12. (a) A Random variable X has the following probability distribution function.

X	0	1	2	3	4	5	6	7	8
Y	a	$3a$	$5a$	$7a$	$9a$	$11a$	$13a$	$15a$	$17a$

Determine (i) the value of a (ii) $P(X \leq 3)$ (iii) $P(X \geq 3)$(iv) $P(4 \leq X \leq 7)$ (7)

(b) The joint probability mass function of X and Y is given by $p(x, y) = (x+2y) \div 18$ if $(x, y) = (1, 1), (1, 2), (2, 1), (2, 2)$. Find (i) Marginal distributions (ii) Verify whether X and Y are independent. (7)

MODULE 2

13. (a) The weight of certain brand of shampoo packets are uniformly distributed between 9.3 gm and 10.5 gm. In a random lot of 100 packets how many packets (i) exceed 10 gm (ii) are below 10.2 gm. (7)

(b) In a normal distribution 7% of the items are under 35 and 10% of the items are above 55. Calculate the mean and variance. (7)

OR

14. (a) The time in hours required to repair a machine is exponentially distributed with mean 20. What is the probability that the required time (i) exceeds 30 hours? (ii) between 16 hours and 24 hours? (7)

(b) The joint PDF of continuous random variable X and Y is given by

$$f(x, y) = \begin{cases} kxy, & 0 \leq x \leq 4, 1 \leq y \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) the value of k (ii) $P(X > 3, Y < 4)$ (iii) marginal distributions (iv) Check whether X and Y are independent. (7)

MODULE 3

15. (a) A die is thrown 9000 times and 3220 times shown 5 or 6. Is the die unbiased at 5% level of significance? (7)

(b) A random sample of size 6 has mean 25 and variance 3.83. Can the sample be regarded as taken from a population with mean lesser than 29 at 1% level of significance? (7)

OR

16. (a) The mean weight obtained from a random sample of size 100 is 64 gm. The standard deviation of the weight distribution of the population is 3 gm. Test the statement that the mean weight of the population is 67 gm at 5% level of significance (7)

(b) The average marks scored by 50 students of class A is 42.75 with variance 1.98. The average marks scored by 60 students of class B is 42.15 with variance 1.82. Based on this data can we conclude that students of class A perform better than students of class B at 5% level of significance level? (7)

MODULE 4

17. (a) Use Lagrange's interpolation formula to find $y(2)$ from the following table

X	1	3	4
Y	1	27	64

(7)

(b) Find the positive root of the equation $x^3 + x + 1 = 0$ using Newton-Raphson method correct to 4 decimal places. (7)

OR

18. (a) Evaluate $\int_0^2 xe^x dx$ using Simpson's $\frac{1}{3}$rd rule with $n = 8$. (7)

(b) Compute $y(13)$ using Newton's Backward difference formula, if given

X	3	6	9	12	15
Y	18	27	36	45	54

(7)

MODULE 5

19. (a) Solve by Gauss-Seidel method the following system:

$$\begin{aligned} 28x + 4y - z &= 32 \\ x + 3y + 10z &= 24 \\ 2x + 17y + 4z &= 35 \end{aligned}$$

(7)

(b) Fit a straight line to the points $(0,2)$, $(2,0)$, $(3,-2)$, $(5,-3)$ using method of least squares. (7)

OR

20. (a) Apply Gauss-Seidel method to solve the equations

$$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$$

(7)

(b) Solve using Runge-Kutta method of order 4: $y' = 8.5 - 20x + 12x^2 - 2x^3$, $y(0) = 1$ for $x = 0.5$ [Choose $h = 0.5$]. (7)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T04	STRUCTURAL ANALYSIS	3	1	0	3	4	2024

Preamble

This course is designed to equip students with the essential methods for analysis of structural systems. It covers the concepts such as indeterminacy, analysis of statically determinate and indeterminate structures and the calculation of internal forces and deflections. The course introduces analysis of special structures such as arches, cables and suspension. Students will also learn to analyse effects of moving loads on structures and construct influence line diagrams.

Prerequisites: Engineering Mechanics, Mechanics of Solids

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Calculate structural responses for statically determinate beams and trusses (Cognitive knowledge level: Apply).
CO 2	Determine deflections and internal forces in statically determinate and indeterminate structures using principles such as virtual work and method of consistent deformations. (Cognitive knowledge level: Apply).
CO 3	Analyse continuous beams and portal frames, considering sway and settlement effects, using the Slope Deflection and Moment Distribution Methods (Cognitive knowledge level: Analyse).
CO 4	Calculate the forces in arches, cables and suspension bridges by evaluating various loading conditions. (Cognitive knowledge level: Apply).
CO 5	Determine the effects of moving loads on beams and construct influence lines for reactions, shear forces and bending moments under various loading conditions. (Cognitive knowledge level: Apply).

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2	1	2				2	1	1	1
CO 2	3	3	2	2	2				2	2	1	1
CO 3	3	3	2	2	3				2	2	1	1
CO 4	3	3	3	2	2				2	2	2	1
CO 5	3	3	2	2	3				2	2	1	1

Assessment Pattern

Structural Analysis			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	10	10	10
Understand	40	40	40
Apply	50	40	40
Analyse		10	10
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

The question paper shall contain two questions from each module. Student has to answer any one question from each module. Each question carries 20 marks and can have maximum 3 sub-divisions.

SYLLABUS

MODULE 1 (9 hours)

Introduction to determinacy: Statically determinate and indeterminate structures

Statically determinate beams: Analysis of simply supported and cantilever beams - Method of successive integrations, Moment area method, Conjugate beam method

Statically determinate truss: Method of joints, Method of sections

MODULE 2 (9 hours)

Deformation response of statically determinate structures using energy methods: Principle of virtual work, Maxwell's law of reciprocal deflections, Unit load method for determination of deflection of beams and trusses

Statically Indeterminate Structures: Degree of static and kinematic indeterminacy - Introduction to force and displacement methods - Method of consistent deformations - Analysis of beams with single redundancy - Concepts of effect of pre-strain - lack of fit, temperature changes and support settlement

MODULE 3 (9 hours)

Slope deflection method: Fundamental equations - Analysis of continuous beams, Analysis of portal frames

Moment distribution method: Carryover moment, Stiffness, Distribution factor, Analysis of continuous beams, Analysis of portal frames

MODULE 4 (9 hours)

Arches: Theory of arches – Eddy's theorem - Analysis of three-hinged arches - Parabolic and circular arches (with supports at same level) - Determination of horizontal thrust, bending moment, normal thrust and radial shear

Cables: Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cable supports

Suspension Bridges: Un-stiffened suspension bridges, Maximum tension in the suspension cable and backstays, Pressure on towers

MODULE 5 (9 hours)

Moving loads and influence lines: Introduction to moving loads - Concept of influence lines - Influence lines for reaction, shear force and bending moment in simply supported beams – Analysis for single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than the span – Conditions for maximum bending moment and shear force.

Textbooks:

1. Devdas Menon, Structural Analysis, Narosa Publications, 2023
2. S Rajasekaran and G Sankarasubramanian, Computational Structural Mechanics, PHI Ltd., 2015
3. G S Pandit, S P Gupta, R Gupta, Theory of Structures, Mc Graw Hill Education India Pvt Ltd, 2017
4. R Vaidyanathan, P Perumal, Structural Analysis (Vol. I & II), Laxmi Publications, 2023
5. S.S Bhavikkatti, Structural Analysis II, Vikas Publication House (P) Ltd, 2021

Reference:

1. R. C. Hibbeler Structural Analysis, Pearson Education, 2021
2. Wang C K, Intermediate Structural Analysis, McGraw Hill, 2017

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Introduction to determinacy: Statically determinate and indeterminate structures	1
1.2	Analysis of statically determinate beams with method of successive integrations	1
1.3	Analysis of statically determinate beams with Moment area method and Conjugate beam method	3
1.4	Analysis of truss with method of joints	2
1.5	Analysis of truss with method of sections	2
2	**Module 2**	**9 hours**
2.1	Principle of virtual work, Maxwell's law of reciprocal deflections	2

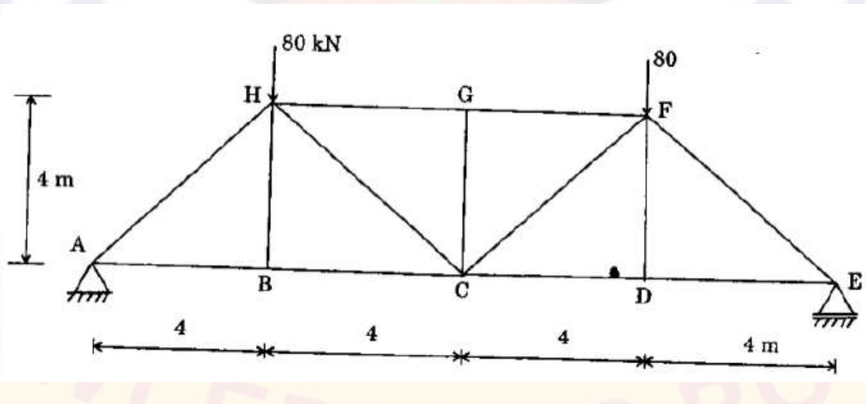
2.2	Unit load method for determination of deflection of beams	1
2.3	Unit load method for determination of deflection of truss	2
2.4	Degree of static and kinematic indeterminacy - Introduction to force and displacement methods	1
2.5	Method of consistent deformations - Analysis of beams with single redundancy	2
2.6	Concepts of effect of pre-strain, lack of fit, temperature changes and support settlement.	1
3	**Module 3**	**9 hours**
3.1	Slope deflection method: Concept and derivation	1
3.2	Slope deflection method: Analysis of continuous beams	2
3.3	Slope deflection method: Analysis of frames	2
3.4	Moment distribution method: Carryover moment, Stiffness, Distribution factor	1
3.5	Moment distribution method: Analysis of continuous beams	2
3.6	Moment distribution method: Analysis of frames	1
4	**Module 4**	**9 hours**
4.1	Theory of arches – Eddy's theorem	2
4.2	Analysis of three-hinged arches - Parabolic and circular arches (with supports at same level) - Determination of horizontal thrust, bending moment, normal thrust and radial shear	2
4.3	Analysis of forces in cables under concentrated and uniformly distributed loads	2
4.4	Anchor Cable supports	1
4.5	Un-stiffened suspension bridges, Maximum tension in the suspension cable and backstays, Pressure on towers	2

5	**Module 5**	**9 hours**
5.1	Introduction to moving loads - Concept of influence lines – Conditions for maximum bending moment and shear force	2
5.2	Influence lines for reaction, shear force and bending moment in simply supported beams	3
5.3	Analysis for single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than the span	4
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Calculate structural responses for statically determinate beams and trusses

1. Explain the method of sections for analysis of trusses
2. Determine the slope at the supports of a simply supported beam loaded with uniformly distributed load over the entire length of beam using conjugate beam method.
3. Determine the vertical displacement at the joint C of the truss. Assume area of cross section as 500 mm^2 and Young's modulus as 200 GPa for all members.

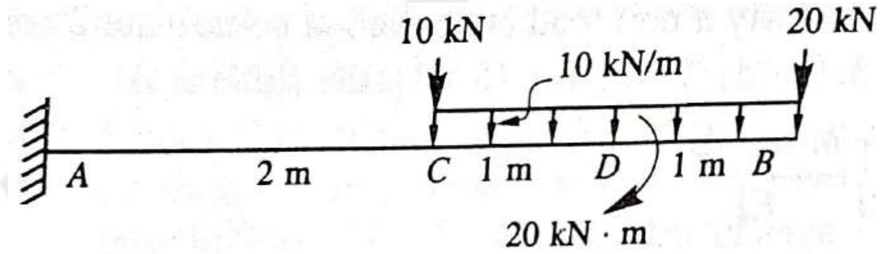


Course Outcome 2 (CO2): Determine deflections and internal forces in statically determinate and indeterminate structures using principles such as virtual work and method of consistent deformations.

1. Identify the reasons for lack of fit in trusses and explain how to incorporate their effects into analysis of structures.

2. Derive expression for strain energy for a straight prismatic bar of length L and cross-sectional area A, if subjected to an axial tensile force T.

3. Determine the slope and deflection at point B of the cantilever beam.



Course Outcome 3 (CO3): Analyse continuous beams and portal frames, considering sway and settlement effects, using the Slope Deflection and Moment Distribution Methods

1. Analyse a fixed beam with uniformly distributed load over the left half of the span using slope deflection equations. Draw bending moment diagram and shear force diagram.

2. Analyse a propped cantilever beam with a single point load acting at the centre using moment distribution method. Draw bending moment diagram and shear force diagram.

3. Explain with illustrations:
   1. Carryover factor
   2. Carryover moment
   3. Stiffness

Course Outcome 4 (CO4): Calculate the forces in arches, cables and suspension bridges by evaluating various loading conditions.

1. Develop the equations for support reactions and horizontal thrust, when cable is subjected to a uniformly distributed load over the entire span.

2. Prove that a freely suspended cable subjected to a uniformly distributed load takes the shape of a parabola.

3. A cable is hanging between two supports A and B at a horizontal distance of 60 m. Three concentrated loads of 30 kN, 20 kN and 40 kN are hanging from points C, D and E at horizontal distances of 20 m, 30 m & 40 m respectively from support A. Point C is 5 m below supports A and B. Determine the support reactions, cable tensions with inclination and the length of the cable.

Course Outcome 5 (CO5): Determine the effects of moving loads on beams and construct influence lines for reactions, shear forces and bending moments under various loading conditions.

1. Illustrate the significance of influence lines in analysing structures subjected to moving loads.

2. Draw the influence line for bending moment at a point located 4 meters from the left support of a simply supported beam of span 10 meters and determine the maximum bending moment at that point due to a single concentrated load of 20 kN moving across the span.

3. A simply supported beam of span 12 m carries a uniformly distributed moving load of intensity 10 kN/m over a length of 6 m. Determine:

   a) The position of the load that gives the maximum shear force at the left support.

   b) The position of the load that gives the maximum bending moment at mid-span. Explain the conditions used to determine these positions.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T04

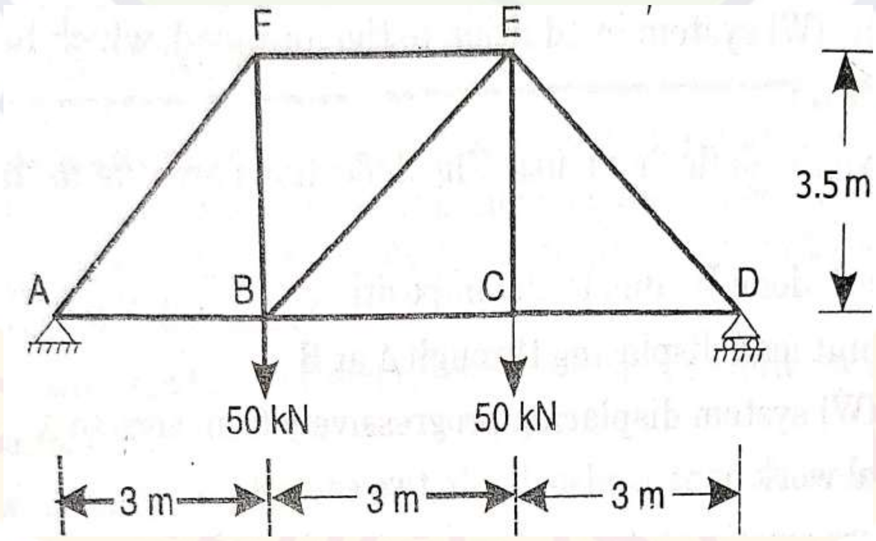
Course Name: STRUCTURAL ANALYSIS

Max. Marks: 100 Duration: 3 hours

Answer all questions

Each question carries 20 marks

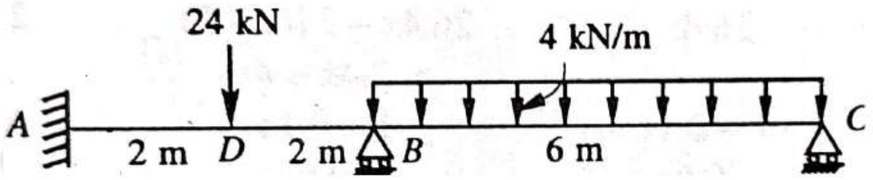
1. (a) Find slope and deflection at the free end of a cantilever beam with a point load acting at the centre of the span using moment area method. (4 marks)
(b) Calculate the member forces of the given truss using method of joints. (16 marks)



OR

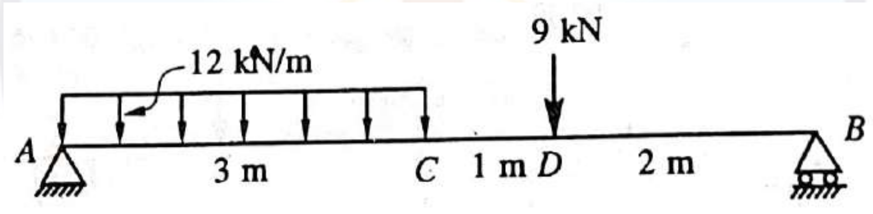
2. (a) Find slope and deflection at the centre of a simply supported beam with uniformly distributed load acting over the entire span using conjugate beam method. (4 marks)
(b) Using the method of successive integration, derive the expressions for the slopes at both supports and the maximum deflection for a simply supported beam subjected to a point load P placed at a distance a from one support. (16 marks)

3. (a) Determine the static and kinematic indeterminacy of a single span beam fixed at both ends. (4 marks)
   (b) Analyse the beam shown in figure using method of consistent deformation and draw bending moment diagram and shear force diagram. (16 marks)

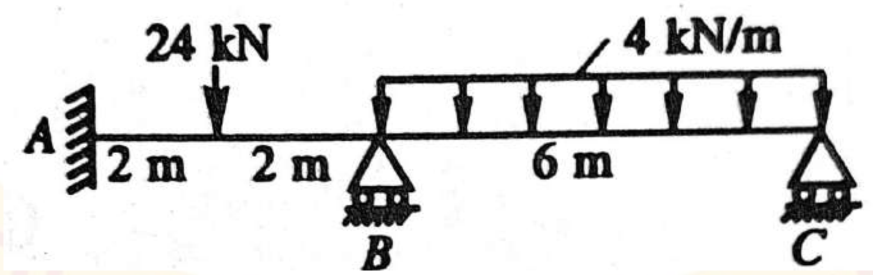


OR

4. (a) Explain with illustrations, how the pre-strains like lack of fit, temperature changes and support settlements affect response of structures. (4 marks)
   (b) Determine slope at the point A and deflection at the point C using unit load method. (16 marks)

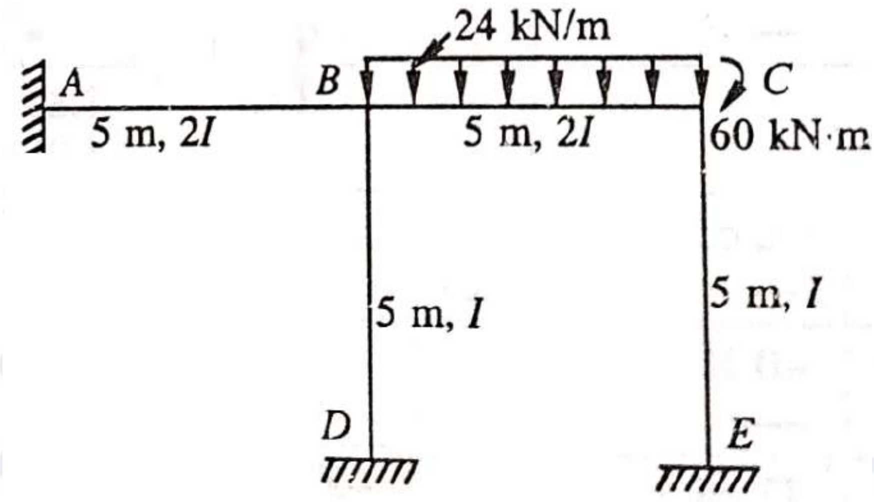


5. Analyse the continuous beam shown in figure using slope deflection method for (i) unyielding support (ii) yielding support which permit a clockwise rotation of $\frac{4}{EI}$ at A and downward settlement of $\frac{24}{EI}$ at B and $\frac{12}{EI}$ at C. Also draw the bending moment diagram. Assume flexural rigidity EI as constant. (20 marks)



OR

6. Analyse the rigid jointed frame shown in figure using moment distribution method and draw the bending moment diagram. (20 marks)



7. (a) State and explain Eddy's theorem. (4 marks)
(b) A three-hinged parabolic arch hinged at the springing points A and B and crown point C, has a span of 40 m and a central rise of 8 m. It carries a uniformly distributed load 50 kN/m over the left half of the span and a concentrated load of 80 kN at the centre of the right half of the span. Find the reactions at the supports, normal thrust, radial shear and bending moment at a section D which is at 8 m from the left support. (16 marks)

OR

8. (a) Illustrate parts of a suspension bridge and indicate the path of load transfer. (4 marks)
(b) The cable of a suspension bridge is of span 100 m and maximum dip 18 m with supporting piers 20 m high. It supports a uniformly distributed load of 10 kN/m over horizontal span. The anchor cable is at 30° to the horizontal. If the cable passes over frictionless pulley on top of the pier, determine the vertical and horizontal force transmitted to the supporting pier and the maximum bending moment in the pier. (16 marks)

9. (a) Develop influence line diagrams for shear force and bending moment at any section of a simply supported beam with a single concentrated moving load. (4 marks)
(b) A uniformly distributed load 50 kN/m and 8 m long crosses a girder of 30 m span from left to right. Draw the influence line diagram for shear force and bending moment at a section 10 m from left support. Calculate the maximum shear force and bending moment at this section using these diagrams. (16 marks)

OR

10. (a) Derive the condition for maximum bending moment at a section at a beam due to the movement of a uniformly distributed load of length shorter than the span of the beam. (4 marks)
(b) A train of moving loads 50 kN, 60 kN, 30 kN and 70 kN spaced at equal distance of 3 m is moving from left to right with 50 kN leading over a simply supported beam of span 30 m. Compute the maximum shear force and bending moment at a point 10 m from the left support. Also determine the absolute maximum bending moment that will develop on the beam. (16 marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T05	SOIL MECHANICS	3	1	0	3	4	2024

Preamble

Introduction of basic concepts and laboratory tests used to evaluate properties of soils: Students learn about classification, compaction permeability, consolidation, and shear strength. There will be practical implications by numerical calculations and experiments, and students develop the capability to understand and respond to geotechnical problem-solving issues faced by civil engineers.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the fundamental soil phase relationships and standard laboratory tests used to determine the physical properties of soils. (Cognitive knowledge level: Understand)
CO 2	Understand the classification, consistency, and compaction characteristics of soils through standard procedures and indices. (Cognitive knowledge level: Understand)
CO 3	Apply the principles of effective stress and permeability to analyze seepage and flow through soils. (Cognitive knowledge level: Apply)
CO 4	Understand the process of one-dimensional consolidation and its influence on soil settlement behavior. (Cognitive knowledge level: Understand)
CO 5	Apply shear strength theories and laboratory test results to evaluate the strength characteristics of soils. (Cognitive knowledge level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2		2	1							2
CO 2	3	2	1	2	1							2
CO 3	3	3	2	2	1	1						2
CO 4	3	2	1	2	1							2
CO 5	3	3	2	3	1							2

Assessment Pattern

Soil Mechanics			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	40	20	25
Understand	40	40	35
Apply	20	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

MODULE 1 (9 hours)

Overview: Importance in Civil Engineering; Soil formation processes, Major soil deposits of India, Classification based on grain size.

Soil Phases and Relationships: Three-phase diagram, weight-volume relationships, Void ratio, porosity, degree of saturation, air content, water content, specific gravity, unit weight – Numerical problems

Basic Tests: Determination of Water content by oven drying, Specific gravity using pycnometer - Determination of Field density by Sand Replacement and Core Cutter method.

MODULE 2 (9 hours)

Gradation of Soil: Sieve analysis – Numerical problem, Hydrometer analysis-stokes's law, gradation of soil, limitations

Consistency of soil: Atterberg Limits and indices – Plasticity charts – activity of soil-laboratory tests for Liquid Limit (Casagrande's apparatus), Plastic Limit and Shrinkage Limit – Numerical problems

Soil Classification Systems: AASHTO, USCS, Indian Standard Classification, Numerical problems Relative. Density- Numerical problems.

Soil Compaction: Definition, Proctor test, Modified Proctor test, Optimum Moisture Content and Maximum Dry Density, Zero Air voids line, factors affecting compaction.

MODULE 3 (9 hours)

Effective Stress Principle: Total, neutral and effective stress – Pressure diagrams in layered soil with water table, saturated by capillary action, subjected to surcharge load – Numerical problems.

Permeability of Soils: Darcy's Law, factors affecting permeability, laboratory determination of permeability. Seepage analysis- Quick sand condition – Critical hydraulic gradient

MODULE 4 (9 hours)

Consolidation of Soils: Definition One-dimensional consolidation, Terzaghi's theory, settlement analysis, consolidation tests. e-log p curve - Compression index, Recompression index and Pre-consolidation Pressure - Normally consolidated, over consolidated and under consolidated soils - Terzaghi's theory of one-dimensional consolidation with its assumptions - average degree of consolidation – Time factor - Coefficient of consolidation - Numerical problems - Laboratory consolidation test – Determination of Coefficient of Consolidation.

MODULE 5 (9 hours)

Shear Strength: Mohr-Coulomb failure criterion, stress-strain behaviour of soils. Mohr circle method- Determination of principal planes and stresses– relationship between shear parameters and principal stresses – Numerical problems. Testing methods - Direct Shear Test, Triaxial Shear Test (UU, CU, CD), Unconfined Compression Test, Vane shear test. Numerical problems.

Text Books:

1. Ranjan G. and A. S. R. Rao, Basic and Applied Soil Mechanics, New Age International, 2002.

2. Arora K. R., Geotechnical Engineering, Standard Publishers, 2006.

3. Das B. M., Principles of Geotechnical Engineering, Cengage India Pvt. Ltd., 2010.

4. Terzaghi K. and R. B. Peck, Soil Mechanics in Engineering Practice, John Wiley, 1967.

Reference Books:

1. A V Narasimha Rao and C Venkat Ramaiah, Numerical Problems, Examples and Objective questions in Geotechnical Engineering, Universities Press (India) Ltd., 2000

2. Muni ram Budhu, Soil Mechanics and Foundations, Wiley, 2010

3. Jonathan Knappett, Craig R F, Craig's Soil Mechanics, CRC Press, 2020

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Overview: Importance in Civil Engineering; Soil formation processes, Major soil deposits of India, Classification based on grain size.	3
1.2	Soil Phases and Relationships: Three-phase diagram, weight-volume relationships, Void ratio, porosity, degree of saturation, air content, water content, specific gravity, unit weight – Numerical problems	3

1.3	Basic Tests: Determination of Water content by oven drying, Specific gravity using pycnometer - Determination of Field density by Sand Replacement and Core Cutter method.	3
2	**Module 2**	**9 hours**
2.1	Gradation of Soil: Sieve analysis – Numerical problem, Hydrometer analysis-stokes's law, gradation of soil, limitations	2
2.2	Consistency of soil: Atterberg Limits and indices – Plasticity charts – activity of soil-laboratory tests for Liquid Limit (Casagrande's apparatus), Plastic Limit and Shrinkage Limit – Numerical problems	2
2.3	Soil Classification Systems: Indian Standard Classification, Numerical problems	2
2.4	Relative Density- Numerical problems.	1
2.5	Soil Compaction: Definition, Proctor test, Modified Proctor test, Optimum Moisture Content and Maximum Dry Density, Zero Air voids line, factors affecting compaction.	2
3	**Module 3**	**9 hours**
3.1	Effective Stress Principle: Total, neutral and effective stress - Pressure diagrams in layered soil with water table, saturated by capillary action, subjected to surcharge load.	3
3.2	Numerical problems.	2
3.3	Permeability of Soils: Darcy's Law, factors affecting permeability, laboratory determination of permeability	3
3.4	Seepage analysis- Quick sand condition – Critical hydraulic gradient.	1
4	**Module 4**	**9 hours**
4.1	Consolidation of Soils: Definition One-dimensional consolidation, Terzaghi's theory, settlement analysis, consolidation tests. e-log p curve - Compression index, Recompression index and Pre-consolidation Pressure	2
4.2	Normally consolidated, over consolidated and under consolidated soils	1

4.3	Terzaghi's theory of one-dimensional consolidation with its assumptions - average degree of consolidation – Time factor - Coefficient of consolidation	1
4.4	Numerical problems	3
4.5	Laboratory consolidation test – Determination of Coefficient of Consolidation.	2
5	**Module 5**	**9 hours**
5.1	Shear Strength: Mohr-Coulomb failure criterion, stress-strain behavior of soils.	1
5.2	Mohr circle method- Determination of principal planes and stresses– relationship between shear parameters and principal stresses	2
5.3	Numerical problems	3
5.4	Testing methods - Direct Shear Test, Triaxial Shear Test (UU, CU, CD), Unconfined Compression Test, Vane shear test. Numerical problems of vane shear test.	3
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Remember the fundamental soil phase relationships and standard laboratory tests used to determine the physical properties of soils.

1. Define specific gravity and unit weight of soil.
2. List the steps involved in determining water content using the oven-drying method.
3. State the relationship between void ratio, porosity, and degree of saturation.

Course Outcome 2 (CO2): Understand the classification, consistency, and compaction characteristics of soils through standard procedures and indices.

1. Explain the procedure for performing a sieve analysis and how to interpret a particle size distribution curve.
2. Describe the Atterberg limits and their significance in soil classification.
3. Discuss the factors affecting the compaction of soils in the field.

Course Outcome 3 (CO3): Apply the principles of effective stress and permeability to analyze seepage and flow through soils.

1. A saturated soil layer has a unit weight of 20 kN/m^3, and the unit weight of water is 9.81 kN/m^3.
   Calculate the effective stress at a depth of 5 meters below the ground surface.
2. A soil sample has a hydraulic conductivity of 1×10^{-5} m/sec. If the hydraulic gradient is 0.5 and the cross-sectional area of the sample is 0.1 m^2, apply Darcy's Law to determine the discharge (Q) through the soil.
3. Analyze the seepage condition leading to a quicksand condition using the concept of critical hydraulic gradient.

Course Outcome 4 (CO4): Understand the process of one-dimensional consolidation and its influence on soil settlement behaviour.

1. Describe the assumptions of Terzaghi's one-dimensional consolidation theory.
2. Explain the significance of the compression index in consolidation behaviour.
3. Interpret the e–log p curve obtained from a laboratory consolidation test.

Course Outcome 5 (CO5): Apply shear strength theories and laboratory test results to evaluate the strength characteristics of soils.

1. A vane shear test conducted in the field on soft clay recorded a torque of 5.5 Nm. The vane has a diameter of 50 mm and height of 100 mm. Calculate the undrained shear strength of the clay.
2. Explain the Mohr–Coulomb failure criterion and illustrate how it helps in evaluating the shear strength of soils under different loading conditions.
3. How does the angle of internal friction (ϕ) affect the shear strength of granular soils?

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T05

Course Name: SOIL MECHANICS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Explain the three-phase diagram of soil with a neat sketch. In what conditions does the three-phase system become a two-phase system?

2. A given soil has equal volume of voids and volume of solids. Estimate its void ratio and porosity.

3. Define Stoke's law and explain its significance.

4. Explain the activity of soil. If a soil has an activity value of 2, what is the type of soil?

5. In what conditions do soils behave as quick? Explain using the concept of critical hydraulic gradient.

6. List any six factors which affect the permeability of soil.

7. Enumerate the assumptions adopted in Terzaghi's theory of consolidation.

8. Differentiate between over-consolidated, under-consolidated, and normally consolidated soils.

9. A sample of dry cohesionless soil was tested in a Triaxial Testing machine. If the angle of shearing resistance is 35° and confining pressure is 100 kPa, determine the deviator stress at failure.

10. Explain the demerits of the Direct Shear Test.

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE - 1

11. (a) Explain with a neat figure Core Cutter method
(b) There are two borrow areas A and B which have soils with void ratios of 0.80 and 0.70, respectively. The in-place water content is 20% and 15%, respectively. The fill at the end of construction will have a total volume of 10,000 m^3, bulk density of 2 Mg/m^3 and a placement water content of 22%. Determine the volume of the soil required to be excavated from both areas. $G = 2.65$. If the cost of excavation of soil and transportation is Rs. 200/- per 100 m^3 for area A and Rs. 220/- per 100 m^3 for area A, which of the borrow area is more economical?

12. (a)Explain the procedure of sand replacement method

(b) In a compaction test on a soil, the mass of wet soil when compacted in the mould was 1.855 kg. The water content of the soil was 16%. If the volume of the mould was 0.945 litres, determine the dry density, void ratio, degree of saturation and percentage air voids. Take $G = 2.68$.

MODULE - 2

13. (a) Enumerate modified proctor test with a neat sketch. Explain OMC, MDD and zero air void line.

(b) The sieve analysis of a soil gave the following results:

- % passing 75μ sieve = 4
- % retained on 4.75 mm sieve = 50
- Coefficient of curvature = 2
- Uniformity coefficient = 5

Classify the soil as per ISC

14. (a) Explain the procedure for determination of liquid limit with a neat figure.

(b) A soil has a liquid limit of 25% and a flow index of 12.5%. If the plastic limit is 15%, determine the plasticity index and the toughness index. If the water content of the soil in its natural condition in the field is 20%, find the liquidity index and the relative consistency.

MODULE - 3

15. (a) Explain variable head permeability test with a neat figure

(b) The falling-head permeability test was conducted on a soil sample of 4 cm diameter and 18 cm length. The head fell from 1.0 m to 0.40 m in 20 minutes. If the cross-sectional area of the stand pipe was 1 cm^2, determine the coefficient of permeability

16. (a) Explain constant head permeability test with a neat figure

    (b) A soil profile consists of a surface layer of sand 3.5 m thick ($\rho = 1.65$ Mg/m^3), an intermediate layer of clay 3 m thick ($\rho = 1.95$ Mg/m^3) and the bottom layer of gravel 3.5 m thick ($\rho = 1.925$ Mg/m^3). The water table is at the upper surface of the clay layer. Determine the effective pressure at various levels immediately after placement of a surcharge load of 58.86 kN/m^2 to the ground surface.

MODULE - 4

17. (a) Graphically explain the determination of preconsolidation pressure

    (b) A stratum of clayey soil of 2 m thick and has an initial overburden pressure of 50 kPa at its middle. Determine final settlement due to an increase in pressure of 40 kPa at the middle of clay layer. The clay is over-consolidated, with a preconsolidation pressure of 75 kPa. The values of the coefficients of recompression and compression index are 0.05 and 0.25, respectively. Take initial void ratio as 1.40.

18. (a) Explain in detail the procedure of laboratory consolidation test

    (b) A 3 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of consolidation of the clay was found to be 0.025 cm^3/minute. The final expected settlement for the layer is 8 cm.

    (a) How much time will it take for 80% of the total settlement to take place?
    (b) Determine the time required for a settlement of 2.5 cm to occur.
    (c) Compute the settlement that would occur in one year.

MODULE - 5

19. (a) Explain in detail Triaxial shear test with a neat figure

    (b) Following results were a series of CU test on soil. Determine c and ϕ of the soil

Sample number	**Confining pressure (kPa)**	**Deviator stress at failure (kPa)**
1	100	600
2	200	750
3	300	870

20. (a) Explain laboratory vane shear test with a neat figure

    (b) A shear vane 7.5 cm dia and 11.25 cm long was pressed into soft clay at the bottom of the bore hole. Find shear strength of soil if the torque required for failure was 40 Nm.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T06	HIGHWAY AND PAVEMENT ENGINEERING	3	1	0	3	3	2024

Preamble

This course equips students with essential knowledge of highway and pavement engineering, preparing them to design and manage road infrastructure that meets safety, efficiency, and sustainability standards. It fosters an understanding of key principles in geometric design, traffic flow, and pavement performance, while also introducing modern advancements such as Intelligent Transportation Systems (ITS). By developing analytical and problem-solving skills, students will be able to contribute effectively to the planning, construction, and maintenance of transportation networks.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Explain the fundamentals of road transportation, including road classification, user and vehicle characteristics, and environmental impacts of highway systems. (Cognitive Knowledge Level: Understand)
CO 2	Apply geometric design principles to highway alignment, sight distance, and curve design, ensuring safety and efficiency. (Cognitive Knowledge Level: Apply)
CO 3	Analyze traffic characteristics, perform traffic flow studies, and design traffic control devices and intersections for efficient traffic management. (Cognitive Knowledge Level: Analyse)
CO 4	Evaluate pavement materials, design flexible pavements using IRC guidelines, and analyze traffic and stress impacts on pavements. (Cognitive Knowledge Level: Understand)
CO 5	Identify common pavement failures, understand construction technologies, and develop maintenance strategies using modern pavement management systems and ITS applications. (Cognitive Knowledge Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		1			2						
CO 2	3	3	3									
CO 3	3	3	2									
CO 4	3		3		2							
CO 5	3			1		2					2	

Assessment Pattern

Highway And Pavement Engineering			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	20	20	20
Understand	30	30	30
Apply	30	30	30
Analyse	20	20	20
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

Module 1: Introduction to Road Transportation (5 hours)

Introduction to highways, Classification of roads, Road User Characteristics, Vehicle Characteristics, Road Vehicle Dynamic, Highway Cross-Section Elements, Highway Alignment Environmental Impact of Highway Systems

Module 2: Geometric Design of Highways (11 hours)

Sight Distances: Stopping, overtaking, and headlight sight distance. Horizontal Alignment: Superelevation, transition curve, extra widening. Vertical Alignment: Design of grades and curves, Grade Compensation, Coordination of Horizontal and Vertical Alignment

Module 3: Traffic Theory / Traffic Flow Studies (10 hours)

Traffic Characteristics: Volume, speed, density, capacity, headway, delay – definitions and relations, Traffic Control Devices: Signs, markings, islands, signals, Intersections: At-grade (incl. rotary) and grade-separated, Traffic Signals: Isolated/coordinated signals, saturation flow, lost time, phases, Webster's method.

Module 4: Pavement Engineering (10 hours)

Types of Pavements, Characterization of pavement materials- Desirable properties and tests on materials and mix, Visco-elastic property of bitumen, Introduction to aggregate packing, Aggregate gradation, Traffic and Stress Analysis: Layered elastic theories, load equivalency factors, Introduction to Mechanistic empirical design procedure, IRC Method of Flexible Pavement Design

Module 5: Pavement Failures, Construction, and Maintenance (9 hours)

Stresses in rigid pavements, IRC method of rigid pavement design, Pavement Failures- (causes & remedies), Introduction to Pavement Construction Technology, best practices in flexible and rigid pavement construction.

Textbooks:

1. Khanna, S.K. and Justo C.E.G. and A Veeraragavan, Highway Engineering,Revised 10 th Edition, Nem Chand & Bros.

2. Huang, Y., Pavement Analysis and Design, 2nd Edition, Prentice-Hall, 2004

Reference:

1. Kadiyali, L.R. and N.B. Lal, Principles and Practices of Highway Engineering, Khanna Publishers, 2013

2. Rogers, M., Highway Engineering, 2nd Edition, Blackwell Publishing, 2008
3. Mannering, F.L. and Washburn S.S., Principles of Highway Engineering and Traffic Analysis, 5th Edition, John Wiley, 2009
4. L R Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers
5. E J Yoder and M W Witzczak, Principles of Pavement Design 2ed, Wiley,2011
6. Relevant IRC Codes, MORTH, AASHTO Codes and HCM

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**5 hours**
1.1.	Introduction : Importance of highway system in overall infrastructural development of a nation and its implication on humans and environment.Challenges and issues faced. Classification of roads: Classification based on importance and functionality.	1
1.2	Road User Characteristics: Visual acuity, legibility distance, reading time of signs, visual field, peripheral vision, hearing, reaction time, walking speed, driver eye height - Vehicle Characteristics: Static and dynamic characteristics - Road vehicle dynamics – Skid resistance, light reflection, roughness, skidding, slipping	2
1.3	Highway Cross-Section Elements, Camber and its design, Right of way, shoulder, camber, carriage way. Highway alignment, Requirements and factors controlling alignment of roads	1
1.4	Environmental Impact of Highway Systems: case study, Green highway concept	1
2	**Module 2**	**11 hours**
2.1	Sight Distances: Stopping sight distance-lag and braking distance, Overtaking sight distance, headlight sight distance	2

2.2	Horizontal Alignment: Superelevation, transition curve, extra widening	4
2.3	Vertical Alignment: Design of grades and curves	3
2.4	Coordination of Horizontal and Vertical Alignment	2
3	**Module 3**	**10 hours**
3.1	Traffic Characteristics: Volume, time mean speed, space mean speed, density, capacity, time headway, space gap, travel time, delay-Definitions and relations between them.	4
3.2	Traffic Control Devices: Signs, markings, islands, signals Intersections: At-grade including rotary, grade-separated	3
3.3	Traffic Signals: Isolated and coordinated signals, Saturation flow, Loss times, phase, Isolated signal design using Webster's method	3
4	**Module 4**	**10 hours**
4.1	Types of Pavements – Classification, Structure and functions, Composite and special pavements	1
4.2	Bitumen grading, Visco-elastic property of bitumen (basic understanding only) Tests on bitumen, desirable range of test values for different types.	1
4.3	Introduction to aggregate packing, Aggregate gradation, Tests on aggregate, desirable properties.	2
4.4	Subgrade soil testing methods: CBR, OMC, Tests on mix	1
4.5	Layer theory (introduction only), ESWL, Equivalent standard axle, environmental design considerations,	2
4.6	Introduction to Mechanistic empirical design procedure, Rutting and Fatigue life calculations, Design of layer thickness according to IRC charts	2
5	**Module 5**	**9 hours**
5.1	Introduction to stresses in rigid pavements and Design procedure according to relevant IRC codes.	4

5.2	Pavement Failures in Flexible and Rigid pavements: causes and remedies.	2
5.3	Pavement Construction Technology-Best practices for flexible and rigid pavement construction (brief description only)	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Explain the different characteristics of road users and provide examples of how these characteristics influence the process of highway design.
2. What do you understand by camber of a road? List out the necessities of providing it and identify the factors influencing its design.

Course Outcome 2 (CO 2):

1. The speed of overtaking and overtaken vehicles in a two-way traffic road are 75 and 40 kmph respectively.
   i) Calculate the Stopping Sight Distance for a design speed of 70 kmph.
   ii) Calculate safe overtaking sight distance for given data. Assume acceleration of overtaking vehicle as 0.99 m/s^2
   iii) Draw a neat sketch indicating the positions of required sign posts for the above designed overtaking zone.
2. A vertical summit curve is formed by $n_1 = +3.0\%$ and $n_2 = -5.0\%$. Design the length of the summit curve for $V = 80$ kmph.

Course Outcome 3 (CO 3):

1. A fixed time 2-phase signal is to be provided at an intersection having a N-S and E-W road where only straight-ahead traffic is permitted. The hour flows are given in the table. Calculate the optimum cycle time and green time for the minimum overall delay. The time lost per phase due to starting delays can be assumed to be 2 seconds. The value of the amber period is 2 seconds. Sketch the timing diagram for each phase. (10 marks)

	N	**S**	**E**	**W**
Design hour flow (q) in PCUs/hour	800	400	750	1000
Saturation flow (s) in PCUs/hour	2400	2000	3000	3000

2. Discuss any two advantages and two disadvantages of rotary intersections.

Course Outcome 4 (CO 4):

1. It is proposed to widen an existing 2-lane National Highway Section to 4-lane divided road. Design the pavement for new carriage way with the following data:
   Current traffic = 300 CV/day (sum of both directions)
   Construction period = 4 years
   Design life = 15 years
   Traffic growth rate = 7.5% per annum
   Vehicle damage factor = 2.5 standard axles per CV
   Design CBR of subgrade soil = 4%
   Draw a neat sketch indicating the thickness of pavement layers as per IRC 37:2018 catalogs.

2. Differentiate between the unsaturated and saturated flow regimes using a typical volume-density plot.

Course Outcome 5 (CO 5):

1. Explain common flexible pavement failures and their causes.

2. Write a short note on design considerations for overlay of pavement.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T06

Course Name: HIGHWAY AND PAVEMENT ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Explain the classification of roads and their importance in transportation planning.
2. Discuss the impact of road user characteristics on highway design.
3. Define stopping sight distance and list the factors affecting it.
4. Explain the importance of superelevation in horizontal alignment design.
5. Draw the fundamental traffic flow diagrams.
6. Illustrate any two types of grade separated intersections using a neat sketch.
7. List the differences between flexible and rigid pavements.
8. Explain the significance of load equivalency factors in pavement design.
9. State the difference between tack coat and prime coat.
10. List and explain any two indices used for pavement performance and condition evaluation.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. a) Describe the various highway cross-section elements and their functional significance. (7 marks)

    b) Discuss the environmental impacts of highway systems and possible mitigation measures. (7 marks)

OR

12. a) Discuss the requirements and factors controlling alignment of roads. (7 marks)

    b) Discuss the role of vehicle dynamics in highway design. (7 marks)

13. a) For a vertical curve, $n_1 = +1/50$ and $n_2 = -1/80$, SSD = 180 m, OSD = 640 m. Due to site constraints, L is limited to 500 m. Calculate the length of summit curve to meet SSD, ISD, and OSD. Discuss results. (7 marks)

    b) Discuss the design considerations for vertical curves in highway alignment. (7 marks)

OR

14. a) Derive the design formula for mechanical widening provided by IRC 78,1980. (7 marks)

    b) Explain how horizontal and vertical alignments are coordinated in highway design. (7 marks)

15. a) Explain the concept of level of service (LOS) and its role in traffic engineering. (7 marks)

    b) Discuss the different types of traffic control devices and their applications. (7 marks)

OR

16. a) Explain the different data collection techniques for O-D survey. (7 marks)

    b) Describe the method of determining Passenger Car Unit (PCU) values in traffic studies. (7 marks)

17. a) Explain the different types of pavement structures and their applications. (7 marks)

    b) Discuss the characterization of bitumen and their role in pavement performance. (7 marks)

OR

18. a) Explain the concept of layered elastic theory in pavement design. (7 marks)

    b) Design the pavement with granular base and sub-base course with the following data:

    a. Dual two-lane carriageway
    b. Initial traffic in the year of completion = 400 CVPD (sum of both directions)
    c. Traffic growth = 7.5%
    d. Design Life = 15 years
    e. VDF = 2.62
    f. Design CBR of Subgrade Soil = 5%. (7 marks)

19. a) Explain common rigid pavement failures and their causes. (7 marks)

    b) Discuss the importance of pavement management systems and their role in maintenance. (7 marks)

OR

20. a) Briefly describe the procedure to be followed for Life Cycle Analysis of pavements. (7 marks)

    b) Discuss the application of Intelligent Transportation Systems (ITS) in pavement maintenance and monitoring. (7 marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24HU2T01	BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT	3	0	0	3	3	2024

Preamble

This course will aid and equip the students to comprehend the various concepts in Business Economics and Finance. They will gain an understanding of price, demand, production, costs and revenue. They will also learn about the functioning of various markets and fathom the problems affecting the world of business. They will be introduced to national income accounting and to the financial tools used in personal finance. The students will also gain an insight into business financing and the functioning of the stock market.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the fundamental concepts and theories of demand, supply, and production to various related economic issues. (Cognitive Knowledge Level: Understand)
CO 2	Understand the concepts relating to costs and revenue to the functioning of firms in different market situations and solve simple business problems using break even analysis. (Cognitive Knowledge Level: Understand)
CO 3	Apply the basic macroeconomic principles to economic concepts influencing the economy as a whole like national income accounting, monetary and fiscal policy, balance of payments and international trade. (Cognitive Knowledge Level: Apply)
CO 4	Make use of the possibilities of financial management to acquire knowledge in the functioning of the Indian financial system and evaluate decisions regarding personal finance. (Cognitive Knowledge Level: Apply)
CO 5	Develop decision making capability by acquiring knowledge in stock markets, mutual funds, business financing and international financing. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	1	1	1	1					1	1
CO 2	1	1	1	1	1	1					1	1
CO 3	1	1	1	1	1	1	1				2	1
CO 4	1	1	1	1	1	2		1	1		2	2
CO 5	1	1	1	1	2	2		1	1		2	2

Assessment Pattern

Business Economics And Financial Management			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	50	30	30
Understand	50	40	40
Apply		30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have maximum 2 sub divisions.

SYLLABUS

MODULE 1 : Fundamentals of Business Economics (8 Hours)

Introduction – Demand and its determinants – Law of demand – Elasticity of demand: Price, Income and Cross - Measurement of elasticity and its applications (Numerical problems) – Supply and its determinants – Determination of Equilibrium Price – Changes in demand and supply and its effects Utility – Law of diminishing marginal utility - Consumer surplus - Producer surplus.

Production concepts: Production function - Cobb Douglas function (Numerical problems) - Average product - Marginal product - Law of variable proportions – Law of Returns to Scale.

MODULE 2 : Cost, Revenue and Markets (7 Hours)

Concepts of cost: Opportunity cost - Explicit and implicit cost – Private and social cost- Short run cost curves – Fixed, variable, total, average and marginal cost curves - Long run cost curves.

Concepts of revenue: Average and marginal revenue - Shutdown point - Break Even analysis (Numerical problems).

Markets: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly - Cartel and Collusion (Features and equilibrium of a firm) - Product pricing: Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming – Administered pricing.

MODULE 3 : National Income, Inflation and International Trade (7 Hours)

Circular flow of income - Multi-sector model - National income concepts: GNP, GDP, NNP, NI, PI, DPI, PCI - Methods of measuring national income – Difficulties (Numerical problems).

Inflation –Types - Causes and effects – Measures to control inflation - Monetary and fiscal policies – Deflation.

International Trade - Balance of payments – Components – Deficit - Devaluation – Tariff and non-tariff barriers.

MODULE 4 : Fundamentals of Financial Management (7 hours)

Introduction - Reserve Bank of India – Functions - Credit control techniques: Quantitative and qualitative techniques - Working capital management - Factors affecting working capital - Management of cash and marketable securities - Receivables management - Balance Sheet - Profit and Loss Account.

Personal Finance: Personal budget – Tracking income and expenses - 50-30-20 budgeting rule – Emergency fund – Debit vs Credit instruments – Diversification of Investments –Shares vs Bonds - Power of Compounding – Financial independence – Types of Insurance - Digital technology in Finance.

MODULE 5 : Business Financing (7 hours)

Introduction: The Stock Market: Functions, Problems faced by the stock market in India – Demat account and trading account – Market indices: Sensex and Nifty - Derivatives: Forwards, Futures, Options, Swaps - Mutual Funds – Types.

Sources of business financing: Equity capital - Preference capital - Debenture capital - Term loans - Retained earnings - Money market – Instruments - International Financing - FDI, FII.

Text Books:

1. Dominic Salvatore "Principles of Microeconomics", Oxford University Press, 2009
2. Gregory N Mankiw, "Principles of Macro Economics", Cengage Leaning India, 2022.
3. Prasanna Chandra, "Financial Management", McGraw Hill, 2022

Reference Books:

1. Paul A Samuelson, "Economics", McGraw Hill, 2019.
2. A. Koutsoyiannis, "Modern microeconomics", Palgrave McMillan, 1979.
3. Geetika Piyali Ghosh and Chodhury "Managerial Economics", McGraw Hill, 2017.
4. M Y Khan & P K Jain, "Financial Management", McGraw Hill, 2018.
5. Ruddar Datt, Indian Economy", S.Chand and Company Ltd, 2018.
6. Dwivedi D N, "Macro Economics", McGraw Hill, 2018.
7. Gregory N Mankiw, "Principles of Micro Economics", Cengage Leaning India, 2020
8. James C Van Horne, "Financial Management and Policy", Pearson Education, 20

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**8 hours**
1.1	Introduction - Demand and its determinants – Law of demand – Elasticity of demand – Measurement of elasticity and its applications (Numerical problems).	2
1.2	Supply and its determinants – Determination of equilibrium price – Changes in demand and supply and its effects.	2
1.3	Law of diminishing marginal utility - Consumer surplus - producer surplus	2
1.4	Production concepts: Production function - Cobb Douglas function (Numerical problems) - Average product - Marginal product - Law of variable proportions - Law of Returns to Scale.	2
Activity 1: OPEC decides to reduce its output of oil. Using demand and supply curves, bring out the effect of this on the price of oil in the world market. **Activity 2:** Derive the determination of the equilibrium price of a super luxury and an economy car.		
2	**Module 2**	**7 hours**
2.1	Concepts of cost - Opportunity cost - Explicit and implicit cost – Private and social cost- Short run cost curves – Fixed, variable, total, average and marginal cost curves - Long run cost curves.	2
2.2	Concepts of revenue – Average and marginal revenue - Shutdown point – Break Even analysis (Numerical problems).	2
2.3	Markets: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly - Cartel and Collusion (Features and equilibrium of a firm).	2
2.4	Product pricing: Cost plus pricing – Target return pricing – Penetration pricing – Predatory pricing – Going rate pricing – Price skimming – Administered pricing.	1

Activity 1: Determination of equilibrium price and output in oligopoly companies in India. **Activity 2:** Pricing strategy followed by Apple in regard to their mobiles.		
3	**Module 3**	**7 hours**
3.1	Circular flow of income - Multi-sector model - National income concepts – GNP, GDP, NNP, NI, PI, DPI, PCI - Methods of measuring national income – Difficulties (Numerical problems).	2
3.2	Inflation –Types - Causes and effects – Measures to control inflation - Monetary and fiscal policies – Deflation.	2
3.3	International Trade - Balance of payments – Components – Deficit.	2
3.4	Devaluation — Tariff and non-tariff barriers.	1
Activity 1: Compare the present BoP position of India and China. **Activity 2:** Impact of tariff wars in today's global scenario.		
4	**Module 4**	**7 hours**
4.1	Introduction - Reserve Bank of India – Functions - Credit control techniques: Quantitative and qualitative techniques.	2
4.2	Working capital management - Factors affecting working capital.	1
4.3	Management of cash and marketable securities - Receivables management. Balance Sheet - Profit and Loss Account.	2
4.4	Personal Finance: Budget – Tracking income and expenses - 50-30-20 budgeting rule – Emergency fund – Debit vs Credit Cards – Diversification of Investments – Shares vs Bonds - Power of Compounding – Financial independence – Insurance – Types of Insurance - Digital technology in Finance.	2
Activity 1: Investigate the historical returns offered by different asset classes. **Activity 2:** Steps needed to circumnavigate financial challenges like student loans, buying a car, purchasing a home vs renting, etc.		

5	**Module 5**	**7 hours**
5.1	Introduction - The Stock Market – Functions, Problems faced by the stock market in India – Demat account and trading account – Market indices: Sensex and Nifty.	3
5.2	Derivatives: Forwards, Futures, Options, Swaps - Mutual Funds – Types.	1
5.3	Sources of business financing: Equity capital - Preference capital - Debenture capital - Term loans - Retained earnings.	2
5.4	International Financing - FDI, FII.	1
Activity 1: Research and present the stock performance of a company. **Activity 2:** Investigate the impact of foreign direct investment into India, taking the examples of multinational companies.		
Total Hours		**36 Hours**

* Activities are a desirable part of the course.

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1):

1. State the Law of demand.
2. With the help of a figure, elucidate the concept of consumer surplus.
3. Define utility. State the Law of diminishing marginal utility.

Course Outcome 2 (CO2):

1. Distinguish between explicit and implicit cost.
2. Bring out the relationship between average and marginal revenue.
3. How does a firm under monopoly attain equilibrium?

Course Outcome 3 (CO3):

1. With the help of a figure, examine the circular flow of income in a multi sector economy.
2. State the government measures to control inflation.
3. What are non-tariff barriers? Give two examples.

Course Outcome 4 (CO4):

1. Mention any four functions of the RBI.
2. Elucidate the concept of working capital management. State the main factors influencing it.
3. Clarify the significance of an emergency fund? Mention its advantages.

Course Outcome 5 (CO5):

1. Elucidate the main problems faced by the stock market in India.
2. Clarify the significance of mutual funds? Mention the main types of mutual funds.
3. Distinguish between FDI and FII.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24HU2T01

Course Name: BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. With the help of a figure, elucidate the concept of consumer surplus.
2. A tea company sold 40000 kg of tea when the price of coffee was Rs.50 per kg. Later they were able to sell 45000 kg when the price of coffee increased to Rs.70 per kg. Calculate the cross elasticity of demand for tea.
3. Distinguish between explicit and implicit cost.
4. List the features of a firm under perfect competition.
5. Define cost plus pricing. Mention its advantage.
6. Write a note on non-tariff barriers. Give two examples.
7. Define Cash Reserve Ratio.
8. Write a note on the significance of receivables management.
9. Distinguish between demat account and trading account.
10. What is FDI? Mention two of its merits.

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE 1

11. a. State the Law of Demand. Also mention the assumptions and exceptions of the law. (7 Marks)

    b. What is the Cobb-Douglas production function? Mention its feature. If the production function of a firm is $Q = 30L^{1/2}K^{1/2}$, find out the average and marginal product of labour from the function, if 225 units of labour is combined with 196 units of capital. (7 Marks)

OR

12. a. State the Law of Diminishing Marginal Utility. Also mention the assumptions and importance of the law. (7 Marks)

    b. Define Income Elasticity. When the income of a consumer was Rs. 50,000 per month, the quantity demanded of a good was 100 units. When his income increased to Rs. 80,000, his demand increased to 110 units. Is the good a normal or an inferior one? Give reason. (7 Marks)

MODULE 2

13. a. State the features of a firm under perfect competition. With the help of a figure, explain the determination of equilibrium price and output under perfect competition. (7 Marks)

    b. A firm sells its product at Rs. 400 per unit. To produce a unit, it needs raw materials for Rs. 150, labour for Rs. 70 and incurs other variable expenses for Rs. 40. The firm's fixed expenses are Rs. 15,00,000. Find the breakeven quantity of the firm. (7 Marks)

OR

14. a. State the features of a firm under monopolistic competition. With the help of a figure, explain the determination of equilibrium price and output under monopolistic competition. (7 Marks)

    b. The value of the total sales of a company is Rs. 1,00,000. Its fixed cost is Rs. 20,000, while its variable cost is Rs. 50,000. Calculate:

       (a) the P/V ratio
       (b) breakeven point
       (c) margin of safety at this level of sales
       (d) If it sells each unit for Rs. 20, how many units should the company sell to break even?
       (e) Find the sales required to earn a profit of Rs. 20,000.

       (7 Marks)

MODULE 3

15. a. With the help of a figure, examine the circular flow of income in a multi-sector economy. (7 Marks)

b. From the following data,
Gross National Product = Rs. 14,700 crores
GST = Rs. 1,100 crores
Undisbursed Profit = Rs. 2,000 crores
Corporate Income Tax = Rs. 1,000 crores
Depreciation = Rs. 1,500 crores
Net Factor Income from Abroad = Rs. 5,200 crores
Income Tax = Rs. 500 crores
Subsidies = Rs. 400 crores
Social Security Contribution = Rs. 300 crores

Calculate:
(i) GDP
(ii) NI
(iii) PI

(7 Marks)

OR

16. a. Elucidate the economic problem of inflation. What are its main types? State the government measures to control inflation. (7 Marks)

b. In an economy, the total expenditure of the people on various goods and services is Rs. 2,000 crores. The government spending is Rs. 500 crores while the total investment is Rs. 300 crores. Exports are Rs. 200 crores and imports are Rs. 100 crores. The depreciation is Rs. 80 crores. Find the value of GNP. (7 Marks)

MODULE 4

17. a. Discuss the functions of the RBI. What are the main quantitative techniques used by the RBI? (7 Marks)

b. State the meaning of balance sheet in accounting. Draw a format of the balance sheet showing the different entries. (7 Marks)

OR

18. a. Write a note on the management of cash and marketable securities. (7 Marks)

b. State the significance of profit and loss account. Illustrate a format of the profit and loss account. (7 Marks)

MODULE 5

19. a. Elaborate the main functions performed by the stock market in an economy. (7 Marks)

b. Elucidate the various sources of business financing available to companies. (7 Marks)

OR

20. a. Elaborate the meaning of mutual funds. Discuss the different types of mutual funds. (7 Marks)

b. Distinguish between FDI and FII. (7 Marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2T07	CONSTRUCTION TECHNOLOGY AND MANAGEMENT	2	1	0	2	3	2024

Preamble

This course provides a comprehensive understanding of construction materials, technologies, and management practices essential for civil engineering. Students will explore traditional and advanced construction materials, cost-effective methods, prefabrication, prestressing principles. Emphasis is placed on mechanization, automation, and the efficient management of construction equipment. The course also covers project management, tendering processes, and contract types, along with construction planning techniques such as bar charts, milestone charts, CPM, and PERT. By the end of this course, students will be equipped to apply these concepts effectively in real-world construction projects.

Prerequisites: Basic civil Engineering

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Identify and understand various construction materials, building components, and structural systems used in the construction industry. (Cognitive Knowledge Level: Understand)
CO 2	Understand and apply various construction technologies, including scaffolding, formwork, prefabrication, prestressing techniques, 3D printing, and identify the causes of building failures. (Cognitive Knowledge Level: Understand)
CO 3	Understand modern construction materials, construction automation methods, and manage various construction equipment effectively. (Cognitive Knowledge Level: Understand)
CO 4	Understand the lifecycle and management of construction projects, including project phases, tendering processes, and various contract types. (Cognitive Knowledge Level: Understand)
CO 5	Apply construction planning techniques, including work breakdown structures, scheduling, bar charts, milestone charts, network analysis, CPM, and PERT. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	2	1	2	1	1	1	1	2
CO 2	3	3	3	2	3	1	2	1	1	1	1	2
CO 3	3	2	2	1	3	1	2	1	1	1	2	2
CO 4	2	2	2	1	2	2	2	1	2	2	3	3
CO 5	3	3	3	2	3	1	2	1	2	2	3	3

Assessment Pattern

Construction Technology And Management			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	30	20	20
Understand	50	50	50
Apply	20	30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 10 questions with 2 questions from each module, having 3 marks for each question.Students should answer all questions. Part B contains 2 questions from each module of which student should answer any one. Each question carries 14 marks and can have maximum 2 sub-divisions.

SYLLABUS

Module 1: Standard Construction Techniques (6 hours)

Construction Technology: Steel and masonry construction. Cost-effective construction – soil-cement block masonry, voided slab technology, filler slab technology, Scaffolding – uses and classification, Formwork – requirements of good formwork and classification - Construction safety- Methods and equipment

Module 2: Advanced Construction Techniques (8 hours)

Prefabricated construction and erection-Modular construction – Basic concept of prestressing – A fundamental understanding of pre-tensioned and post-tensioned construction, 3D printing, rapid wall construction and slip form technique, Reinforced brick masonry, Raised Access Flooring technology, Tunnel Form Construction

Module 3: (8 hours)

Construction equipments and automation - Mechanisation in construction – Earth moving, handling, pneumatic and hoisting equipment – Pile driving equipment - Advanced tunneling equipment– Soil compaction & stabilization equipment's –Bridge erection equipment-Concrete pumping- Automation in construction

Module 4: (7 hours)

Construction Project Management: Construction projects, categories, life cycle of a project – Pre-project phase, project phase, post-project phase, Detailed Project Report – Contents Tendering - types of tenders, stages in tendering, Contracts: Types of contracts – item rate contract, lumpsum contract, percentage rate contract, turnkey contracts, concession contracts– EPC

Module 5: (7 hours)

Construction Planning: Work breakdown structure Types of Schedules – Construction schedule, Material schedule, labour schedule, equipment schedule, financial schedule, Bar chart, Mile Stone Charts, Networks - Network representation – Activity on Node (AON) and activity on arrow (AOA) Diagram, Network analysis – Critical Path Method (CPM), Programme Evaluation and Review Technique(PERT) – Concepts and problems

Text Books:

1. Kumar Neeraj Jha (2015), Construction Project Management: Theory and Practice, Pearson India Education Services Pvt.Ltd.

2. Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2019

Reference Books:

1. Mehta and Monteiro, Concrete-Micro structure, Properties and Materials , McGraw Hill Professional 2017

2. Varghese P. C. (2007), Building Construction, Prentice Hall India.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**6 hours**
1.1	Construction Technology: steel and masonry construction. Cost-effective construction	2
1.2	Soil-cement block masonry, voided slab technology, filler slab technology, Scaffolding – uses and classification	2
1.3	Filler slab technology, Scaffolding – uses and classification, Formwork – requirements of good formwork and classification, Construction safety-methods and equipment	2
2	**Module 2**	**8 hours**
2.1	Prefabricated construction and erection - Modular construction – Basic concept of prestressing – a fundamental understanding of pre-tensioned and post-tensioned construction	4
2.2	3D printing, rapid wall construction and slip form technique	2
2.3	Reinforced brick masonry, Raised Access Flooring technology, Tunnel Form Construction.	2

3	**Module 3**	**8 hours**
3.1	Modern construction materials – Intelligent buildings – building automation.	2
3.2	Mechanisation in construction – Earth moving, handling, pneumatic and hoisting equipment – pile driving equipment – equipments– Advanced tunneling equipment	4
3.3	Soil compaction & stabilization equipments – Automation in construction -owning and operating works of construction equipment.	2
4	**Module 4**	**7 hours**
4.1	Construction Project Management: Construction projects, categories, life cycle of a project – pre-project phase, project phase, post-project phase, Detailed Project Report – contents	3
4.2	Tendering: Types of tenders, stages in tendering	2
4.3	Contracts: Types of contracts – item rate contract, lumpsum contract, percentage rate contract, turnkey contracts, concession contracts – EPC	2
5	**Module 5**	**7 hours**
5.1	Construction Planning: Work breakdown structure Types of Schedules – Construction schedule, Material schedule, labour schedule, equipment schedule, financial schedule	2
5.2	Bar chart, Mile Stone Charts, Networks, Network representation – Activity on Node (AON) and activity on arrow (AOA) Diagram	2
5.3	Network analysis – Critical Path Method (CPM), Programme Evaluation and Review Technique(PERT) – concepts and problems	3
Total Hours		**36 Hours**

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CE2T07

Course Name: CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Explain the classification of scaffolding and its uses in construction.
2. What are the requirements of good formwork?
3. Define modular construction and explain its key benefits.
4. Compare pre-tensioned and post-tensioned construction methods in prestressing.
5. List different types of earth-moving equipment and their applications.
6. What are the advantages of automation in construction equipment operations?
7. What are the types of contracts used in construction projects? Provide examples.
8. List the stages involved in tendering and their importance.
9. Differentiate between Activity on Node (AON) and Activity on Arrow (AOA) diagrams.
10. What is the significance of milestone charts in construction scheduling

PART B

Answer any one question from each module. Each question carries 14 marks.

11. Discuss the construction techniques adopted for cement block masonry, voided slab technology, and filler slab technology, along with their applications.

OR

12. Compare steel and masonry construction techniques, highlighting their advantages and limitations.

13. Discuss the slip form technique and rapid wall construction, emphasizing their importance in modern construction practices.

OR

14. Elaborate on the concept of 3D printing in construction and its future impact on the industry.

15. Discuss the significance of construction equipment mechanization and automation in improving project efficiency.

OR

16. Describe the mechanisms and applications of hoisting equipment, pneumatic handling equipment, and earth-moving equipment used in a construction site.

17. Explain the life cycle of a construction project, detailing the phases from pre-project to post-project stages.

OR

18. Compare EPC and turnkey contracts in terms of implementation, financial benefits, and risk-sharing.

19. Describe the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), including examples of their applications in construction planning.

OR

20. Discuss the preparation of different types of schedules (construction schedule, material schedule, labor schedule, equipment schedule, financial schedule) for effective construction planning.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2L05	MATERIAL TESTING LABORATORY	0	0	3	3	2	2024

Preamble

This course offers a comprehensive insight into civil engineering materials, emphasizing the relationship between their structural characteristics and properties, as well as practical applications. Through experimental work, students will analyze mechanical features such as tensile, shear, bending, and torsional strength. Additionally, students will develop skills to compute stress, strain, and displacement, applying these principles to the design and analysis of real-world structures.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Perform standard mechanical tests (tension, torsion, bending, shear, and impact) on different engineering materials to determine key mechanical properties: (Cognitive Knowledge Level: Apply)
CO 2	Evaluate material hardness using Vickers and Brinell hardness testing methods and interpret the results for different materials: (Cognitive Knowledge Level: Evaluate)
CO 3	Analyse the behaviour of materials and structural elements like springs and beams under load. (Cognitive Knowledge Level: Analyse)
CO 4	Apply theoretical principles such as Maxwell's reciprocal theorem to validate experimental observations: (Cognitive Knowledge Level: Apply)
CO 5	Demonstrate technical skills in measuring, recording, and interpreting data from material testing experiments while adhering to safety and accuracy standards: (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	2	1	1			2	1		2
CO 2	3	2	2	2	1	1			1	1		2
CO 3	3	3	3	2	1	1			2	1		2
CO 4	3	3	2	3	1	1			1	1		2
CO 5	2	2	3	2	2	3	1	2	3	2	1	3

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test	:	20 marks
Viva-Voce/Test	:	15 marks
Lab Record	:	5 marks

End Semester Examination Pattern

The following guidelines should be followed regarding the award of marks:

Preliminary work	:	20 marks
Implementing the work / Conducting the experiment	:	20 marks
Performance, result and inference (usage of equipment and troubleshooting)	:	30 marks
Viva voce	:	30 marks

SYLLABUS

LIST OF EXPERIMENTS

No	Description
1	Tension test on mild steel/ TMT bar
2	Double shear test on mild steel rod.
3	Vicker's Hardness test on a given material (Brass / Steel)
4	Brinell Hardness test on a given material (Brass / Steel/ Aluminum)
5	Torsion Pendulum Test with given wire specimen (Brass & Steel)
6	Flexural rigidity of given steel I Beam.
7	Impact test of the given material using Izod and Charpy test.
8	Spring test on close coiled spring & open coiled spring.
9	Bending test on wooden beam
10	Verification of Clerk Maxwell's law of reciprocal theorem.
11	Torsion test on mild steel specimen

*Minimum Eight Experiments Are Mandatory

Reference Books:

1. G E Dieter. Mechanical Metallurgy, McGraw Hill, 2013 (3rd edition)
2. Dally J W, Railey W P, Experimental Stress analysis, McGarw Hill,1991 S Timoshenko, D H Young, et al, "Engineering mechanics", McGraw Hill Education.
3. Timoshenko, S., & Young, D. (2021). Strength of Materials. (3rd edition)
4. Russell Hibbeler, "Engineering mechanics: Statics and Dynamics", Pearson Education, 2022 (15th edition).

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CE2L06	CIVIL ENGINEERING DRAFTING LAB	0	0	3	3	2	2024

Preamble

The primary objectives of this course are to provide civil engineering students with the vital skills needed to create computer-aided engineering drawings understand the construction details of various building elements, and visualize the completed form of buildings along with the intricacies of construction based on engineering drawings. Through this comprehensive approach, students will gain a solid foundation in the principles and practices of architectural and engineering design.

Prerequisites: Graphics for Civil Engineers

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	To understand the fundamental AutoCAD commands essential for creating technical drawings.(Cognitive Knowledge Level: Apply)
CO 2	To illustrate the ability to organize technical drawings systematically and professionally.(Cognitive Knowledge Level: Apply)
CO 3	To demonstrate the ability to create and organize accurate sectional details, elevations, and plans for various building components. (Cognitive Knowledge Level: Apply)
CO 4	To prepare the floor plan, section, and elevation of the building from the layout in compliance with building rules.(Cognitive Knowledge Level: Apply)
CO 5	To prepare a complete document for the building permit to include all necessary information regarding the drawing. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2				2					2		1
CO 2	1				3					2		1
CO 3	2				3					2		1
CO 4	1				3					2		1
CO 5	1				3					2		1

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test	:	20 marks
Viva-Voce/Test	:	15 marks
Lab Record	:	5 marks

End Semester Examination Pattern

The following guidelines should be followed regarding the award of marks:

Preliminary work	:	20 marks
Implementing the work / Conducting the experiment	:	20 marks
Performance, result and inference (usage of equipment and troubleshooting)	:	30 marks
Viva voce	:	30 marks

SYLLABUS

A. Introduction to AutoCAD

Basic Drawing Commands, Layers and Annotation, Blocks, Groups, and Hatching. Printing and Plotting — Setting up sheets and layouts, Applying scales and setting print preferences, Exporting drawings to different formats (PDF, DWG, DXF).

Detailed Drawings of:

1. Draw sectional details and elevation of panelled doors, glazed windows and ventilators in wood.

2. Draw elevation, section and detailing of connection between members, arrangement for fixing at the support for steel roof truss.

3. Draw plan, section, and elevation of dog-legged staircase.

4. Draw sectional details of a load-bearing wall over strip footing, RCC Column over isolated footing, and pile with pile cap.
5. Draw the sectional details, detailing of Septic Tank and Soak Pit drawings.
6. Develop the layout and design the floor plan, sectional view, and elevation for a single-story residential building featuring a flat roof.
7. Develop the layout and design the floor plan, section and elevation of two - storied residential building. Also include the site plan and service plan as per the latest building rules (KPBR or KMBR).
8. Draw plan, section and elevation of a public buildings — office complex, public health center, post office, bank etc.

B. Introduction to Revit Architecture

Create and modify basic building components—such as walls, floors, roofs, doors, and windows—within a 3D environment. The focus is on visualizing simple structural forms and developing accurate, well-coordinated 3D models.

Reference Books:

1. National Building Code of India
2. Kerala panchayat building rules, 2019
3. Kerala Municipality building rules, 2019
4. Dr. Balagopal T S Prabhu, Building Drawing and Detailing, Spades Publishers, 2007.
5. AutoCAD Essentials, Autodesk official Press, John Wiley & Sons, USA
6. Shah, M.G., Kale, C. M. and Patki, S.Y. Building Drawing With An Intergrated Approach to Built Environment, Tata McGraw Hill Publishing Company Limited, New Delhi
7. Elise Moss, Autodesk Revit 2024 Architecture Basics: From the Ground Up, SDC Publications,2023

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEM42	SOLID WASTE MANAGEMENT	3	1	0	3	4	2024

Preamble

This course offers a comprehensive exploration of solid waste management principles, practices, and emerging challenges.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Identify scope and regulations of solid waste management. (Cognitive Knowledge Level: Remember)
CO 2	Identify and explain the different types of solid waste and ensure effective and scientific management of municipal solid waste. (Cognitive Knowledge Level: Understand)
CO 3	Describe solid waste collection methods, transfer logistics, and onsite handling with relevant equipment and design considerations. (Cognitive Knowledge Level: Understand)
CO 4	Identify Methods and technologies used to manage waste, including recycling, composting, energy recovery, and landfilling. (Cognitive Knowledge Level: Understand)
CO 5	Identify various categories of special wastes and explain emerging environmental issues related to their management. (Cognitive Knowledge Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1					2	2	1				1
CO 2	1					2	2	1				1
CO 3	1					2	2	1				1
CO 4	1					2	2	1				1
CO 5	1					2	2	1				1

Assessment Pattern

Solid Waste Management			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	40	40	40
Understand	60	60	60
Apply			
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which any one is to be answered. Each question carries 14 marks and can have maximum 2 sub-divisions.

SYLLABUS

Module 1: Introduction to Solid Waste Management (9 hours)

Overview of solid waste management: definition, scope, and historical development, Legislations and regulations: national and international policies, Sources of solid waste: residential, commercial, industrial, institutional, and agricultural. Indian rules and guidelines for municipal solid waste, hazardous waste, electronic waste, construction and demolition waste and plastic waste and their amendments.

Module 2: Sources, Types, and Characteristics of Municipal Solid Waste (9 hours)

Types of solid waste: biodegradable, recyclable, inert, hazardous, and electronic waste; Physical and chemical characteristics: composition analysis, moisture content, density, calorific value, Waste generation rates: factors influencing generation and estimation methods. Integrated solid waste management: waste management hierarchy and sustainable practices; management of sanitary waste.

Module 3: Collection, Transfer, and Transport of Municipal Solid Waste (9 hours)

Collection systems: methods (curbside, block, community bins), equipment, and vehicles, Transfer and transport: transfer stations, transportation logistics, and route optimization, On-site handling and storage: segregation practices, storage containers, and design considerations.

Module 4: Processing and Disposal Methods (9 hours)

Site selection criteria; Processing techniques: mechanical (shredding, compaction), biological (composting, anaerobic digestion), thermal (incineration, pyrolysis), Resource recovery: material recovery facilities and energy recovery technologies, Disposal methods: landfills (site selection, design, operation, closure), leachate and gas management.

Module 5: Special Wastes and Emerging Issues (9 hours)

Hazardous waste management: definition, classification, treatment, and disposal methods, TSDF facility; Site selection criteria; Biomedical waste management: categories, handling protocols; bar code system for effective management of bio-medical waste, treatment, and disposal regulations, electronic waste management: sources, recycling, and disposal challenges, Recent trends and technologies: circular economy concepts, advances in waste processing, policy developments for sustainability.

Text books:

1. Handbook of Solid Waste Management, 2nd Edition, George Tchobanoglous and Frank Kreith, McGraw-Hill Education, 2002.

2. Introduction to Waste Management: A Textbook, Syed E. Hasan, Wiley, 2018.

3. Solid Waste Technology & Management, George Tchobanoglous, McGraw-Hill Education, 2011.

4. Waste Management: A Reference Handbook, Robert L. France, ABC-CLIO, 2011.

Reference books:

1. Environmental Pollution Control Engineering, S.K. Garg, Khanna Publishers, 2015.

2. Solid Waste Management, S.K. Garg, Khanna Publishers, 2015.

3. Elements of Environmental Engineering, Duggal K.N., S. Chand and Co. Ltd., 2014.

4. Environmental Engineering, B.C. Punmia, A.K. Jain, and A. Jain, Laxmi Publications, 2014.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Overview of solid waste management: definition, scope, and historical development,	3
1.2	Legislation and regulations: national and international policies, Municipal Solid Waste Management Rules	3
1.3	Integrated solid waste management: waste management hierarchy and sustainable practices	3
2	**Module 2**	**9 hours**
2.1	Sources of solid waste: residential, commercial, industrial, institutional, and agricultural	2
2.2	Types of solid waste: biodegradable, recyclable, inert, hazardous, and electronic waste	2
2.3	Physical and chemical characteristics: composition analysis, moisture content, density, calorific value.	3
2.4	Waste generation rates: factors influencing generation and estimation methods	3

3	**Module 3**	**9 hours**
3.1	Collection systems: methods (curbside, block, community bins), equipment, and vehicles,	3
3.2	Transfer and transport: transfer stations, transportation logistics, and route optimization	3
3.3	On-site handling and storage: segregation practices, storage containers, and design considerations	3
4	**Module 4**	**9 hours**
4.1	Processing techniques: mechanical (shredding, compaction), biological (composting, anaerobic digestion), thermal (incineration, pyrolysis),	3
4.2	Resource recovery: material recovery facilities and energy recovery technologies,	3
4.3	Disposal methods: landfills (site selection, design, operation, closure), leachate and gas management.	3
5	**Module 5**	**9 hours**
5.1	Hazardous waste management: classification, treatment, and disposal methods,	2
5.2	Biomedical waste management: categories, handling protocols, treatment, and disposal regulation.	2
5.3	Electronic waste management: sources, recycling, and disposal challenges,	2
5.4	Recent trends and technologies: circular economy concepts, advances in waste processing, policy developments	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1): To Identify scope and regulations of solid waste management

1. What are the historical roots of solid waste management, and how has it evolved over time?

2. What national policies and regulations govern solid waste management in your country?
3. How does solid waste management impact public health, the environment, and the economy?

Course Outcome 2 (CO 2): To Identify and explain the different types of solid waste and to ensure effective and scientific management of municipal solid waste.

1. What are the benefits and challenges of implementing integrated solid waste management systems?
2. How can sanitary waste management be integrated with other waste management systems?
3. How do physical and chemical characteristics influence waste management decisions?

Course Outcome 3 (CO 3):

1. What are the considerations for choosing a waste collection method, and how do they impact waste management operations?
2. How do collection vehicles contribute to greenhouse gas emissions, and what alternatives are available?
3. What technologies can be used to optimize transportation logistics and reduce costs?

Course Outcome 4 (CO 4):

1. What types of waste are suitable for anaerobic digestion, and what are the benefits of anaerobic digestion?
2. How does incineration affect the environmental impacts of waste, and what are the challenges associated with incineration?
3. What are the advantages and disadvantages of each processing technique, and how do they apply to different types of waste?

Course Outcome 5 (CO 5):

1. What are the different types of hazardous waste, and how are they managed?
2. What are the potential health impacts of hazardous waste, and how can they be prevented?
3. What are the proper procedures for handling and storing biomedical waste?

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEM42

Course Name: SOLID WASTE MANAGEMENT

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. What sustainable practices can be adopted to reduce waste generation, increase recycling, and promote environmentally friendly waste disposal?
2. What is the purpose of a transfer station in waste management, and how does it operate?
3. How do route optimization algorithms work, and what data do they require?
4. How does shredding affect the physical characteristics of waste, and what are the benefits of shredding?
5. What are the proper procedures for handling and storing hazardous waste?
6. How is moisture content measured, and what is its impact on waste management?
7. How do route optimization algorithms work, and what data do they require?
8. What are the benefits of route optimization, and how can they be measured?
9. What national policies and regulations govern solid waste management in your country?
10. How do these policies and regulations address issues like waste generation, disposal, and recycling?

PART B

Answer any one question from each module. Each question carries 14 marks.

11. a) What are the responsibilities of local governments, waste generators, and other stakeholders under these rules? (7 marks)

    b) What role can education, awareness, and community engagement play in promoting sustainable waste management practices? (7 marks)

OR

12. a) What sustainable practices can be adopted to reduce waste generation, increase recycling, and promote environmentally friendly waste disposal? (7 marks)

    b) What is solid waste management, and what are its primary objectives? (7 marks)

13. a) How do transportation routes and schedules impact waste collection and disposal operations? (7 marks)

    b) How do collection vehicles contribute to greenhouse gas emissions, and what alternatives are available? (7 marks)

OR

14. a) What is the purpose of a transfer station in waste management, and how does it operate? (7 marks)

    b) What is block collection, and how is it used in urban areas? (7 marks)

15. a) What design considerations should be taken into account when planning on-site waste handling. (7 marks)

    b) What safety features should be considered when designing or selecting waste collection equipment and vehicles? (7 marks)

OR

16. a) What are the key considerations for transportation logistics in waste management, and how do they impact costs and efficiency? (7 marks)

    b) How can waste handling and storage facilities be designed to minimize environmental impacts and maximize efficiency? (7 marks)

17. a) How does composting affect the environmental impacts of waste, and what are the challenges associated with composting. (7 marks)

    b) How does pyrolysis affect the environmental impacts of waste, and what are the challenges associated with pyrolysis. (7 marks)

OR

18. a) How do mechanical, biological, and thermal processing techniques compare in terms of efficiency, cost, and environmental impacts? (7 marks)

    b) What are the advantages and disadvantages of each processing technique, and how do they apply to different types of waste? (7 marks)

19. a) What are the common sources of hazardous waste generation, and how can they be minimized. (7 marks)

    b) What are the proper procedures for handling and storing hazardous waste? (7 marks)

OR

20. a) What are the options for disposing of biomedical waste, and what are the associated risks and benefits? (7 marks)

    b) How can biomedical waste be disposed of in an environmentally responsible manner? (7 marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEM43	LAND USE AND URBAN PLANNING	3	1	0	3	4	2024

Preamble

This course provides a comprehensive introduction to land use and urban planning, emphasizing its role in shaping sustainable and livable cities. Students will explore the historical evolution of urban planning, and the foundational elements of urban design. The course also addresses critical issues such as urban growth, sprawl, and sustainability, with a focus on smart cities and green development. Legal frameworks, urban policies, and future challenges—including climate change and technological integration—are examined to prepare students for real-world planning scenarios in the Indian urban context.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the fundamentals of urban planning and land use and Identify the challenges and goals of urban planning with a focus on sustainability. (Cognitive Knowledge Level: Understand)
CO 2	Understand the principles and practices of land use classification and zoning and gain knowledge of the regulatory and legal frameworks for zoning. (Cognitive Knowledge Level: Understand)
CO 3	Learn the principles and practices of urban design and understand the importance of infrastructure planning and its connection to urban development. (Cognitive Knowledge Level: Understand)
CO 4	Understand the factors that drive urban growth and their implications on land use and planning and Analyze the challenges of urban sprawl and discuss strategies to manage it. (Cognitive Knowledge Level: Understand)
CO 5	Understand the key urban planning policies and laws in India and gain insights into the legal and regulatory frameworks for urban planning. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1						2	1			1		
CO 2						2	1			1		
CO 3						3	3			1		
CO 4						2	2			1		
CO 5						2	1			1		

Assessment Pattern

Land Use and Urban Planning			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	40	40	40
Understand	50	50	50
Apply	10	10	10
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 mark and can have maximum 2 sub - divisions.

SYLLABUS

MODULE 1 (9 hours)

Introduction to Land Use and Urban Planning : Definition of land use and urban planning, Historical evolution of urban planning, Importance of land use in urban development, Objectives of urban planning, Relationship between urban planning and sustainable development. Introduction to smart urban planning, Role of IoT and AI in modern urban planning.

MODULE 2 (9 hours)

Land Use Classification and Zoning : Land Use Classification, Importance of land use classification in urban planning, Case studies of land use patterns in Indian cities, Zoning Concepts and Types, Zoning regulations and their significance in urban planning, Challenges in Land Use and Zoning. Introdution to use of GIS and AI in Land use mapping and zoning.

MODULE 3 (9 hours)

Urban Design and Infrastructure Planning: Elements of urban design, The importance of aesthetics, functionality, and safety in urban design, The role of infrastructure in urban planning, Planning for transportation and mobility, Infrastructure challenges in urban areas, especially in Indian cities, Key principles of sustainable urban design, Case studies on sustainable urban design practices in India, Role of urban design in reducing environmental impacts of urbanization. AI in urban Infrastructure Management.

MODULE 4 (9 hours)

Urban Growth, Sprawl, and Sustainability: Factors Influencing Urban Growth, The role of urban policies and economic development in urban growth, Regional growth and the interaction between rural and urban areas, Urban sprawl and its causes and effects, Strategies for controlling sprawl, Planning for sustainable urban growth: Smart cities and green buildings, The role of urban planners in ensuring environmental sustainability, Case studies on sustainable urban development in India.

MODULE 5 (9 hours)

Urban Planning Policies, Legal Framework, and Future Challenges: Urban Planning Policies in India, The role of the National Urban Transport Policy, Master Plans, and Smart Cities Mission, Policies for affordable housing and urban renewal, Legal Framework in Urban Planning: The Town and Country Planning Acts:, The role of legal regulations in urban development, Future Challenges in Urban Planning, The future of smart cities and technological integration in urban planning. Ethical considerations and data privacy in smart urban planning.

Text Books:

1. P.K. Jain, “Urban Planning and Development”,Vol I, CBS Publishers & Distributors Pvt. Ltd
2. S.P. Vyas ,”Town Planning in India”, Vol II ,M/s Scientific Publishers
3. N.C.K.S.R.K. Rao ,”Urban Land Use Planning “,Vol II, CBS Publishers
4. C.S.V. Murthy ,”Principles of Urban and Regional Planning” , Revised Edition , CBS Publishers
5. R.K. Mishra ,”Urban Planning and Development: Theory and Practice”, Vol I , Atlantic Publishers
6. A.S. Rao ,”Sustainable Development in Urban Planning”, Vol I , Concept Publishing Company

Reference Books:

1. Ashok Kumar, Sanjeev Vidyarthi, and Poonam Prakash, “City Planning in India” (2021),Routledge India
2. S.K. Kulshrestha,” Urban and Regional Planning in India”: A Handbook for Professional Practice (2012), SAGE Publications
3. Sameer Sharma , “A Textbook of Urban Planning and Geography”, (2020), PHI Learning Pvt. Ltd.
4. Vidyadhar K. Phatak , “Planning for India’s Urbanisation”, (2024), CEPT University Press

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Introduction to Urban Planning: Definition, scope, and importance of urban planning, Overview of urban planning principles and concepts, Historical development of urban planning	2
1.2	Urbanization and Land Use :Growth of cities and the role of urban planning in managing land us, Urbanization trends in India and globally, The impact of urbanization on land use patterns	2

1.3	The Role of Urban Planning :Objectives of urban planning: Housing, transportation, infrastructure, and community development, The role of urban planning in shaping social, economic, and environmental outcomes.	2
1.4	Urban Planning and Sustainable Development: Relationship between urban planning and sustainability, Role of planners in promoting sustainable urban growth, Challenges in urban planning in India, focusing on sustainability issues. Introduction to smart urban planning, Role of AI and IoT in modern urban planning.	3
2	**Module 2**	**9 hours**
2.1	Land Use Classification : Different types of land use: Residential, commercial, industrial, recreational, and agricultural, Importance of land use classification in urban planning, Case studies of land use patterns in Indian cities.	3
2.2	Zoning Concepts and Types: Zoning regulations and their significance in urban planning, Different types of zoning: Residential, commercial, industrial, and mixed-use zones, Zoning ordinances and their role in controlling land use.	3
2.3	Challenges in Land Use and Zoning:Issues faced in land use planning: Land acquisition, land tenure, informal settlements, Challenges of implementing zoning regulations in rapidly growing cities. Introduction to use of AI and GIS in land use mapping and zoning.	3
3	**Module 3**	**9 hours**
3.1	Principles of Urban Design: The role of urban design in shaping cities, Elements of urban design: Street patterns, open spaces, and public spaces, The importance of aesthetics, functionality, and safety in urban design	3
3.2	Infrastructure Planning in Urban Areas : The role of infrastructure in urban planning: Roads, water supply, sanitation, and electricity, Planning for transportation and mobility: Public transport, road networks, and pedestrian pathways, Infrastructure challenges in urban areas, especially in Indian cities	3

3.3	Sustainable Urban Design: Key principles of sustainable urban design: Green spaces, energy-efficient buildings, and eco-friendly transport systems, Case studies on sustainable urban design practices in India, Role of urban design in reducing environmental impacts of urbanization. AI in urban infrastructure management.	3
4	**Module 4**	**9 hours**
4.1	Factors Influencing Urban Growth: Population growth, migration, and economic factors, The role of urban policies and economic development in urban growth, Regional growth and the interaction between rural and urban areas	3
4.2	Urban Sprawl: The concept of urban sprawl and its causes, Environmental, economic, and social consequences of urban sprawl, Strategies for controlling sprawl: Compact cities, transit-oriented development	3
4.3	Sustainable Urban Growth: Planning for sustainable urban growth: Smart cities and green buildings, The role of urban planners in ensuring environmental sustainability, Case studies on sustainable urban development in India.	3
5	**Module 5**	**9 hours**
5.1	Urban Planning Policies in India: Key urban planning policies and their evolution in India, The role of the National Urban Transport Policy, Master Plans, and Smart Cities Mission, Policies for affordable housing and urban renewal.	3
5.2	Legal Framework in Urban Planning: The Town and Country Planning Acts: Overview and impact on land use and urban planning,The role of legal regulations in urban development: Zoning laws, land acquisition, and property rights, Issues related to land tenure and informal settlements.	3
5.3	Future Challenges in Urban Planning: The impact of climate change, population pressure, and technological advancements on urban planning, The future of smart cities and technological integration in urban planning, Addressing issues like affordable housing, pollution, and inclusive urban development., Ethical considerations and Data privacy in smart urban planning.	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1):

1. Compare traditional and modern urban planning principles with examples.
2. Explain how planning theories have evolved to suit contemporary urban issues.
3. Discuss how urban planning influences socio-economic outcomes.

Course Outcome 2 (CO2):

1. Define zoning ordinance and explain its purpose.
2. Differentiate between residential and industrial land uses in terms of infrastructure requirements.
3. How does mixed-use zoning differ from traditional single-use zoning?

Course Outcome 3 (CO3):

1. How should planners integrate utilities and services into urban planning from the start?
2. What is the significance of open and public spaces in urban environments?
3. Explain how sustainable urban design can be integrated into land use planning.

Course Outcome 4 (CO4):

1. Discuss the economic and social impacts of urban sprawl on infrastructure and community life.
2. Explain features of smart city and discuss how they contribute to sustainable urban living
3. Define the main drivers of urban growth. How do population growth and migration contribute to urban expansion?

Course Outcome 5 (CO5):

1. Explain the objectives and impact of the National Urban Transport Policy (NUTP).
2. Describe the role and structure of Master Plans in Indian cities
3. Discuss the urban planning challenges posed by informal settlements and slum development

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEM43

Course Name: LAND USE AND URBAN PLANNING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Define urban planning and explain its significance in modern urban development.
2. Explain the role of land use in urban planning with relevant examples.
3. What is zoning, and how does it influence urban planning?
4. Describe different land use classifications in urban areas and their significance.
5. Discuss the core principles of urban design and their role in shaping cities.
6. How does infrastructure planning contribute to the success of urban planning?
7. What are the key factors contributing to urban growth in India? Discuss their implications.
8. Explain the concept of urban sprawl and its negative effects on cities.
9. Explain the role of legal frameworks in urban planning.
10. How can smart city initiatives address urban planning challenges in India?

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE - 1

11. How does urban planning contribute to sustainability in urban development? Discuss its importance.

OR

12. Explain the historical evolution of urban planning with reference to major cities in India.

MODULE - 2

13. Explain the concept of mixed-use zoning and its advantages.

OR

14. How does land use classification affect urban infrastructure development?

MODULE - 3

15. Explain the concept of sustainable urban design. Provide examples from Indian cities.

OR

16. How do urban design and infrastructure planning influence economic activities in cities?

MODULE - 4

17. What is sustainable urban growth? How can it be achieved in Indian cities?

OR

18. Discuss strategies for managing urban growth and reducing urban sprawl in Indian cities.

MODULE - 5

19. Discuss the major urban planning policies in India. How have they impacted urban development?

OR

20. What are the future challenges in urban planning in India? Discuss how planners can address these challenges.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH41	STRUCTURAL FORMS AND MATERIALS	3	1	0	3	4	2024

Preamble

This course introduces the fundamental structural forms and explores the behavior and efficiency of various structural systems. It examines the mechanical and physical properties of traditional and modern building materials including concrete, steel, timber, and composites.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand different structural forms and explain their behavior in terms of force distribution and structural efficiency. (Cognitive Knowledge Level- Understand)
CO 2	Understand the various mechanical and thermal properties. Understand the properties, types, and mix design of concrete as a structural material. (Cognitive Knowledge Level- Understand)
CO 3	Analyze the mechanical properties and types of structural steel, and assess the behavior and design considerations of steel structural systems. (Cognitive Knowledge Level- Analyze)
CO 4	Analyze the mechanical properties and structural behavior of timber, and understand its joinery techniques, durability, and maintenance strategies. (Cognitive Knowledge Level- Analyze)
CO 5	Understand the structural behavior of composite materials, and the characteristics of advanced construction materials such as high-performance concrete, self-healing concrete and smart materials (Cognitive Knowledge Level- Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1					1				2	1
CO 2	1	2	2			1	2			2	2	1
CO 3	1	2	2			2	2			2	2	1
CO 4	1	2	1			2	2			2	2	1
CO 5	1	1	2			1	2				2	1

Assessment Pattern

Structural Forms And Materials			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (Marks)**
	Test 1 (Marks)	**Test 2 (Marks)**	
Remember			
Understand	50	40	50
Apply	30	40	30
Analyse	20	20	20
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which only 1 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

MODULE 1 (9 hours)

Overview of Structural Forms: Definition and classification of structural forms - Types of structures: Frames, slabs, arches, shells and membranes. Force distribution in different structural forms: Beam, frame, arch, and shell - Structural efficiency: Strength-to-weight ratio, stiffness, and stability.

MODULE 2 (9 hours)

Building Materials: Mechanical Properties of Materials: Stress, strain, and their relationship - Tensile, compressive, shear, and bending stresses - Creep and fatigue behavior in materials - Modulus of elasticity, Poisson's ratio and thermal properties.

Concrete as a Structural Material: Basic properties – Mix design and factors affecting concrete quality – Concrete in reinforced and prestressed forms. Types of Concrete-Durability and degradation of concrete. Applications of concrete in structural systems.

MODULE 3 (9 hours)

Steel as a Structural Material: Properties of steel: Yield strength, tensile strength, and ductility, stiffness and fatigue behavior of steel – Types of steel: Carbon steel, alloy steel, stainless steel and high strength steel.

Steel Structural System: Structural shapes – I beams, channels, angles, hollow sections, and plates. Connections and joining techniques (bolted, welded, reveted) – Steel columns, beams, frames, and trusses. Design considerations for steel structures – buckling, torsional buckling, and stability of steel members.

MODULE 4 (9 hours)

Timber as a Structural Material: Properties of Timber – Mechanical properties of wood: Strength, modulus of elasticity, and moisture content - Timber's anisotropic nature and behavior under loads.

Timber Structural Systems: Beams, trusses, columns, and frames in timber structures – Joinery techniques and connections (nailing, bolting, gluing) - Glulam and laminated veneer lumber (LVL). Durability and Maintenance of Timber Structures - Timber decay, insect attack, and moisture content management - Treatment methods for timber.

MODULE 5 (9 hours)

Composites Materials: Introduction to composites in structural systems - Types of composites - uses and behaviour in structural systems - Applications of composites in strengthening and retrofitting structures.

Advanced Materials in Modern Construction -High-performance concrete (HPC), self-healing concrete, Smart materials.

Textbooks:

1. Allen Edward, Iano Joseph "Fundamentals of Building Construction: Materials and Methods", John Wiley & Sons Inc, Seventh Edition 2019
2. Misra, Anil Kumar "Building Materials and Construction", S. Chand Publishing, 2018
3. Ram S Gupta " Principles of Structural Design – Wood, Steel, and Concrete", Taylor and Francis Group, Second Edition 2014
4. S S Bhavikatti "Building Materials", Vikas Publishing House 2012

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	**Overview of Structural Forms:** Definition and classification of structural forms	2
1.2	Types of structures: Frames, slabs, arches, shells and membranes	2
1.3	Force distribution in different structural forms: Beam, frame, arch, and shell	3
1.4	Structural efficiency: Strength-to-weight ratio, stiffness, and stability	2
2	**Module 2**	**9 hours**
2.1	**Building Materials:** Mechanical Properties of Materials: Stress, strain, and their relationship -Tensile, compressive, shear, and bending stresses	1
2.2	Creep and fatigue behavior in materials	1
2.3	Modulus of elasticity, Poisson's ratio and thermal properties	2
2.4	Concrete as a Structural Material: Basic properties – Mix design and factors affecting concrete quality	2

2.5	Concrete in reinforced and prestressed forms. Types of Concrete- Durability and degradation of concrete.	2
2.6	Applications of concrete in structural systems	1
3	**Module 3**	**9 hours**
3.1	**Steel as a Structural Material:** Properties of steel: Yield strength, tensile strength, and ductility, stiffness and fatigue behavior of steel	2
3.2	Types of steel: Carbon steel, alloy steel, stainless steel and high strength steel.	2
3.3	Steel Structural System: Structural shapes – I beams, channels, angles, hollow sections, and plates.	1
3.4	Connections and joining techniques (bolted, welded, riveted) – Steel columns, beams, frames, and trusses.	2
3.5	Design considerations for steel structures – buckling, torsional buckling, and stability of steel members – Fire resistance of steel.	2
4	**Module 4**	**9 hours**
4.1	**Timber as a Structural Material:** Properties of Timber – Mechanical properties of wood: Strength, modulus of elasticity, and moisture content	1
4.2	Timber's anisotropic nature and behavior under loads.	2
4.3	Timber Structural Systems: Beams, trusses, columns, and frames in timber structures	2
4.4	Joinery techniques and connections (nailing, bolting, gluing) - Glulam and laminated veneer lumber (LVL).	2
4.5	Durability and Maintenance of Timber Structures - Timber decay, insect attack, and moisture content management - Treatment methods for timber	2
5	**Module 5**	**9 hours**
5.1	**Composites Materials:** Introduction to composites in structural systems - Types of composites-uses and behaviour in structural systems	3

5.2	Applications of composites in strengthening and retrofitting structures	3
5.3	Advanced Materials in Modern Construction -High-performance concrete (HPC), self-healing concrete and Smart materials.	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1):

1. Classify the structural forms based on their structural efficiency.
2. Describe the behavior of membrane structures under load.
3. Explain the force distribution in an arch and slab.

Course Outcome 2 (CO2):

1. Discuss the influence of thermal properties in the selection of materials for modern commercial buildings.
2. What are the key factors that influence the quality of concrete?
3. Discuss the importance of durability in concrete used for marine or coastal structures.

Course Outcome 3 (CO3):

1. Why is ductility an important property in structural steel applications?
2. How does fatigue behavior influence the design of steel bridges?
3. Compare different types of steel based on their suitability for structural applications.

Course Outcome 4 (CO4):

1. Compare and contrast different timber joinery and connection techniques.
2. Analyze the mechanical behavior and structural applications of timber, considering its anisotropic nature and moisture sensitivity.
3. Propose methods to improve the durability of timber used in outdoor construction.

Course Outcome 5 (CO5):

1. Explain the commonly used types of composite materials in structural engineering.
2. How do composite materials contribute to reducing the self-weight of structural elements?
3. Describe a real-world example where advanced composites have been successfully used in strengthening an existing structure.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEH41

Course Name: STRUCTURAL FORMS AND MATERIALS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Explain the importance of the strength-to-weight ratio in structural efficiency.
2. Define and classify structural forms with examples.
3. How does the structural behavior of a shell differ from that of a frame?
4. Explain the importance of the strength-to-weight ratio in structures? Give one practical implication.
5. What are the major factors affecting concrete mix quality?
6. Explain the significance of buckling in steel design.
7. Compare bolted and welded connections in steel structures.
8. Explain the anisotropic behavior of timber and its impact on structural design.
9. Describe two joinery techniques used in timber structures.
10. Define composite materials and give two examples used in structures.

PART B

Answer any one question from each module. Each question carries 14 marks

11. (a) Discuss various types of structural forms used in buildings.
    (b) Explain how force is distributed in frames, arches, and shells.

OR

12. (a) Explain the criteria for evaluating the structural efficiency of a system.
    (b) Compare strength-to-weight ratio and stiffness among beam, arch, and shell.

13. Compare reinforced and prestressed concrete systems with suitable diagrams. Mention their advantages and limitations.

OR

14. Explain the stress-strain behavior in concrete. How are creep and fatigue relevant in its long-term material performance?

15. Explain the design considerations for steel structures, including buckling, torsional buckling, and member stability.

OR

16. Compare different types of connections used in steel construction with neat sketches.

17. Discuss the causes of timber degradation and explain the treatment methods to improve durability.

OR

18. Explain the mechanical properties of timber and describe how its anisotropic nature affects design.

19. Write a detailed note on the role of composites in retrofitting and strengthening existing structures with examples.

OR

20. Explain the role of smart materials in adaptive and responsive structures.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH42	NON DESTRUCTIVE TESTING	3	1	0	3	4	2024

Preamble

This course explores various Non Destructive Testing (NDT) methods, their principles, and applications that enhance modern engineering diagnostics. By integrating theoretical foundations with practical applications, students will develop expertise in using NDT techniques to evaluate civil engineering materials, detect defects, and ensure compliance with design standards.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the principles, significance, and advantages of NDT in civil engineering, differentiating it from destructive testing methods (Cognitive knowledge level: Understand).
CO 2	Apply their knowledge to detect surface and subsurface defects in civil engineering materials (Cognitive knowledge level: Apply).
CO 3	Assess structural integrity with the help of various NDT techniques, ensuring safe and reliable construction practices (Cognitive knowledge level: Apply).
CO 4	Apply advanced NDT methods, to assess subsurface and material integrity in civil engineering structures (Cognitive knowledge level: Apply).
CO 5	Analyse real-world applications and case studies of NDT techniques while ensuring compliance with industry standards and codes (Cognitive knowledge level: Apply).

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	3		3		1						
CO 2	2	3		3	2	1						
CO 3	2	3		3	2	1						
CO 4	2	3		3	2	1						1
CO 5	3	3		3	3	1			3	3		1

Assessment Pattern

Non Destructive Testing			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	20	20	20
Understand	40	40	40
Apply	40	40	40
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts: Part A and Part B. Part A contain 10 questions, with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module, of which students should answer any one. Each question carries 14 marks and can have a maximum of 2 sub-divisions.

SYLLABUS

MODULE 1: Introduction to Non-Destructive Testing (9 hours)

Overview of NDT: Definition, importance, and applications in civil engineering. Comparison with Destructive Testing: Advantages and limitations, Principles of NDT: Fundamental concepts and mechanics, Commonly Tested Materials: Concrete, steel, composites, and other civil engineering materials.

MODULE 2: Surface and Subsurface Inspection Techniques (9 hours)

Visual Inspection - Types of Distress and Identification, Visual Tesing (VT): Methods, tools, and applications for detecting visible surface defects., Liquid Penetrant Testing (LPT): Techniques, steps, and applications for detecting surface cracks, Magnetic Particle Testing (MPT): Principles, equipment, and applications for ferromagnetic materials. Rebound hammer testing - Meyhods, correlation with compressive strength, calibration. Applications in Civil Engineering: Case studies of surface inspection in bridges, pavements, and structures.

MODULE 3: Ultrasonic Testing (UT) and Radiographic Testing (RT) (9 hours)

Ultrasonic Testing: Working principle (use of high-frequency sound waves), Types (pulse-echo, through-transmission).Applications in structural integrity assessment. Radiographic Testing : Principles (X-ray and gamma-ray techniques). Safety considerations, Applications for internal defect detection in large components.

MODULE 4: Electromagnetic and Advanced NDT Techniques (9 hours)

Ground Penetrating Radar (GPR): Principles, equipment, and applications in subsurface assessment, Eddy Current Testing (ECT): Working principles and use in identifying defects in conductive materials, Infrared Thermography: Techniques for thermal imaging and moisture detection, Emerging Technologies: Digital twins, AI-based inspection, and other innovations in civil engineering NDT.

MODULE 5: Practical Applications, Case Studies, and Standards (9 hours)

Field Applications: Real-life applications in inspecting various civil engineering structures, Case Studies: Analysis of NDT techniques used in major construction or failure investigations, Standards and Codes: Overview of codes used for NDT testing, Hands-on Training: Laboratory exercises and fieldwork using NDT equipment.

Text Books:

1. P. H. Emmons, Concrete Repair and Maintenance Illustrated. R.S. Means Company Inc, 2002.

2. C. Hellier, Handbook of Non-destructive Evaluation, 3rd ed. Mc-Graw Hill Education, 2020.

Reference Books:

1. C. Maierhofer, H. Reinhardt, and G. Dobmann, Non-destructive Evaluation of Reinforced Concrete Structures: Volume 1: Deterioration Processes and Standard Test Methods. Woodhead Publishing, 2010.

2. Baldev Raj, T. Jayakumar, M. Thavasimuthu, ”Practical Non-Destructive Testing”, Narosa Publishing, London, 2012.

3. Paul E. Mix, ”Introduction to Non Destructive Testing”, A Training Guide, Wiley-Interscience, New Jersey, USA, June 2005.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Overview of NDT: Definition, importance, and applications in civil engineering.	2
1.2	Comparison with Destructive Testing: Advantages and limitations	1
1.3	Principles of NDT: Fundamental concepts and mechanics	3
1.4	Commonly Tested Materials: Concrete, steel, composites, and other civil engineering materials.	3
2	**Module 2**	**9 hours**
2.1	Visual Inspection - Types of Distress and Identification, and structures.	2
2.2	Visual Tesing (VT): Methods, tools, and applications for detecting visible surface defects.	2
2.3	Liquid Penetrant Testing (LPT): Techniques, steps, and applications for detecting surface cracks	1

2.4	Magnetic Particle Testing (MPT): Principles, equipment, and applications for ferromagnetic materials. Rebound hammer testing - Methods, correlation with compressive strength, calibration.	2
2.5	Applications in Civil Engineering: Case studies of surface inspection in bridges, pavements	2
3	**Module 3**	**9 hours**
3.1	Ultrasonic Testing: Working principle (use of high-frequency sound waves), Types (pulse echo, through-transmission).	2
3.2	Applications in structural integrity assessment.	2
3.3	Radiographic Testing: Principles (X-ray and gamma-ray techniques).	2
3.4	Safety considerations, Applications for internal defect detection in large components.	3
4	**Module 4**	**9 hours**
4.1	Ground Penetrating Radar (GPR): Principles, equipment, and applications in subsurface assessment.	2
4.2	Eddy Current Testing (ECT): Working principles and use in identifying defects in conductive materials	2
4.3	Infrared Thermography: Techniques for thermal imaging and moisture detection.	2
4.4	Emerging Technologies: Digital twins, AI-based inspection, and other innovations in civil engineering NDT.	3
5	**Module 5**	**9 hours**
5.1	Field Applications: Real-life applications in inspecting various civil engineering structures	3
5.2	Case Studies: Analysis of NDT techniques used in major construction or failure investigations	2
5.3	Standards and Codes: Overview of codes used for NDT testing	2

5.4	Hands-on Training:Laboratory exercises and fieldwork using NDT equipment.	2
Total Hours		**45 Hours**

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEH42

Course Name: NON DESTRUCTIVE TESTING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Define Non-Destructive Testing (NDT) and mention two of its advantages over Destructive Testing.
2. List four materials commonly tested using NDT in civil engineering.
3. What are the basic steps involved in Liquid Penetrant Testing (LPT)?
4. Mention two applications of Magnetic Particle Testing (MPT) in civil engineering structures.
5. Differentiate between pulse-echo and through-transmission techniques in Ultrasonic Testing.
6. List two safety precautions that must be taken while performing Radiographic Testing.
7. State two applications of Ground Penetrating Radar (GPR) in civil engineering.
8. What is Eddy Current Testing and which materials is it most suitable for?
9. Mention two international standards used in Non-Destructive Testing.
10. Give an example of a civil engineering failure that was investigated using NDT

PART B

Answer any one question from each module. Each question carries 14 marks

11. Explain the differences between Destructive Testing and Non-Destructive Testing. Discuss the advantages and limitations of NDT in detail.

OR

12. Describe the principles of NDT and explain how it is applied to assess the integrity of civil engineering materials like concrete and steel.
13. Explain in detail the working principle, procedure, and applications of Visual Testing (VT) and Liquid Penetrant Testing (LPT).

OR

14. Describe Magnetic Particle Testing (MPT) and its significance in detecting subsurface flaws. Support your answer with examples from civil engineering structures like bridges or pavements.
15. Discuss the principle and methodology of Ultrasonic Testing. How is it applied to assess the structural integrity of civil engineering components?

OR

16. Explain Radiographic Testing with the help of diagrams. Discuss its principle, advantages, safety considerations, and applications in large civil components.
17. Explain the working principles and applications of Ground Penetrating Radar (GPR), Eddy Current Testing (ECT), and Infrared Thermography.

OR

18. Discuss emerging technologies in NDT such as digital twins and AI-based inspections. How are these technologies transforming the inspection of civil infrastructure?
19. Describe the real-life field applications of NDT techniques in civil engineering. Include case studies of bridges, dams, or buildings.

OR

20. Discuss the importance of standards and codes in NDT. Explain how hands-on training with NDT equipment supports better understanding and implementation of testing procedures.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH43	CLIMATE CHANGE AND SUSTAINABILITY	3	1	0	3	4	2024

Preamble

This course introduces students to the fundamental concepts of climate, the factors influencing it, and the science behind climate change. It emphasizes the critical link between climate change and sustainability, aiming to build a strong foundation for understanding global environmental challenges. Through this course, students will explore the real-world impacts of climate change and examine effective adaptation and mitigation strategies.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Explain the fundamental concepts of climate and its influencing factors(Cognitive Knowledge Level: Understand)
CO 2	Explain the factors affecting climate change and the harmful impacts due to climate change (Cognitive Knowledge Level: Understand)
CO 3	Discuss the problems due to urbanization and the need for sustainable development (Cognitive Knowledge Level:Apply)
CO 4	Demonstrate the various adaptation and mitigation techniques for combating climate change (Cognitive Knowledge Level:Understand)
CO 5	Discuss multilateral agreements on climate change, Case studies on Climate change(Cognitive Knowledge Level:Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2		1			1	3	1				3
CO 2	2	2	1	2		1	3	1				3
CO 3	2	2	1	2		1	3	1				3
CO 4	2		1			1	3	1				3
CO 5	2		1			1	3	1				3

Assessment Pattern

Climate Change And Sustainability			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	40	40	40
Understand	40	40	40
Apply	20	20	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contains 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which any one is to be answered. Each question carries 14 marks and can have maximum 2 sub-divisions.

SYLLABUS

MODULE 1 (9 hours)

Climate: Climate and weather, Meteorology and climatology, Composition and structure of atmosphere.Factors influencing climate-Insolation, Temperature, Humidity, Pressure, Wind, Precipitation, Topography. Atmospheric stability, Lapse rate, Inversions, Types of inversions.Cyclones and Anticyclones.

MODULE 2 (9 hours)

Climate change: Climate change, anthropogenic drivers of climate change, Global warming, Green house effect, Air pollution, carbon foot print, Impact of climate change on water cycle, agriculture, forest, water resources, urban areas, biodiversity, human health. Carbon sequestration , vulnerability index.

MODULE 3 (9 hours)

Urbanisation and Industrialization, Urbanisation, problems of urbanisation, Urban sprawl, Urban heat islands, causes, mitigation measures. Urban flooding, water conservation and ecological aspects.Urban Planning, Zoning of Land Use

Pillars of Sustainable development, Sustainability indicators, Life cycle analysis, Material flow analysis, Green energy, Waste management, 3R concepts, Sustainable cities, Sustainable Urbanisation.

MODULE 4 (9 hours)

Adaptation and mitigation strategies:Green Engineering, Design for Engineering, Green technologies, Circular economy. Planning of cities as climate resilient, Climate change and infrastructure planning, Climate resilient infrastructure, nature based solutions in disaster management, adaptation strategies for combating climate change

MODULE 5 (9 hours)

Climate and sustainability: Sustainability Engineering , Kyoto mechanisms to reduce GHG emission- Clean Development Mechanism, Joint Implementation, Emission trading, Case studies on Kyoto mechanism, Case studies on climate change and climate change risk reduction.

Text Books

1. Lal, DS, “Climatology”, Published by Sharda Pustak Bhawan, ISBN8186204121

2. John T. Hardy, Jean Ponce, “Climate Change - Causes, Effects, and Solutions”, Wiley Publications, 2003

3. Jonathan Tomkin, Tom Theis, ”Sustainability - A Comprehensive Foundation”, 12th Media Services, 2018

Reference Books

1. Karthik Karuppu, ”Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination Book”, NVICO Notion Press, 2019

2. Keith D. Alverson, ZintaZommers, ”Resilience : The science of adaptation to climate change”, Elsevier, 2018

3. Leal Filho, W., Azul, A.M., Brandli, L., Özuyar, P.G., Wall, T. (Eds.), “Sustainable Cities and Communities” Springer

4. Intergovernmental Panel on Climate Change (IPCC) reports

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH44	CONSTRUCTION SCHEDULING AND PLANNING	3	1	0	3	4	2024

Preamble

This course offers students an in-depth understanding of construction scheduling techniques, project lifecycle stages, and advanced tools for monitoring progress and minimizing risks. The knowledge gained will enable students to tackle real-world challenges in the construction industry.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Understand the importance of construction planning and scheduling to identify key phases of a construction project. (Cognitive Level: Understand)
CO 2	Utilize the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) for effective project scheduling. (Cognitive Level: Understand)
CO 3	Analyze resource allocation techniques and implement cost-time trade-off strategies to optimize project efficiency. (Cognitive Level: Apply)
CO 4	Apply scheduling tools like Gantt charts and network diagrams to monitor and manage project progress effectively. (Cognitive Level: Apply)
CO 5	Identify potential risks in construction scheduling and develop mitigation strategies using Lean construction principles. (Cognitive Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	3	2	1	2			1			
CO 2	2	1	3	2	1	2	1				1	
CO 3	2	1	3	2	1	2						
CO 4	2	1	3	2	1	2		1		1		2
CO 5	3	1	3	2	1	2			1			

Assessment Pattern

Construction Scheduling And Planning			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	20	20	20
Understand	50	50	50
Apply	30	30	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 marks and can have a maximum of 2 sub - divisions.

SYLLABUS

MODULE 1 (9 hours)

Importance of Construction Planning and Scheduling, Need for effective scheduling in construction projects, Overview of project management in construction, Construction Project Lifecycle, Phases of a construction project (planning, design, procurement, construction, commissioning), Basic Concepts in Project Management, Project scope, objectives, and constraints (time, cost, quality), Types of Construction Projects-Residential, commercial, industrial, and infrastructure projects.

MODULE 2 (9 hours)

Critical Path Method (CPM), Introduction to CPM and its application in construction scheduling, Steps involved in CPM: Activity listing, sequencing, duration estimation, network diagram, critical path determination, Program Evaluation and Review Technique (PERT), Differences between PERT and CPM, Use of PERT for uncertain project durations, Float and Slack Time-Calculation and significance of float in scheduling.

MODULE 3 (9 hours)

Resource Planning in Construction Projects, Types of resources: Labor, materials, equipment., Resource levelling and resource smoothing techniques, Cost and Time Trade-offs, Managing cost vs. schedule balance, Techniques to optimize resources without delaying the project, Project Crashing, Definition and use of project crashing techniques to reduce project duration, Construction Project Constraints, Identifying and handling constraints related to resources, time, and budget.

MODULE 4 (9 hours)

Overview of commonly used construction scheduling tools, Activity scheduling, resource allocation, and cost estimation, Generating Gantt charts, network diagrams, and resource histograms, Scheduling and Monitoring Progress, Techniques for tracking project progress, Updating schedules in response to delays or changes, Real-time Project Management.

MODULE 5 (9 hours)

Risk Management in Construction Scheduling, identifying potential risks and their impact on the schedule, Techniques for mitigating scheduling risks, Lean Construction and Scheduling, Introduction to Lean principles in construction scheduling, Applying Lean concepts to reduce waste and optimize time, Contractor's Schedule vs. Owner's Schedule, Differences between contractor schedules and owner schedules, Managing the relationship and communication between stakeholders regarding schedules.

Text Books:

1. Project Management for Construction by Chris Hendrickson
2. Construction Scheduling: Principles and Practices by Jay S. Newell

Reference Books:

1. Project Management in Construction by Anthony Walker
2. Construction Project Management by Erik W. Howell and James J. P. Paulson
3. Microsoft Project for Dummies by Cynthia Snyder Dionisio (for hands-on software experience)

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEH44

Course Name: CONSTRUCTION SCHEDULING AND PLANNING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Explain the importance of construction planning and scheduling in the context of project management.
2. What are the key phases of a construction project lifecycle, and how does planning contribute to each phase?
3. What are the key types of resources in construction projects, and why is effective resource planning essential?
4. Explain the concept of project crashing and how it helps reduce project duration.
5. What is the significance of Gantt charts in construction scheduling, and how do they help track project progress?
6. List and briefly describe two commonly used construction scheduling tools and their features.
7. What are the primary techniques used in Lean Construction to optimize scheduling and reduce waste?
8. Define risk management in construction scheduling and discuss its significance.
9. Define the Critical Path Method (CPM) and explain its importance in construction scheduling.
10. How does float/slack time affect the overall project schedule in CPM?

PART B

Answer any one question from each module. Each question carries 14 marks

11. Discuss the role of effective scheduling in construction projects, addressing how it influences the project's time, cost, and quality. Provide examples of real-world projects where scheduling played a pivotal role.

OR

12. Describe the various types of construction projects (residential, commercial, industrial, and infrastructure) and explain how the scheduling needs and approaches differ across these types of projects.

13. Compare and contrast the Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT). Discuss the advantages and disadvantages of each method in the context of construction scheduling.

OR

14. Explain the steps involved in CPM (activity listing, sequencing, duration estimation, network diagram, critical path determination) and apply these steps to a hypothetical construction project. Discuss how delays in non-critical activities affect project completion.

15. Discuss resource levelling and resource smoothing techniques. Explain how each technique is applied to minimize delays without increasing project costs.

OR

16. In a construction project, how can the balance between cost and time be optimized? Describe the strategies used to handle resource constraints and avoid project delays.

17. Explain the importance of real-time project management in construction scheduling. Discuss how real-time updates to the schedule can impact project outcomes.

OR

18. Describe how scheduling software tools assist in activity scheduling, resource allocation, and cost estimation. Discuss how such tools can help in managing delays and tracking progress in large construction projects.

19. Explain the process of identifying and mitigating risks in construction scheduling. Discuss various risks (e.g., delays, resource shortages, weather) and their potential impact on the project timeline.

OR

20. Discuss the differences between a contractor's schedule and an owner's schedule. Explain the importance of managing communication between contractors and owners to ensure successful project completion.

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH45	PUBLIC TRANSPORT SYSTEMS	3	1	0	3	4	2024

Preamble

Public transport systems are vital for urban mobility, providing efficient, affordable, and sustainable transportation. This course provides essential knowledge of public transport systems, focusing on efficiency, sustainability, and accessibility. Students learn transit planning, demand estimation, network design, and ITS, gaining skills to enhance operations. It also explores public transport's role in reducing congestion, supporting sustainability, and driving economic growth, preparing students for urban mobility planning.

Prerequisites: NIL

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Explain the role of public transport, its evolution, and the safety concerns associated with different transit modes. (Cognitive Level: Understand)
CO 2	Identify and describe the methods used for predicting transit usage and evaluating network accessibility. (Cognitive Level: Understand)
CO 3	Explain the data collection process, including manual data collection techniques and survey design for transit planning. (Cognitive Level: Understand)
CO 4	Analyze transit network planning, vehicle and crew scheduling, and fare structuring to improve operational efficiency. (Cognitive Level: Analyze)
CO 5	Analyze the impact of public transport systems on urban development, land use, environmental sustainability, and policy frameworks. (Cognitive Level: Analyze)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2				3	2					1
CO 2	3	3	2	2		2	2			1		2
CO 3	3	3	2	2						1	1	2
CO 4	3	3	3	3	2		2			2	1	2
CO 5	3	3	2	2	3	3	3	2	2	3		3

Assessment Pattern

Public Transport Systems			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (%)**
	Test 1 (%)	**Test 2 (%)**	
Remember	20	20	20
Understand	30	30	30
Apply	30	30	30
Analyse	20	20	20
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance	:	10 marks
Continuous Assessment Test (2 numbers)	:	25 marks
Assignment/Quiz/Course Project	:	15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

MODULE 1 (9 hours)

Introduction to Public Transport Systems and Transit Modes: Issues, safety, role of transit, evolution of urban transportation, Public transport travel characteristics, Modes of public transport and comparison - Modes; bus & coaches, Train (Commuter, intercity and high speed rail), tram and light rail, Rapid transit, personal rapid transit, cable-propelled transit, Ferry, Auto-Rickshaws, paratransit system, Feeder services–choice of transit technology

MODULE 2 (9 hours)

Transit Demand and Network Evaluation: Prediction of transit usage - Evaluation of network, accessibility considerations, estimating demand in transit planning studies, demand. Characteristics of transit travel riders, attitudes, modal splits special group of users, passenger load factor.

MODULE 3 (9 hours)

Data Collection and Survey Techniques for Transit Planning: Data Collection Program Design Process, Data Needs, Manual Data Collection Techniques, Sampling, Special Considerations for Surveying

MODULE 4 (9 hours)

Transit Network Planning and Operations : Transit Network Planning, Vehicle scheduling, Transit Network Planning, crew scheduling, Fare structure, Demand response to fare changes, Fare technology

MODULE 5 (9 hours)

Emerging Trends and Policy in Public Transport: Operational capability during disaster (introduction only), ITS in transit, Transit Oriented Development Impact on development, land use thereby, urban form, environmental impact, energy policy regulations, future policies, policy issues, public private partnership (PPP), Transit signal priority, integrated public transport planning

Textbooks:

1. Ceder, A., Public Transit Planning and Operation: Theory, Modeling and Practice, CRC Press, 2016.
2. Vuchic, V. R., Urban Transit: Systems and Technology, John Wiley & Sons, 2007.
3. Black, A., Urban Mass Transportation Planning, McGraw-Hill, 1995.
4. Kittelson & Associates, Transit Capacity and Quality of Service Manual, 3rd Edition, Transportation Research Board, 2013.
5. White, P., Public Transport: Its Planning, Management and Operation, Routledge, 2016.

Reference:

1. Vuchic, V. R., Transit Operations and Planning, John Wiley & Sons, 2005.
2. Gubbins, E. J., Managing Transport Operations, Kogan Page, 2003.
3. Gray, G. E., and Hoel, L. A., Public Transportation, Prentice Hall, 1992.
4. Meyer, M. and Miller, E., Urban Transportation Planning: A Decision-Oriented Approach, McGraw-Hill, 2001.
5. Currie, G., New Perspectives and Methods in Transport and Social Exclusion Research, Emerald Group Publishing, 2011.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Importance of public transport and role in urban mobility	2
1.2	Safety concerns and measures in different transit modes	2
1.3	Evolution of urban transportation and major developments	2
1.4	Overview of public transport modes and comparisons	3
2	**Module 2**	**9 hours**
2.1	Methods for predicting transit usage and network evaluation	3
2.2	Factors influencing transit demand and modal split	2
2.3	Passenger load factor and special user groups	2
2.4	Accessibility considerations and transit service quality	2
3	**Module 3**	**9 hours**
3.1	Data needs and collection methods in transit planning	2
3.2	Manual data collection techniques and survey design	2

3.3	Sampling methods and considerations in data collection	3
3.4	Case studies on data collection and analysis	2
4	**Module 4**	**9 hours**
4.1	Fundamentals of transit network planning and scheduling	3
4.2	Crew scheduling and fare structuring strategies	2
4.3	Demand response to fare changes and fare technology	2
4.4	Service reliability, performance indicators, and optimization	2
5	**Module 5**	**9 hours**
5.1	Role of ITS in public transport and its applications	3
5.2	Transit-oriented development (TOD) and land use impact	2
5.3	Public-private partnerships (PPP) in transit planning	2
5.4	Integrated transport planning and future policy trends	2
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Explain the evolution of urban transportation and its impact on public mobility.
2. Compare different public transport modes based on efficiency, capacity, and sustainability.
3. Discuss major safety concerns in public transport and suggest strategies to enhance passenger safety.

Course Outcome 2 (CO 2):

1. Explain how transit demand estimation is conducted in transport planning studies.
2. Discuss the factors influencing public transport ridership, including accessibility and user attitudes.
3. Analyze the role of passenger load factors in determining transit service efficiency.

Course Outcome 3 (CO 3):

1. Describe various data collection methods used in transit planning and their applications.
2. Explain the significance of sampling techniques in public transport surveys.
3. Discuss the challenges and special considerations involved in conducting transit surveys.

Course Outcome 4 (CO 4):

1. Analyze the key factors involved in designing an efficient transit network.
2. Explain the process of vehicle and crew scheduling in public transport operations.
3. Discuss the impact of fare policies on ridership and transit revenue.

Course Outcome 5 (CO 5):

1. Explain the role of Intelligent Transportation Systems (ITS) in improving public transport efficiency.
2. Analyze how Transit-Oriented Development (TOD) influences urban growth and land use.
3. Discuss the role of public-private partnerships (PPP) in enhancing public transport infrastructure.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEH45

Course Name: PUBLIC TRANSPORT SYSTEMS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Explain the role of public transport in urban mobility.
2. What are the key characteristics of public transport travel demand?
3. What are the major factors influencing transit ridership?
4. Define modal split and its significance in transit planning.
5. What are the major challenges in collecting transit-related data?
6. Explain the importance of sampling in public transport surveys.
7. What are the key objectives of transit network planning?
8. Describe the role of fare structuring in public transport.
9. How does public transport contribute to environmental sustainability?
10. Discuss the significance of public-private partnerships (PPP) in transit planning.

PART B

Answer any one question from each module. Each question carries 14 marks.

11. a) Explain the evolution of urban transportation and its impact on modern public transit. (7 marks)

    b) Discuss the advantages and limitations of various public transport modes. (7 marks)

OR

12. a) Compare and contrast different types of rail-based transit systems. (7 marks)

    b) Discuss the role of feeder services in enhancing public transport accessibility. (7 marks)

13. a) Explain different methods used to predict transit demand. (7 marks)

    b) Discuss the role of accessibility considerations in transit planning. (7 marks)

OR

14. a) Analyze the impact of passenger load factor on transit service efficiency. (7 marks)

    b) Explain how rider attitudes influence modal choice in public transport. (7 marks)

15. a) Describe various manual data collection techniques used in transit planning. (7 marks)

    b) Explain the challenges in conducting transit surveys and ensuring data accuracy. (7 marks)

OR

16. a) Discuss special considerations in designing surveys for public transport studies. (7 marks)

    b) What are the key factors in ensuring effective sampling for transit data collection? (7 marks)

17. a) Explain the key principles of transit network planning. (7 marks)

    b) Discuss how vehicle and crew scheduling affects transit efficiency. (7 marks)

OR

18. a) Describe the impact of fare structuring on ridership and revenue generation. (7 marks)

    b) Analyze how public transport demand responds to fare changes. (7 marks)

19. a) How can public transport systems enhance operational capability during disasters? (7 marks)

    b) Discuss the significance of transit signal priority in urban mobility. (7 marks)

OR

20. a) Explain the role of Intelligent Transportation Systems (ITS) in improving public transport operations. (7 marks)

    b) Discuss key policy challenges in implementing integrated public transport planning. (7 marks)

CODE	COURSE NAME	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
B24CEH46	REINFORCED SOIL AND GEOSYNTHETICS	3	1	0	3	4	2024

Preamble

This subject introduces the principles, materials, and applications of reinforced soil and geosynthetics in geotechnical engineering. It emphasizes design methods, performance evaluation, and practical applications, preparing students to apply innovative and sustainable solutions for soil stabilization, containment, and earth structure reinforcement.

Prerequisites: Nil

Course Outcomes: After the completion of the course, the student will be able to:

CO 1	Remember the types, functions, and basic principles of reinforced soil and geosynthetics used in geotechnical engineering. (Cognitive Level: Remember)
CO 2	Understand the properties, functions, and design considerations of geotextiles and geogrids in soil stabilization and reinforcement. (Cognitive Level: Understand)
CO 3	Apply design principles for geomembranes and geonets in containment and drainage systems based on material properties and site requirements. (Cognitive Level: Apply)
CO 4	Understand and analyze the design and construction of reinforced soil structures such as slopes, retaining walls, and foundations. (Cognitive Level : Understand)
CO 5	Apply knowledge of seismic behaviour, innovations, and practical applications of geosynthetics in real-world geotechnical projects. (Cognitive Level: Understand)

Mapping of Course Outcomes With Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1		1	1					1		1
CO 2	3	2	1	2	2				1	1	1	1
CO 3	3	2	3	2	2		1		1	1	1	2
CO 4	3	3	3	2	2		1		1	2	1	2
CO 5	3	2	2	2	3	1	2	1	2	2	2	3

Assessment Pattern

Reinforced Soil And Geosynthetics			
Bloom's Category	**Continuous Assessment Tests**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	40	20	30
Understand	40	40	40
Apply	20	40	30
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course Project : 15 marks

End Semester Examination Pattern

There will be two parts; Part A and Part B. Part A contain 10 questions carrying 3 marks each. Part B contains 2 questions from each module out of which 1 to be answered. Each question carries 14 mark and can have maximum 2 sub- divisions.

SYLLABUS

MODULE 1 (9 hours)

Overview of Reinforced Soil: Definition and principles of reinforced soil, Types of reinforcement materials (geotextiles, geogrids, fibers), Applications and advantages of reinforced soil in construction

Introduction to Geosynthetics: Types of geosynthetics (geotextiles, geogrids, geomembranes, geonets), Functions and applications of geosynthetics in geotechnical engineering, Properties and selection criteria for geosynthetic materials.

Soil-Reinforcement Interaction: Mechanisms of interaction between soil and reinforcement, Factors affecting soil-reinforcement behavior, Design considerations for reinforced soil structures

MODULE 2 (9 hours)

Geotextiles: Types of geotextiles (woven, non-woven, knitted), Properties of geotextiles (filtering, drainage, separation), Design and applications of geotextiles in soil stabilization and erosion control

Geogrids: Types of geogrids (uniaxial, biaxial, triaxial), Properties of geogrids (tensile strength, stiffness), Applications of geogrids in soil reinforcement, retaining walls, and embankments

Design Considerations: Methods for determining the required properties of geotextiles and geogrids, Design guidelines for incorporating geosynthetics into soil structures, Quality control and performance evaluation of geosynthetics

MODULE 3 (9 hours)

Geomembranes: Types of geomembranes (HDPE, LLDPE, PVC, EPDM), Properties and applications (containment, waterproofing, liners), Installation techniques and performance testing

Geonets: Types of geonets and their properties, Applications in drainage systems and landfill liners, Design considerations for integrating geonets into geotechnical systems

Design and Performance: Design methods for geomembranes in containment and environmental applications, Assessment of geonets for drainage and filtration, Case studies and performance evaluation

MODULE 4 (9 hours)

Reinforced Soil Slopes and Embankments: Design principles for reinforced soil slopes and embankments, Stability analysis and reinforcement design methods, Case studies of reinforced soil slopes and embankments

Reinforced Soil Retaining Walls: Design and analysis of reinforced soil retaining walls, Types of retaining walls (segmental, wrapped-face, hybrid), Construction techniques and design considerations

Reinforced Soil Foundations: Applications of reinforced soil in foundation design, Load transfer mechanisms and design methods, Case studies of reinforced soil foundations

MODULE 5 (9 hours)

Seismic Design Considerations: Impact of seismic forces on reinforced soil structures, Design strategies for earthquake-resistant reinforced soil systems, Case studies of seismic performance of reinforced soil structures

Innovations in Geosynthetics: Recent advancements in geosynthetic materials and technologies, Emerging applications and trends in geosynthetics, Future directions for research and development in geosynthetics

Case Studies and Practical Applications: Review of real-world projects using reinforced soil and geosynthetics, Lessons learned from failures and successes in geosynthetic applications, Integration of geosynthetics into multidisciplinary engineering projects

Text Books:

1. Rao, S. A. S. Reinforced Soil and Its Engineering Applications. CRC Press, 2008.
2. Chien, L. S. M. Geosynthetics: Fundamentals, Testing, and Applications. CRC Press, 2014.
3. Koerner, R. M. Geosynthetics in Civil Engineering. CRC Press, 2013.

Reference Books:

1. Hegazy, T. Reinforced Soil Structures: Design and Construction. Taylor & Francis. 2014
2. Jones, C. J. F. P. Earth Reinforcement and Soil Structures. Spon Press. 1996
3. Leshchinsky, D. and Hsuan, Y. G. Geosynthetics in Civil Engineering. CRC Press. 2015
4. Berg, R. A., and Boulanger, R. W. Geosynthetics for Soil Improvement. Springer. 2013
5. Sharma, H. D., and R. K. Sharma. Geosynthetics in Civil Engineering. Wiley. 2014
6. Huang, H., and Zhang, L. Reinforced Soil and Geosynthetics. Springer. 2020

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No. of Lecture/ Tutorial Hours
1	**Module 1**	**9 hours**
1.1	Overview of Reinforced Soil: Definition and principles of reinforced soil, Types of reinforcement materials (geotextiles, geogrids, fibers), Applications and advantages of reinforced soil in construction.	2
1.2	Introduction to Geosynthetics: Types of geosynthetics (geotextiles, geogrids, geomembranes, geonets), Functions and applications of geosynthetics in geotechnical engineering, Properties and selection criteria for geosynthetic materials.	4
1.3	Soil-Reinforcement Interaction: Mechanisms of interaction between soil and reinforcement, Factors affecting soil-reinforcement behaviour, Design considerations for reinforced soil structures	3
2	**Module 2**	**9 hours**
2.1	Geotextiles: Types of geotextiles (woven, non-woven, knitted), Properties of geotextiles (filtering, drainage, separation), Design and applications of geotextiles in soil stabilization and erosion control	2
2.2	Geogrids: Types of geogrids (uniaxial, biaxial, triaxial), Properties of geogrids (tensile strength, stiffness), Applications of geogrids in soil reinforcement, retaining walls, and embankments	3
2.3	Design Considerations: Methods for determining the required properties of geotextiles and geogrids, Design guidelines for incorporating geosynthetics into soil structures, Quality control and performance evaluation of geosynthetics	4

3	**Module 3**	**9 hours**
3.1	Geomembranes: Types of geomembranes (HDPE, LLDPE, PVC, EPDM), Properties and applications (containment, waterproofing, liners), Installation techniques and performance testing	2
3.2	Geonets: Types of geonets and their properties, Applications in drainage systems and landfill liners, Design considerations for integrating geonets into geotechnical systems	3
3.3	Design and Performance: Design methods for geomembranes in containment and environmental applications, Assessment of geonets for drainage and filtration, Case studies and performance evaluation	4
4	**Module 4**	**9 hours**
4.1	Reinforced Soil Slopes and Embankments: Design principles for reinforced soil slopes and embankments, Stability analysis and reinforcement design methods, Case studies of reinforced soil slopes and embankments	3
4.2	Reinforced Soil Retaining Walls: Design and analysis of reinforced soil retaining walls, Types of retaining walls (segmental, wrapped-face, hybrid), Construction techniques and design considerations	3
4.3	Reinforced Soil Foundations: Applications of reinforced soil in foundation design, Load transfer mechanisms and design methods, Case studies of reinforced soil foundations	3
5	**Module 5**	**9 hours**
5.1	Seismic Design Considerations: Impact of seismic forces on reinforced soil structures, Design strategies for earthquake-resistant reinforced soil systems, Case studies of seismic performance of reinforced soil structures	3
5.2	Innovations in Geosynthetics: Recent advancements in geosynthetic materials and technologies, Emerging applications and trends in geosynthetics, Future directions for research and development in geosynthetics	3

5.3	Case Studies and Practical Applications: Review of real-world projects using reinforced soil and geosynthetics, Lessons learned from failures and successes in geosynthetic applications.	3
Total Hours		**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Remember the types, functions, and basic principles of reinforced soil and geosynthetics.

1. Define reinforced soil and explain its key components.
2. List different types of geosynthetic materials and their primary functions.
3. Describe the advantages of using reinforced soil in construction projects.

Course Outcome 2 (CO2): Understand the properties, functions, and design considerations of geotextiles and geogrids.

1. Explain the differences between woven and non-woven geotextiles.
2. Describe the role of geogrids in improving slope stability.
3. Illustrate how the tensile strength of geogrids influences soil performance.

Course Outcome 3 (CO3): Apply design principles for geomembranes and geonets in containment and drainage systems.

1. Select a suitable geomembrane for a landfill project and justify your choice.
2. Calculate the required thickness of a geomembrane liner based on given site parameters.
3. Apply appropriate design criteria for integrating geonets into a drainage layer.

Course Outcome 4 (CO4): Understand and analyze the design and construction of reinforced soil structures.

1. Explain the reinforcement mechanism in soil-retaining walls.
2. Discuss stability considerations in designing reinforced embankments.
3. Interpret a case study on the failure or success of a reinforced soil slope.

Course Outcome 5 (CO5): Apply knowledge of seismic behaviour, innovations, and practical applications of geosynthetics.

1. Design a reinforced soil retaining wall with considerations for seismic loads.
2. Analyze the performance of geosynthetics in earthquake-prone regions through a case study.
3. Propose innovative geosynthetic solutions for improving foundation performance under seismic stress.

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: ....

Name: ....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FOURTH SEMESTER B. TECH DEGREE EXAMINATION, MONTH YEAR

Course Code: B24CEH46

Course Name: REINFORCED SOIL AND GEOSYNTHETICS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks

1. Define reinforced soil and explain the basic principles behind its use in construction.
2. List the different types of reinforcement materials used in reinforced soil and briefly explain the characteristics of geotextiles and geogrids.
3. Explain the three types of geotextiles and briefly describe their primary characteristics.
4. Give any three applications of geogrids in soil reinforcement.
5. Briefly explain any 3 types of geomembranes and their primary characteristics.
6. What are the key applications of geomembranes in containment and waterproofing, and how do they perform as liners?
7. What are the key design principles for reinforced soil slopes and embankments, and how do they contribute to the stability of the structure?
8. List and briefly explain the different types of reinforced soil retaining walls and their applications.
9. Explain the impact of seismic forces on reinforced soil structures and how seismic events can affect their stability and performance.
10. What are the recent advancements in geosynthetic materials and technologies? Briefly describe one emerging application of geosynthetics.

PART B

Answer any one question from each module. Each question carries 14 marks

MODULE - 1

11. (a) Explain the advantages and applications of reinforced soil in construction, including its use in retaining walls, embankments, and slopes. How does reinforced soil improve the stability of these structures?
(b) Describe the mechanisms of interaction between soil and reinforcement. What factors influence the soil-reinforcement behaviour, and how can these be accounted for in the design of reinforced soil structures?

12. (a) What are the key properties and selection criteria for geosynthetic materials in geotechnical engineering? Explain how the selection of geosynthetics impacts the performance of soil-reinforcement systems.
(b) Explain the different types of geosynthetics used in civil engineering, their functions and applications.

MODULE - 2

13. (a) Enumerate the properties of geogrids, including tensile strength and stiffness, and explain how these properties affect the performance of geogrid-based soil reinforcement systems.
(b) Describe the different types of geogrids and explain their respective applications in soil reinforcement stabilization.

14. (a) Explain the design considerations for incorporating geosynthetics, specifically geotextiles and geogrids, into soil structures. What are the methods used for determining the required properties of these materials?
(b) Enumerate the design guidelines for using geosynthetics in soil stabilization and erosion control. How do quality control and performance evaluation ensure the long-term effectiveness of geosynthetics in these applications?

MODULE - 3

15. (a) Describe the different types of geonets and their properties. How are geonets used in drainage systems and landfill liners, and what are the design considerations when integrating geonets into geotechnical systems?
(b) Explain the installation techniques for geomembranes and detail the performance testing methods used to ensure their effectiveness in containment and environmental applications.

16. (a) What are the design methods for geomembranes in containment and environmental applications? Enumerate the key considerations and challenges involved in designing geomembranes for long-term performance.
(b) Explain the role of geonets in drainage and filtration systems. How do you evaluate the performance of geonets in real-world applications?

MODULE - 4

17. (a) Describe the design and analysis methods for reinforced soil retaining walls. What are the advantages and challenges of using segmental, wrapped-face, and hybrid retaining walls in construction.
(b) Explain the stability analysis and reinforcement design methods for reinforced soil slopes and embankments. How do these methods help in determining the safety and performance of such structures?

18. (a) There are various applications of reinforced soil in foundation design. Justify the statement.
(b) By enumerating a case study of reinforced soil slopes, embankments, or foundations, explain how these real-world examples highlight the effectiveness of reinforced soil in improving the stability and performance of geotechnical structures.

MODULE - 5

19. (a) Explain the design strategies for earthquake-resistant reinforced soil systems. How do these strategies help in mitigating the effects of seismic forces on reinforced soil structures?
(b) Enumerate a case study of reinforced soil structures during seismic events. How did these structures perform, and what lessons were learned regarding their design and stability in seismic conditions?

20. (a) Explain the emerging trends and future directions for research and development in geosynthetics. How are these advancements shaping the future of civil and geotechnical engineering?
(b) Enumerate both the successes and failures, and highlight the key lessons learned from a real-world project which used reinforced soil and geosynthetics.