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 **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 $\iint_D (2x^2y + 9y^3)\, dx\, dy$ 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.

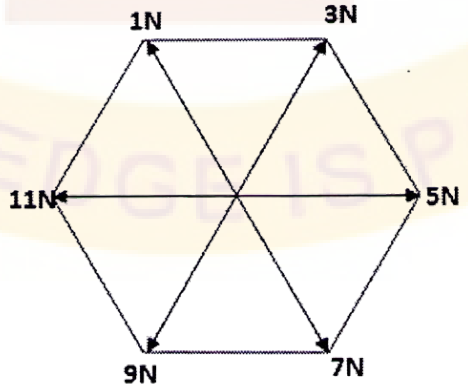


Figure 1

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

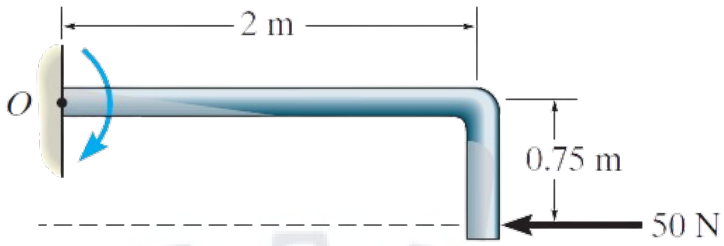


Figure 2

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.

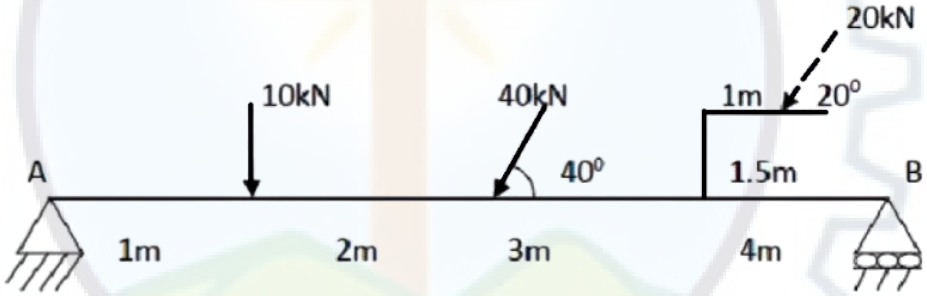


Figure 3

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

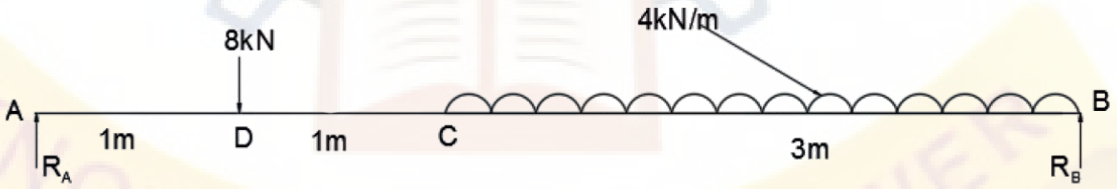


Figure 4

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).

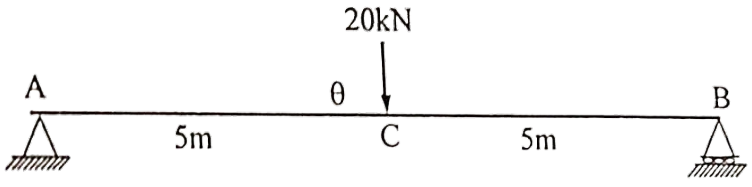


Figure 5

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.

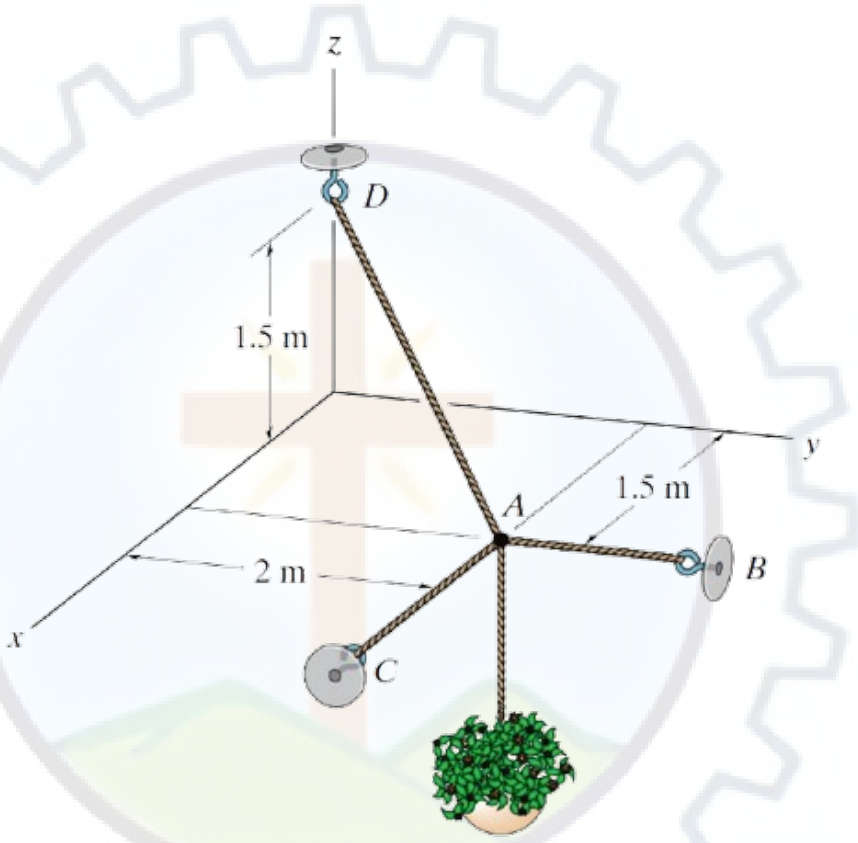


Figure 6

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.

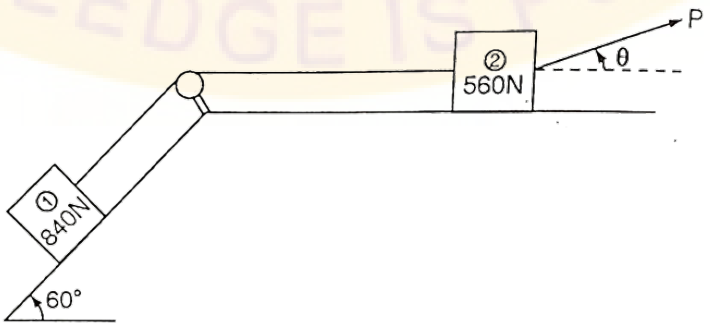


Figure 7

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.

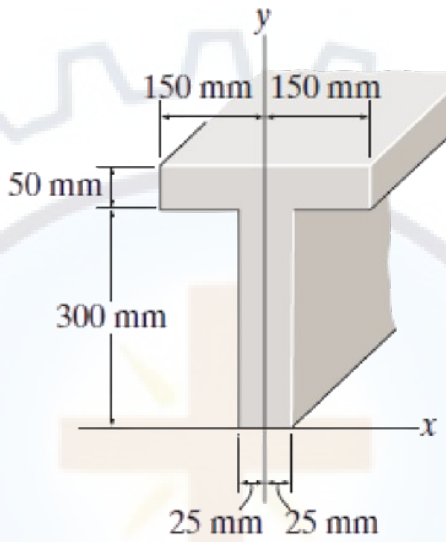


Figure 8

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.

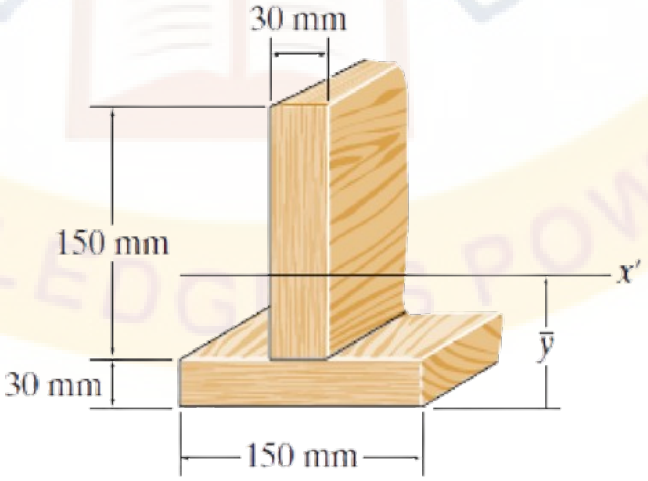


Figure 9

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)

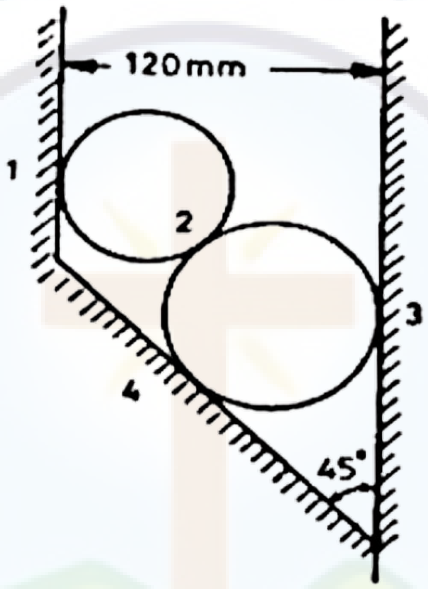


Figure 1

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)

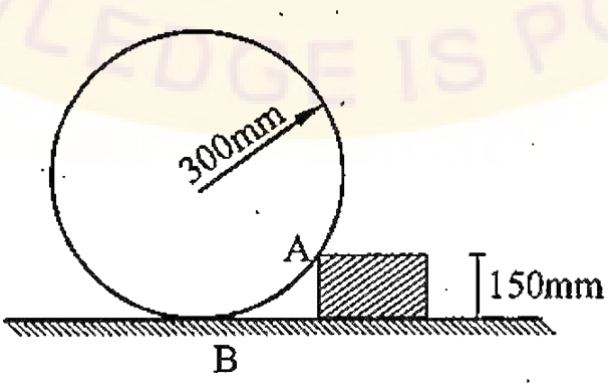


Figure 2

MODULE 2

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

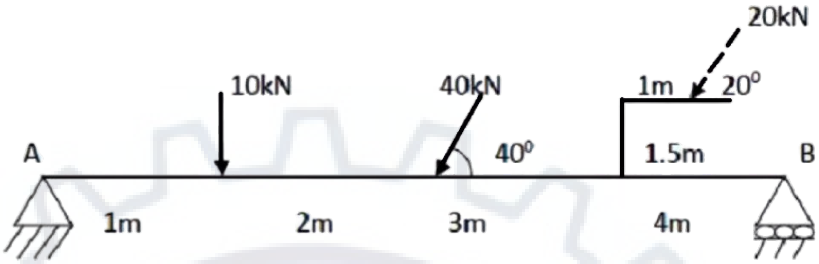


Figure 3

(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)

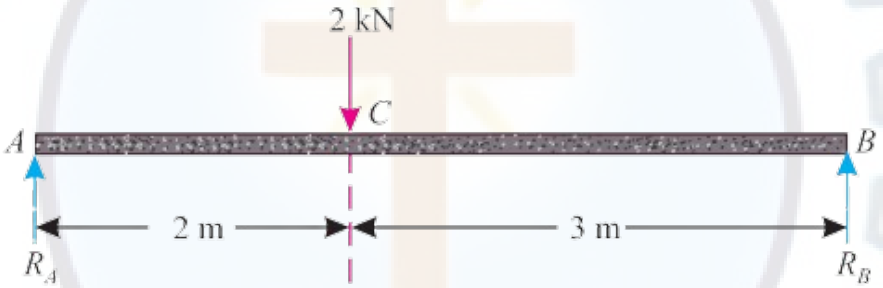


Figure 4

OR

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

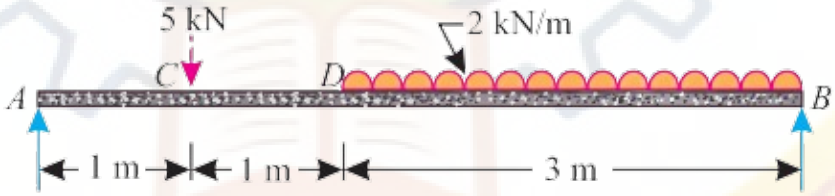


Figure 5

(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)

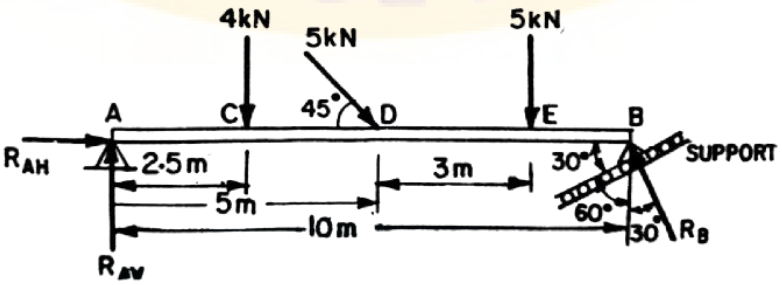


Figure 6

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)

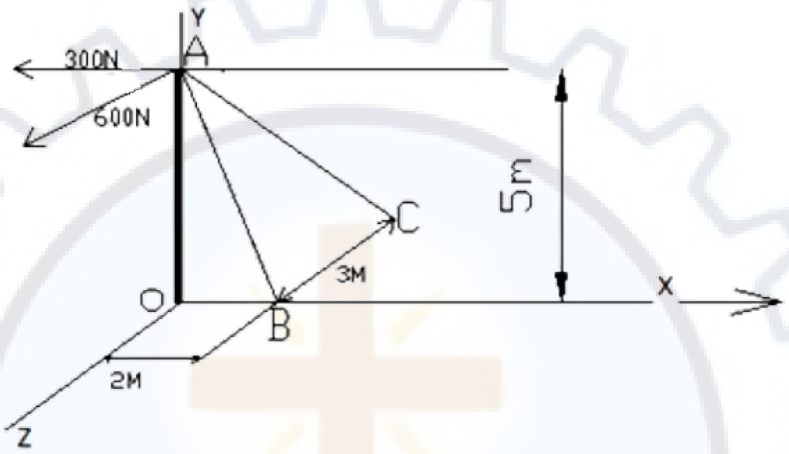


Figure 7

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)

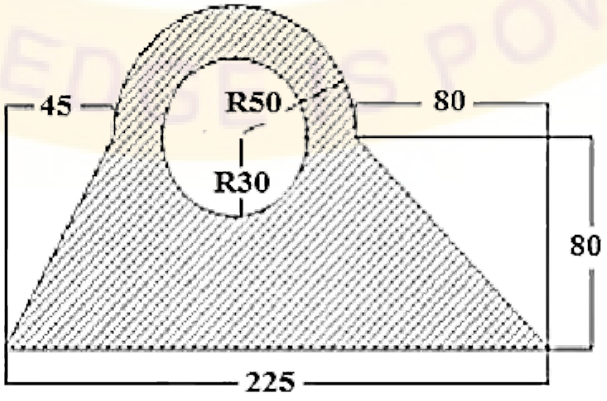


Figure 8

(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)

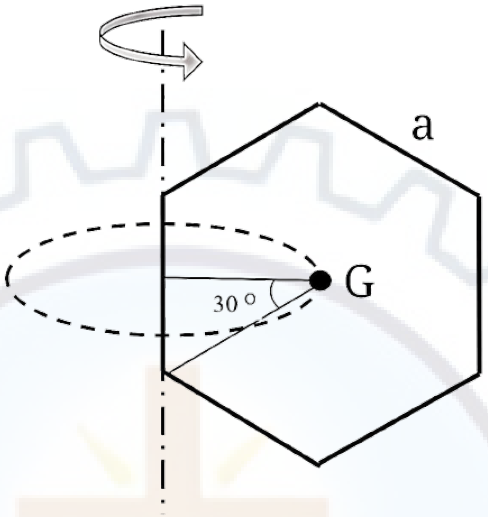


Figure 9

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)

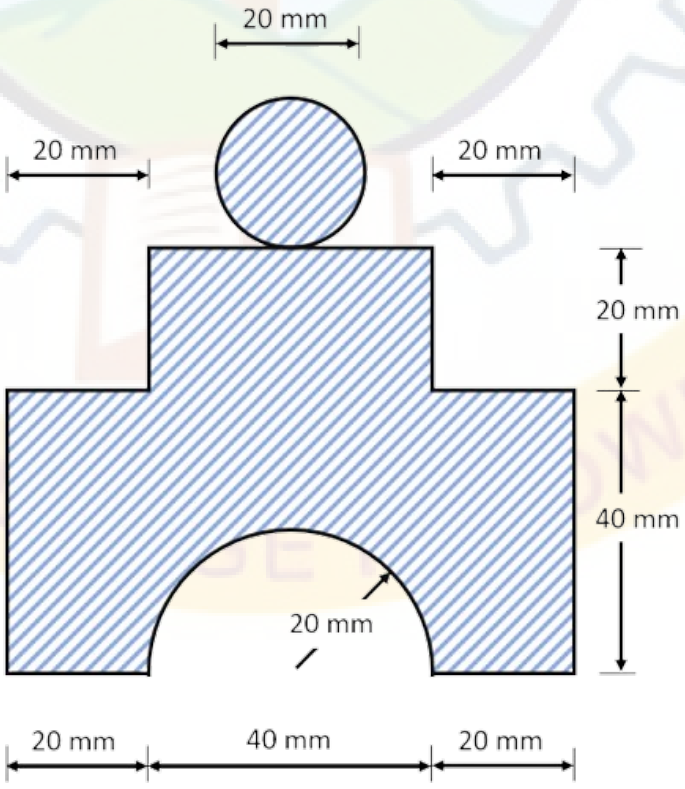


Figure 10

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)

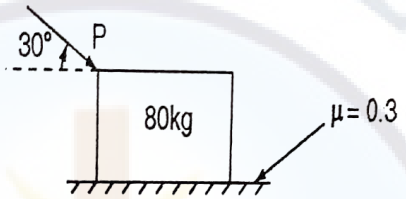


Figure 11

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)

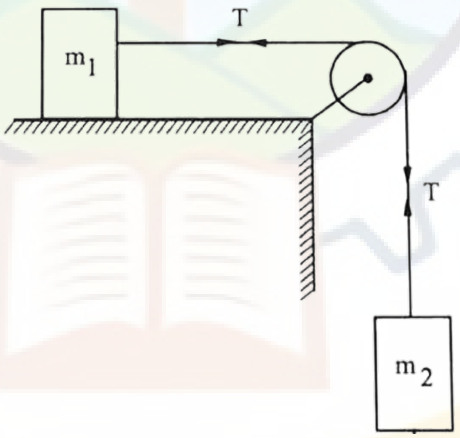


Figure 12

    (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)

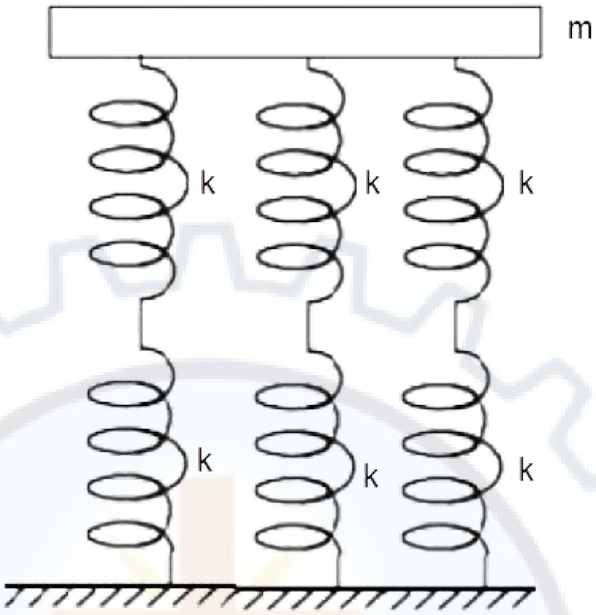


Figure 13

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

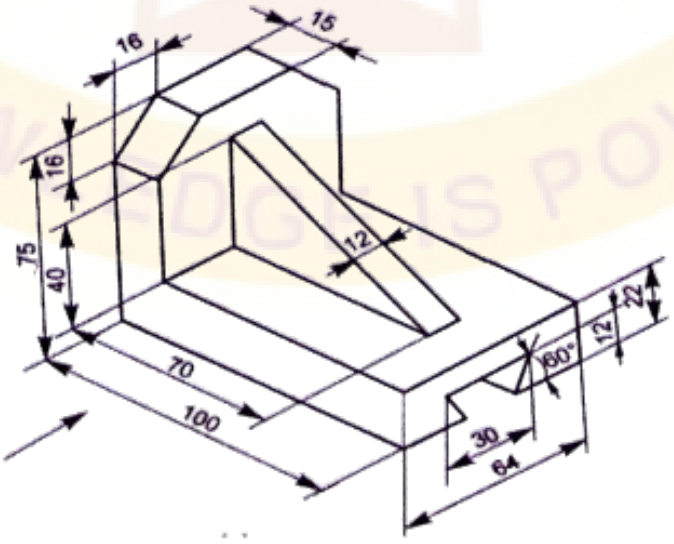
5. A cylinder with a 60 mm base diameter and 70 mm axis is resting on its base in the HP. It is cut by an auxiliary inclined plane which makes an angle of 60^0 with the HP and perpendicular to VP and passes through the top end of the axis. Draw its front view, sectional top view and true shape of the 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 - Biodegrad-

able 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

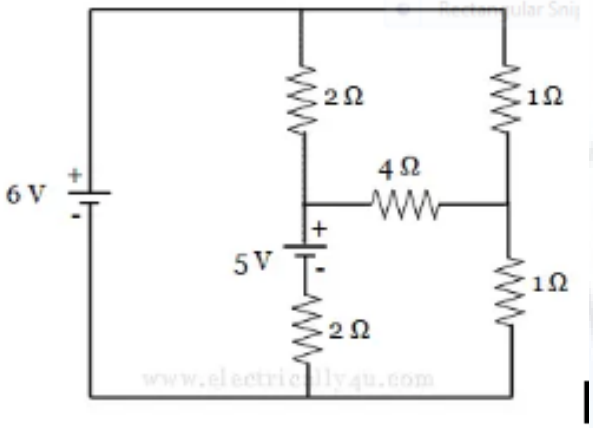


Figure 1:

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.