MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH MECHANICAL ENGINEERING

CURRICULUM AND SCHEME

SEMESTER 1

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA1T01	LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS	3-1-0-3	4	4
B	B24ES1T01B	PROBLEM SOLVING AND PROGRAMMING TECHNIQUES (B)	2-1-0-2	3	3
C	B24ES1T07	FUNDAMENTALS OF ELECTRICAL ENGINEERING	2-1-0-2	3	3
D	B24ES1T05B	BASIC CIVIL AND MECHANICAL ENGINEERING (B)	2-2-0-2	4	4
E	B24ME1T01	ENGINEERING GRAPHICS	2-1-2-4	5	4
F	B24ES1L04B	BASIC CIVIL AND MECHANICAL WORKSHOP (B)	0-0-2-2	2	1
G	B24ES1L01B	PROGRAMMING LABORATORY (B)	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**	**21**

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.	B24CY1T01A	ENGINEERING CHEMISTRY (A)	2-1-0-2	3	3
D	B24ES1T08	FUNDAMENTALS OF ELECTRONICS ENGINEERING	2-1-0-2	3	3
E	B24ME1T02	STATICS AND DYNAMICS FOR ENGINEERS	3-1-0-3	4	4
F	B24ES1L05	ELECTRICAL AND ELECTRONICS WORKSHOP	0-0-2-2	2	1
G	B24ME1L01	COMPUTER AIDED MACHINE DRAWING	0-0-3-3	3	3
H	B24PH1L01B	ENGINEERING PHYSICS LABORATORY (B)	0-0-1-1	2	1
	B24CY1L01A	ENGINEERING CHEMISTRY LABORATORY (A)	0-0-1-1		
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**	**22**

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	B24ME2T01	MECHANICS OF SOLIDS	3-1-0-3	4	4
C	B24ME2T02	MECHANICS OF FLUIDS	3-1-0-3	4	4
D	B24ME2T03	METALLURGY AND MATERIALS SCIENCE	2-1-0-2	3	3
E	B24HU2T02	ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS	2-1-0-2	3	3
G	B24ME2L02	MATERIAL TESTING LAB	0-0-3-3	3	2
H	B24ME2L03	MACHINE TOOLS LAB	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	B24ME2T04	THEORY OF MACHINES	3-1-0-3	4	4
C	B24ME2T05	METROLOGY AND MACHINE TOOLS	3-1-0-3	4	3
D	B24ME2T06	ENGINEERING THERMODYNAMICS	3-1-0-3	4	4
E	B24HU2T01	BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT	3-0-0-3	3	3
F	B24ME2T07	FLUID MACHINES	2-1-0-2	3	3
G	B24ME2L04	MECHANICAL MEASUREMENTS LAB	0-0-3-3	3	2
H	B24ME2L05	FLUID MECHANICS AND MACHINES LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONORS	3-1-0-3	4	4
			TOTAL*	**36**	**25**

SEMESTER 5

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24ME3T01	DYNAMICS AND DESIGN OF MACHINES	3-1-0-3	4	4
B	B24ME3T02	THERMAL POWER ENGINEERING	3-1-0-3	4	4
C	B24ME3T03	MANUFACTURING TECHNOLOGY	3-1-0-3	4	4
D	B24ME3T04	ROBOTICS AND AUTOMATION	3-1-0-3	4	4
E	B24ME3T05	INDUSTRIAL AND SYSTEMS ENGINEERING	2-1-0-2	3	3
F	B24ME3P1x	PROGRAMME ELECTIVE I	2-1-0-2	3	3
G	B24ME3L06	ROBOTICS AND AUTOMATION LAB	0-0-3-3	3	2
H	B24ME3L07	THERMAL POWER LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONORS	3-1-0-3	4	4
			TOTAL*	**36**	**26**

PROGRAMME ELECTIVE I

B24ME3P11	OPERATIONS MANAGEMENT
B24ME3P12	ORGANIZATIONAL BEHAVIOUR & HUMAN RESOURCES MANAGEMENT
B24ME3P13	STRATEGIC MARKETING MANAGEMENT
B24ME3P14	OPERATIONS RESEARCH
B24ME3P15	OBJECT ORIENTED PROGRAMMING
B24ME3P16	DATA ANALYTICS FOR ENGINEERS
B24ME3P17	BASICS OF ARDUINO PROGRAMMING

SEMESTER 6

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24ME3T06	DESIGN OF MACHINE ELEMENTS	3-1-0-3	4	4
B	B24ME3T07	HEAT AND MASS TRANSFER	3-1-0-3	4	4
C	B24ME3T08	FINITE ELEMENT METHODS	3-1-0-3	4	4
D	B24ME3T09	ADVANCED AUTOMOTIVE SYSTEMS	3-1-0-3	4	4
E	B24ME3P2x	PROGRAMME ELECTIVE II	2-1-0-2	3	3
F	B24ME3G1x	OPEN ELECTIVE I	2-1-0-2	3	3
G	B24ME3L08	THERMAL SYSTEMS LAB	0-0-3-3	3	2
H	B24ME3L09	COMPUTER AIDED DESIGN AND ANALYSIS LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	4
N		HONORS	3-1-0-3	4	4
			TOTAL*	**36**	**26**

PROGRAMME ELECTIVE II

B24ME3P21	MAINTENANCE MANAGEMENT AND RELIABILITY ENGINEERING
B24ME3P22	FINANCIAL ENGINEERING
B24ME3P23	TECHNOLOGY MANAGEMENT
B24ME3P24	INDUSTRY 4.0 AND INTERNET OF THINGS
B24ME3P25	DATA STRUCTURES AND ALGORITHMS
B24ME3P26	SYSTEM MODELING AND SIMULATION
B24ME3P27	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
B24ME3P28	ALGORITHMS FOR NON TRADITIONAL OPTIMIZATION

OPEN ELECTIVE I

B24ME3G11	QUANTITATIVE TECHNIQUES FOR ENGINEERS
B24ME3G12	INTRODUCTION TO PRODUCT DEVELOPMENT
B24ME3G13	OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT
B24ME3G14	AUTOMOTIVE TECHNOLOGY
B24ME3G15	NON DESTRUCTIVE TESTING
B24ME3G16	MATERIAL HANDLING SYSTEMS
B24ME3G17	FUNDAMENTALS OF DATA ANALYSIS

SEMESTER 7

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24ME4T01	PROJECT MANAGEMENT	2-1-0-2	3	3
B	B24ME4P3x	PROGRAMME ELECTIVE III	2-1-0-2	3	3
C	B24ME4P4x	PROGRAMME ELECTIVE IV	2-1-0-2	3	3
D	B24ME4G2x	OPEN ELECTIVE II	2-1-0-2	3	3
E	B24HU4T04	DISASTER MANAGEMENT AND INDUSTRIAL SAFETY	2-1-0-2	3	3
G	B24ME4L10	ADVANCED MECHANICAL ENGINEERING LAB	0-0-3-3	3	2
H	B24ME4L11	PROJECT PHASE 1	0-0-6-6	6	3
J	B24ME4L12	SEMINAR	0-0-4-4	4	2
K	B24ME4T02	VIVA VOCE	0-0-0-0	-	1
M		MINOR	3-1-0-3	4	4
N		HONORS	3-1-0-3	4	4
			TOTAL*	**36**	**23**

PROGRAMME ELECTIVE III

B24ME4P31	PRODUCT DESIGN AND DEVELOPMENT
B24ME4P32	ADVANCED DESIGN SYNTHESIS
B24ME4P33	INDUSTRIAL TRIBOLOGY
B24ME4P34	RENEWABLE ENERGY
B24ME4P35	COMPUTATIONAL FLUID DYNAMICS
B24ME4P36	INDUSTRIAL HYDRAULICS
B24ME4P37	ADVANCED METAL JOINING TECHNIQUES
B24ME4P38	ADVANCED MANUFACTURING TECHNIQUES
B24ME4P39	SURFACE ENGINEERING AND COATING TECHNOLOGY

PROGRAMME ELECTIVE IV

B24ME4P41	OPTIMIZATION TECHNIQUES AND APPLICATIONS
B24ME4P42	FRACTURE MECHANICS
B24ME4P43	PRESSURE VESSEL AND PIPING DESIGN
B24ME4P44	FUNDAMENTALS OF UNMANNED AERIAL VEHICLES (UAV)
B24ME4P45	REFRIGERATION AND CRYOGENICS
B24ME4P46	HEAT TRANSFER EQUIPMENT DESIGN
B24ME4P47	ADVANCED NON DESTRUCTIVE TESTING
B24ME4P48	MEMS AND NANOTECHNOLOGY
B24ME4P49	ADVANCED NUMERICALLY CONTROLLED MACHINING

OPEN ELECTIVE II

B24ME4G21	INTRODUCTION TO BUSINESS ANALYTICS
B24ME4G22	PATENTS AND INTELLECTUAL PROPERTY RIGHTS
B24ME4G23	FUNDAMENTALS OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT
B24ME4G24	RENEWABLE ENERGY ENGINEERING
B24ME4G25	INTRODUCTION TO 3D PRINTING
B24ME4G26	FUNDAMENTALS OF COMPOSITE MATERIALS
B24ME4G27	INTRODUCTION TO ACOUSTICS AND NOISE CONTROL

SEMESTER 8

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A, B, C		INTERNSHIP & MOOC COURSES** (3 NUMBERS)			9
		OR			
A	B24ME4P5x	PROGRAMME ELECTIVE V	2-1-0-2	3	3
B	B24ME4P6x	PROGRAMME ELECTIVE VI	2-1-0-2	3	3
C	B24ME4G3x	OPEN ELECTIVE III	2-1-0-2	3	3
		AND			
H	B24ME4L13	PROJECT PHASE 2	0-0-12-12	12	6
M		MINOR PROJECT[#]	0-0-3-3	3	6
N		HONORS PROJECT	0-0-6-6	6	6
			TOTAL[*]	30	15

[#]Can be done in S7 as well

* Semester total does not include the credits of honors and minor courses

** Students can take up the MOOC courses in semester 7 as well. The courses should be from the list approved by the Board of Studies.,

PROGRAMME ELECTIVE V

B24ME4P51	ADVANCED THEORY OF VIBRATION
B24ME4P52	ACOUSTICS AND NOISE CONTROL
B24ME4P53	COMPOSITE MATERIALS
B24ME4P54	GAS DYNAMICS AND JET PROPULSION
B24ME4P55	IC ENGINE COMBUSTION AND POLLUTION
B24ME4P56	HEATING VENTILATION AND AIR CONDITIONING
B24ME4P57	ADDITIVE MANUFACTURING
B24ME4P58	POWDER METALLURGY
B24ME4P59	METAL FORMING AND INJECTION MOULDING

PROGRAMME ELECTIVE VI

B24ME4P61	SIX SIGMA AND QUALITY MANAGEMENT
B24ME4P62	OCCUPATIONAL HEALTH AND SAFETY
B24ME4P63	MEP SYSTEMS AND MANAGEMENT
B24ME4P64	PIPING DESIGN AND MANUFACTURING
B24ME4P65	LOGISTICS AND SUPPLY CHAIN MANAGEMENT
B24ME4P66	BASICS OF PLC PROGRAMMING

OPEN ELECTIVE III

B24ME4G31	FACILITY LOCATION AND PLANNING
B24ME4G32	TOTAL QUALITY MANAGEMENT
B24ME4G33	INTRODUCTION TO INDUSTRY 4.0
B24ME4G34	MAINTENANCE ENGINEERING AND MANAGEMENT
B24ME4G35	NANOTECHNOLOGY AND APPLICATIONS
B24ME4G36	INFORMATION TECHNOLOGY MANAGEMENT

MINOR

Basket I (Design)

SEMESTER	COURSE NO.	COURSE NAME
S3		MECHANICS OF MATERIALS
S4		MECHANICS OF MACHINES
S5		DYNAMICS OF MACHINES
S6		MACHINE DESIGN
S7		DESIGN THINKING AND PRODUCT DEVELOPMENT
S8		MINOR PROJECT*

Basket II (Thermal)

SEMESTER	COURSE NO.	COURSE NAME
S3		FLUID MECHANICS & MACHINERY
S4		THERMODYNAMICS
S5		THERMAL SCIENCE AND ENGINEERING
S6		HEAT TRANSFER
S7		AUTOMOTIVE SYSTEMS
S8		MINOR PROJECT*

Basket III (Production)

SEMESTER	COURSE NO.	COURSE NAME
S3		MATERIAL SCIENCE & TECHNOLOGY
S4		MANUFACTURING PROCESS
S5		PRECISION MANUFACTURING AND MACHINING TECHNOLOGY
S6		INTRODUCTION TO OPERATIONS MANAGEMENT
S7		FUNDAMENTALS OF ROBOTICS AND AUTOMATION
S8		MINOR PROJECT*

HONOURS

Group I (Design)

SEMESTER	COURSE NO.	COURSE NAME
S4		DESIGN OF HYDRAULIC AND PNEUMATIC EQUIPMENTS
S5		DESIGN FOR MANUFACTURING AND ASSEMBLY
S6		ADVANCED THEORY OF MACHINES
S7		TRIBOLOGY
S8		HONORS PROJECT

Group II (Thermal)

SEMESTER	COURSE NO.	COURSE NAME
S4		ADVANCED FLUID MECHANICS
S5		MEASUREMENT METHODS FOR ENGINEERS
S6		SOLAR THERMAL ENGINEERING
S7		AEROSPACE ENGINEERING
S8		HONORS PROJECT

Group III (Production)

SEMESTER	COURSE NO.	COURSE NAME
S4		ADVANCED ENGINEERING MATERIALS
S5		ADVANCED MATERIAL PROCESSING
S6		ADVANCED CHARACTERISATION TECHNIQUES
S7		JIGS AND FIXTURES
S8		HONORS PROJECT

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B.TECH MECHANICAL 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.

B24ES1T07	FUNDAMENTALS OF ELECTRICAL ENGINEERING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

This course aims to provide the student with an understanding of the fundamental concepts of electrical circuits, DC and AC machines. It gives an overall concept about the fundamental principles of electric circuits, constructional details and characteristics of electrical machines. The course equips the students to apply the acquired knowledge to analyse the electric circuits, DC and AC electric machines.

Prerequisites

Nil

Course Outcomes

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

CO 1	Understand the fundamental concepts of electric circuits and apply circuit laws to solve basic DC electric circuits. (Cognitive Knowledge Level: Apply)
CO 2	Analyse the characteristics of DC machines and select appropriate machines for different applications. (Cognitive Knowledge Level: Analyse)
CO 3	Understand the fundamental concepts of AC systems and analyse single-phase AC circuits with series combinations of R, L, and C. (Cognitive Knowledge Level: Analyse)
CO 4	Explain the working of transformers and induction motors and identify their applications. (Cognitive Knowledge Level: Apply)
CO 5	Describe the operation of alternators and BLDC motors and their 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	3	2	2		2	1		1	1	1	1
CO 2	3	2	2	1		2	1		1	1	1	1
CO 3	3	3	2	2		3	1		1	1	1	1
CO 4	3	2	2	1		3	1		1	1	1	1
CO 5	3	2	2	1		3	2		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	20	20	20
Apply	20	40	30
Analyse	40	20	30
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 (5 hours)

Introduction to Electrical Systems: Basic Terminology including Electric circuit, Voltage, Current, Power, Energy, Resistance, Inductance and Capacitance.

Analysis of DC electric circuits: Resistances in Series and Parallel combination – Current and Voltage division rules, Ohm's Law, Kirchoff's L aws. S olution o f E lectrical circuits using Mesh analysis

MODULE 2 (8 hours)

DC Generator: Construction, Working of a DC Generator, types of Armature windings, EMF equation, Types of DC Generators, Losses, Condition for maximum efficiency, Power flow d iagram, E fficiency, Arm ature rea ction (Co ncept only), Applications.

DC Motors: Principle of operation, Back emf, Necessity of Starters, Speed and Torque equation, Types of DC motor, Speed- Torque characteristics of Shunt and Series motors, Losses, Applications.

MODULE 3 (8 hours)

AC Fundamentals: Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self-Inductance and Mutual inductance, Coefficient of coupling. (Concept and equations only). Generation of Alternating Voltages and Waveform, Frequency, Period, Average, RMS values, Form factor and Peak factor of Sine wave forms only. Phasor representation of sinusoidal quantities, Lagging and Leading Concepts. Rectangular and Polar representation of Phasors.
Analysis of Series RL, RC and RLC circuits with introduction to Power, Power factor, Active Power, Reactive Power and Apparent Power. Generation of Three Phase AC, Phase sequence, Comparison between Three phase and Single Phase, Line and Phase Values of Current and Voltage in Star and Delta connections.

MODULE 4 (9 hours)

Transformers: Types based on Construction, Principle of operation, EMF equation, Ideal Transformer, Losses, Efficiency, Condition for Maximum efficiency, Transformer ratings, Applications.
Three phase Induction motor: Construction, Classification, Rotating Magnetic Field, Principle of operation, Torque equation, Torque- Slip characteristics, Need of Starter, Starting using a Star Delta starter, Speed Control and Braking in Induction motors, Applications. Single phase Induction motors, Different types, Applications.

MODULE 5 (6 hours)

Three Phase Alternators: Construction details, Classification based on construction, Principle of operation, emf equation, Voltage regulation by direct method, Necessary conditions for the Parallel operation of Alternators, Applications.
BLDC motor: Construction, Principle of operation, Applications.

Text Books

1. B. L. Theraja, A. K. Theraja, Textbook of "Electrical Technology" Volume 1, S. Chand & Co., 2005.

2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", 3rd Edition, Tata McGraw Hill, 2010.

3. V. K. Mehta & Rohit Mehta, "Principles of Electrical Engineering", S Chand Publishing, 2003.

4. J. B. Gupta, "Theory and Performance of Electrical Machines", S.K. Kataria & Sons, 2007.

5. R. K. Rajput, "Basic Electrical Engineering", Laxmi Publications, 2009.

6. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 2010.

Reference Books

1. C. L. Wadhwa, "Basic Electrical Engineering", New Age International Publisher, 2007.

2. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education India, 2011.

3. Del Toro V, "Electrical Engineering Fundamentals", Pearson Education, 2015.

4. A. Sudhakar, Shyammohan S.,"Circuits and Networks: Analysis and Synthesis "by McGraw-Hill, 2017.

5. Hayt W H, Kemmerly J E, and Durbin S M, "Engineering Circuit Analysis", Tata McGraw-Hill, 2013.

6. Hughes, "Electrical and Electronic Technology", Pearson Education, 2010.

COURSE CONTENTS AND LECTURE SCHEDULE

No	**{**Topic	**No of Lecture/Tutorial Hours**
	Module 1	**5**
1.1	**Introduction to Electrical Systems:** Basic Terminology including Electric circuit, Voltage, Current, Power, Energy, Resistance, Inductance and Capacitance.	1
1.2	**Analysis of DC electric circuits:** Resistances in Series and Parallel combination – Current and Voltage division rules, Ohm's Law, Kirchoff's Laws. Solution of Electrical circuits using Mesh analysis. Numerical problems.	4
	Module 2	**8**
2.1	**DC Generator:** Construction, Working of a DC Generator, types of Armature windings.	1
2.2	EMF equation, Types of DC Generators, Losses, Condition for maximum efficiency, Power flow diagram, Efficiency, Armature reaction (Concept only), Applications. Numerical Problems	4
2.3	**DC Motors:** Principle of operation, Back emf, Necessity of Starters. Speed and Torque equation, Types of dc motor, Speed- Torque characteristics of Shunt and Series motors, Losses, Applications. Numerical Problems	3
	Module 3	**8**

3.1	**AC Fundamentals:** Faraday's Laws of Electromagnetic Induction, Lenz's Law, Self-Inductance and Mutual inductance, Coefficient of coupling. (Concept and equations only).	1
3.2	Generation of Alternating Voltages and Wave form, Frequency, Period, Average and RMS values, Form factor and peak factor of Sine wave forms only. Phasor representation of sinusoidal quantities, Lagging and Leading Concepts. Rectangular and Polar representation of Phasors. Numerical problems	3
3.3	Analysis of Series RL, RC and RLC circuits with introduction to Power, Power factor, Active Power, Reactive Power and Apparent Power. Generation of Three Phase AC, Phase sequence, Comparison between Three phase and Single Phase, Line and Phase Values of Current and Voltage in Star and Delta connections. Numerical problems	4
	Module 4	**9**
4.1	**Transformers:** Types based on Construction, Principle of operation, EMF equation, Ideal Transformer, Losses, Efficiency, Condition for Maximum efficiency, Transformer ratings, Applications. Numerical problems	3
4.2	**Three phase Induction motor:** Construction, Classification, Rotating Magnetic Field, Principle of operation.	2
4.3	Torque equation, Torque- Slip characteristics, Need of Starter, Starting using a Star Delta starter, Speed Control and Braking in Induction motors, Applications. Single phase Induction motors, Different types, Applications. Numerical problems	4
	Module 5	**6**
5.1	**Three Phase Alternators:** Construction details, Classification based on construction, Principle of operation, emf equation, Voltage regulation by direct method, Necessary conditions for the Parallel operation of Alternators, Applications. Numerical problems	5
5.2	**BLDC motor:** Construction, Principle of operation, Applications.	1
	Total Hours	**36 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Define the terms such as Voltage, Current, Power etc

2. Solve problems based on series/parallel network reduction method and current/Voltage division rule
3. Solve problems with Mesh analysis.

Course Outcome 2 (CO 2):

1. Describe the construction and Principle of working of DC Generator/Motor
2. Explain different types of DC Generator/Motor and its applications.
3. Problems on emf induced, speed, Torque etc

Course Outcome 3 (CO 3):

1. Explain Faraday's laws of Electromagnetic Induction, self-inductance, mutual inductance and coefficient of coupling etc.
2. Problems on rms and average values of sinusoidal waveforms
3. Analyze Series RL, RC, RLC ac circuits, Develop the relation between Line and Phase values of voltage and current in Star and Delta connections.

Course Outcome 4 (CO 4):

1. Describe the construction, principle of Operation of Transformers.
2. Problems on emf equation and efficiency of Transformer
3. Describe the construction and working of of Three phase Induction motor and its applications.
4. Explain a single-phase Induction motor and its applications.

Course Outcome 5 (CO 5):

1. Explain the construction, working principle and classifications of an Alternator.
2. Problems on the emf equation, Voltage regulation by direct method.
3. Explain the construction and working of BLDC motor.

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: B24ES1T07

Course Name: FUNDAMENTALS OF ELECTRICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART A

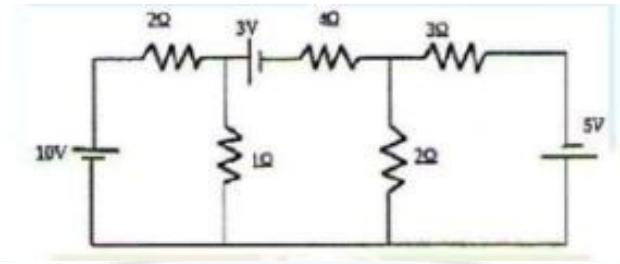
Answer all questions. Each question carries 3 marks.

1. Derive an expression for the energy stored in an inductor
2. Two coils connected in parallel across 100V supply mains take 10A from the line. The power dissipated in one coil is 600W. What is the resistance of the other coil?
3. Explain the necessity of starters in dc motors
4. Calculate the emf generated by 4 pole wave wound with 65 slots and 12 conductors/pole when driven at 1200rpm. Flux per pole is 0.02wb.
5. Define the following (a) cycle (b) time period (c) average value (d) rms value (e) peak factor (f) form factor.
6. State Faradays law of Electromagnetic Induction.
7. Derive the emf equation for a single-phase transformer
8. What is the effect of supply voltage on the torque of an induction motor?
9. What are the necessary conditions for parallel operation of an alternator?
10. List out the applications of BLDC motors.

PART B

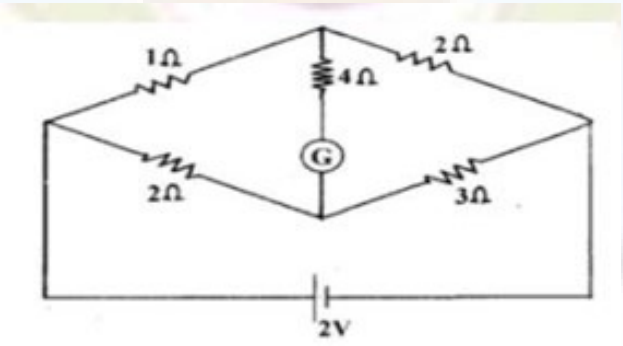
Answer any one question from each module. Each question carries 14 marks.

11. Calculate the node voltage in the circuit shown, applying node analysis



OR

12. State and explain Kirchhoff's laws. Calculate the current through the galvanometer G in the circuit shown



13. A 250V, 4 pole series motor has a two-circuit wave wound winding with 105 slots, each consisting of 12 conductors. The gap flux per pole is 0.02 wb when motor is on full load and taking a current of 45A. The armature and field resistances are 0.2Ω and 0.1Ω respectively. The iron and frictional losses are 700W. Calculate the (a) speed (b) shaft torque (c) bhp

OR

14. Two dc shunt generators with induced emfs of 120V and 115V, armature resistance of 0.05Ω and field resistances of 20Ω and 25Ω are in parallel suppling a total load of 25Kw. Calculate the load shared by each generator

15. Differentiate between statically and dynamically induced emf. A conductor of length 0.5m moves in uniform magnetic field of flux density 1.1T at a velocity of 30m/s. Calculate the emf induced in the conductor if the direction of motion of the conductor is inclined at an angle 60 to the direction of field.

OR

16. Derive the average value, rms value, amplitude factor and formfactor of a purely sinusoidal waveform.

17. A three phase, 50Hz induction motor has starting torque which is 1.25 times full load torque and a maximum torque which is 2.5 times full load torque. Neglecting stator resistance and rotational losses and assuming constant rotor resistance, find (i) the slip at full load (ii) slip at maximum torque and (iii) the rotor current at starting in per unit of full load rotor current.

OR

18. The primary and secondary windings of a 500Kva single phase transformer have resistance of 0.4Ω and 0.0015Ω. The primary and secondary voltages are 6000V and 400V and the iron loss is 3.2Kw. Calculate the efficiency on (a) full load (b) half load

19. With neat diagram, explain the construction and principle of operation of BLDC motors

OR

20. Discuss the constructional details of three phase alternators and classify them.

B24ES1T05B	BASIC CIVIL AND MECHANICAL ENGINEERING (B)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	2	0	2	4	2024

Preamble

In pursuit of advancing knowledge and fostering a holistic understanding of engineering disciplines, this course on Basic Civil and Mechanical Engineering endeavors to provide students of Mechanical Engineering with a comprehensive insight into the fundamentals of both Civil and Mechanical Engineering. It seeks to empower students with the knowledge and skills necessary to contribute meaningfully to the advancement and innovation of Civil and Mechanical engineering practices, thereby meeting the evolving needs of society.

Prerequisites

Nil

Course Outcomes

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

CO 1	Recall the role of civil engineer in society and to relate the various disciplines of Civil Engineering.(Cognitive Knowledge Level: Understand)
CO 2	Discuss the Materials, energy systems, water management and environment for green buildings. (Cognitive Knowledge Level: Apply)
CO 3	Explain different types of buildings, building components, building materials and building construction. (Cognitive Knowledge Level: Apply)
CO 4	Understand the basic Thermodynamic concepts and Illustrate the working of IC engines.(Cognitive Knowledge Level: Understand)
CO 5	Understand the basic principle of power transmission elements and material handling devices. (Cognitive Knowledge Level: Understand)
CO 6	Describe the fundamentals of Refrigeration and air conditioning systems and basic knowledge on manufacturing and metal joining processes. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

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

For the end semester examination, there will be two parts: Part I – Basic Civil Engineering and Part II – Basic Mechanical Engineering. Part I and PART II carries 50 marks each. Part I contain 2 parts - Part A and Part B. Part A contain 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 to be answered. Each question carries 10 mark and can have maximum 2 sub-divisions. The pattern for end semester examination for part II is same as that of part I. **The student should answer both part I and part 2 in separate answer booklets.**

SYLLABUS
PART I– Basic Civil Engineering

MODULE 1 (9 hours)

Introduction to Civil Engineering : Relevance of Civil Engineering in the overall infrastructural development of the country, Brief introduction to major disciplines of Civil Engineering

Conventional construction materials : Types, properties and uses of building materials: bricks, stones, cement, sand, timber and steel. Cement concrete: Plain Cement Concrete (PCC) and Reinforced Cement Concrete (RCC), Constituent materials and properties (brief discussion only).

Other construction materials: Glass, Ceramics, Plastics, Composite materials, Thermal and acoustic insulating materials, Decorative panels, water proofing materials, Gypsum.

Surveying: Basic Principles of surveying, instruments, methods and measurements.

Environment :Water Supply and Sanitary Systems, Urban Air Pollution Management, Solid Waste Management, Urban Flood Control (brief discussion only).

MODULE 2 (8 hours)

Components of a building: **Sub-structure** :Foundation- types of foundations- Shallow and deep, Machine foundation.

Super structure : Masonry: Brick masonry- Header and stretcher bond, English bond & Flemish bond-plan, elevation and isometric view, Stone masonry, Rubble masonry and Ashlar masonry.

Roof: Functions, types, and materials– flat roof, pitched roof, Shells and folded plates, Roof coverings for pitched roof-Thatch, Shingle, Tiles, Slates, Aluminium sheets, Galvanised iron (G.I.) sheets, Sandwich roof panels, roofing for industrial buildings.

Flooring: Functions, types of flooring - Mud, Brick, Flag stone, Cement concrete, Terrazzo, Mosaic, Marble, Tiles, Timber, Rubber, P.V.C.

Types of structures : Framed structures and load bearing wall structures. Pre-fabricated, pre-cast and modular construction. (brief discussion only).

MODULE 3 (6 hours)

Type of buildings : Classification of buildings based on occupancy as per NBC
Building area: : Plinth area, built-up area, floor area, carpet area and floor area ratio for a building as per KMBR
Building rules and regulations: Relevance of NBC, KMBR & CRZ norms (brief discussion only), Selection of site-Site plan preparation for buildings as per Kerala Municipal Building Rules, general provisions regarding site and building requirements.
Green buildings: Materials, energy systems, water management and environments for green buildings. (brief discussions only)

PART II– Basic Mechanical Engineering

MODULE 4 (8 hours)

Basics of thermodynamics: State, Process, Cycle, System and control volume concept, Enthalpy and Entropy, Types of thermodynamic processes, thermodynamic laws, Carnot, Otto and Diesel cycles, Efficiency, Heat addition and rejection, Problems
I.C Engines: Working of SI and CI engine, Two stroke and Four stroke engine, IC engine parts, Fuel, Cooling and Lubrication systems, CRDI and MPFI engines. Concept of hybrid engines.

MODULE 5 (7 hours)

Power Transmission Elements Classification and applications of mechanical drives, Velocity ratio of belt drive, Length of belt, Slip in belt, Power transmitted. Gear drive: Types, Gear Ratio, Simple, compound and epicyclic gear trains (simple descriptions only)
Automotive Drives: Manual Transmission, Automatic Manual Transmission (AMT), Continuous Variable Transmission (CVT), Torque converter.

MODULE 6 (8 hours)

Refrigeration : Basic terminologies, Vapour Compression Refrigeration system with PH and TS diagram, Air conditioning- Summer and winter air conditioning, Unitary and central air conditioning system, Inverter technology.
Basic description of the manufacturing processes: (Basic Concepts only and examples of products) – Die Casting, Forging, Rolling, Extrusion. Basic description of Lathe and Drilling Machine, Lathe operations. Basic description of Metal Joining Processes: Arc and gas Welding, Soldering and Brazing, their applications

Text Books

1. S. C. Rangwala, “Civil Engg. Drawing”, Charotar Pub. House Anand.
2. B. C. Punamia, “Surveying Vol .I & II”, Laxmi Publication Delhi.

3. J. Benjamin, "Basic Mechanical Engineering", Pentex Books, 9th Edition, 2018
4. P. Balachandran, Basic Mechanical Engineering, Owl Books

Reference Books

1. R. Chudley, "Construction Technology Vol. I to IV", Longman Group, England (2011).
2. R. Chudley and R. Greeno, "Building Construction Handbook", Addison Wesley, Longman Group, England (1998).
3. M. S. Mamlouk, and J. P. Zaniewski, "Materials for Civil and Construction Engineering", Pearson Publishers (2011)
4. W.B. McKay and J.K. McKay, "Building Construction Vol. 1 to 4", Pearson India Education Services. (2013)
5. S. C. Rangwala and K.B. Dalal, Building Construction, Charotar Publishing House (2017).
6. Kerala Municipal Building Rules (latest revision)
7. M. Clifford, K. Simmons, "An Introduction to Mechanical Engineering Part I", CRC Press
8. Roy and Choudhary, "Elements of Mechanical Engineering", Media Promoters &Publishers Pvt. Ltd., Mumbai.
9. G. S. Sawhney, "Fundamentals of Mechanical Engineering", PHI
10. 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
	Module 1	**9**
1.1	Introduction to Civil Engineering: Relevance of Civil Engineering in the overall infrastructural development of the country, Brief introduction to major disciplines of Civil Engineering .	2

1.2	Conventional construction materials: types, properties and uses of building materials: bricks, stones, cement, sand, timber and Steel. Cement concrete: Plain Cement Concrete (PCC) and Reinforced Cement Concrete (RCC), Constituent materials and properties (brief discussion only).	2
1.3	Other construction materials: Glass, Ceramics, Plastics, Composite materials, Thermal and acoustic insulating materials, Decorative panels, water proofing materials, Gypsum .	2
1.4	Surveying: Basic Principles of surveying, instruments, methods and measurements	1
1.5	Environment: Water Supply and Sanitary Systems, Urban Air Pollution Management, Solid Waste Management, Urban Flood Control (brief discussion only).	2
	Module 2	**8**
2.1	Components of a building: Sub-structure: Foundation-types of foundations- Shallow and deep, Machine foundation .	2
2.2	Super structure: Masonry: Brick masonry- Header and stretcher bond, English bond & Flemish bond-plan, elevation and isometric view, Stone masonry, Rubble masonry and Ashlar masonry.	2
2.3	Roof: Functions, types and materials– flat roof, pitched roof, Shells and folded plates, Roof coverings for pitched roof-Thatch, Shingle, Tiles, Slates, Aluminium sheets, Galvanised iron (G.I.) sheets, Sandwich roof panels, roofing for industrial buildings.	2
2.4	Flooring: Functions, types of flooring - Mud, Brick, Flag stone, Cement concrete, Terrazzo, Mosaic, Marble, Tiles, Timber, Rubber, P.V.C.	1
2.5	Types of structures: Framed structures and load bearing wall structures. Pre-fabricated, pre-cast and modular construction. (brief discussion only).	1
	Module 3	**6**
3.1	Type of buildings: Classification of buildings based on occupancy as per NBC.	1
3.2	Building area: Plinth area, built-up area, floor area, carpet area and floor area ratio for a building as per KMBR.	2
3.3	Building rules and regulations: Relevance of NBC, KMBR & CRZ norms (brief discussion only), Selection of site-Site plan preparation for buildings as per Kerala Municipal Building Rules, general provisions regarding site and building requirements.	2
3.4	Green buildings: Materials, energy systems, water management and environments for green buildings.(brief discussions only)	1
	Module 4	**8**

4.1	Basics of thermodynamics: State, Process, Cycle, System and control volume concept,Enthalpy and Entropy, Types of thermodynamic processes.	1
4.2	Carnot, Otto and Diesel cycles, Efficiency, Problems	2
4.3	Working of SI and CI engine, Two stroke and Four stroke engine, IC engine parts.	2
4.4	Fuel, Cooling and Lubrication systems, CRDI and MPFI engines.	2
4.5	Concept of hybrid engines.	1
	Module 5	**7**
5.1	Power Transmission Elements: Classification and applications of mechanical drives.	1
5.2	Velocity ratio of belt drive.	1
5.3	Length of belt, Slip in belt, Power transmitted. Gear drive: Types, Gear Ratio, Simple, compound and epicyclic gear trains (simple descriptions only)	3
5.4	Automotive Drives: Manual Transmission, Automatic Manual Transmission (AMT), Continuous Variable Transmission (CVT), Torque converter.	2
	Module 6	**8**
6.1	Refrigeration, Air conditioning, Vapour Compression Refrigeration system, Summer and winter air conditioning.	2
6.2	Basic description of the manufacturing processes (Basic Concepts only and examples of products)	1
6.3	Die Casting, Forging, Rolling, Extrusion.	2
6.4	Basic description of Lathe and Drilling Machine, Lathe operations.	1
6.5	Basic description of Metal Joining Processes: Arc and gas Welding, Soldering and Brazing, their applications.	2
	Total Hours	**46 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Define the role of a civil engineer in society
2. Address complex challenges in the built environment.
3. How do civil engineers contribute to the development of environmentally conscious infrastructure.

Course Outcome 2 (CO 2):

1. Examine the role of materials in green building construction
2. Evaluate the integration of energy systems in green buildings.
3. How do green building practices address water conservation, reuse, and efficient management of water resources?

Course Outcome 3 (CO 3):

1. Compare and contrast the characteristics and purposes of residential, commercial, and industrial buildings.
2. Discuss the importance of building components in the construction process.
3. How have innovations in techniques influenced the efficiency, sustainability, and safety of construction practices?

Course Outcome 4 (CO 4):

1. Describe the working of a four-stroke diesel engine.
2. Why two stroke engines are less efficient than four stroke engine?
3. In an Isothermal process, Why does the temperature remains constant despite the heat exchange?

Course Outcome 5 (CO 5):

1. Derive an expression to determine the length of an open belt drive
2. Explain the working of CVT system.
3. What are the advantages of AMT Vehicles?.

Course Outcome 6 (CO 6):

1. With the aid of a neat sketch, explain the working of a Vapour Compression Refrigeration system.
2. List the commonly used metal joining processes in manufacturing.
3. How the operation of a summer air conditioner differs from a winter air conditioner

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: B24ES1T05B

Answer both part I and part 2 in separate answer booklets

Course Name: BASIC CIVIL AND MECHANICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

Answer both part I and part 2 in separate answer booklets

PART I: BASIC CIVIL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks.

1. How does Civil Engineering contribute to the comprehensive development of a country's infrastructure?
2. How does the increase in ground resistance due to earth pitting mechanisms affect the safety and reliability of equipment?
3. Elaborate on how the Floor Area Ratio (FAR) is determined for a building
4. Compare load-bearing masonry structures and framed structures.
5. Provide examples of machinery foundation types and their applications in various industrial settings.

PART B

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

Module 1

6. Provide a concise overview of the basic principles, instruments, methods, and measurements involved in surveying. 10

OR

7. How do water supply and sanitary systems, urban air pollution management, solid waste management, and urban flood control collectively contribute to environmental sustainability in urban areas? 10

Module 2

8. How do green buildings incorporate sustainable practices in terms of materials, energy systems, water management, and overall environmental considerations? 10

OR

9. Explain the essential components of a residential building and elaborate on their functions within the functionality of the structure. 10

Module 3

10. Elaborate on the structural characteristics and load-bearing capabilities of brick masonry, stone masonry, and rubble masonry. 10

OR

11. (a) What advantages do steel trusses offer in terms of strength, span capabilities, and cost-effectiveness? 6

    (b) How do industrial roofing requirements differ from those of residential structures, and what specific roofing materials are commonly used in industrial buildings? 4

PART II: BASIC MECHANICAL ENGINEERING

PART A

Answer all questions. Each question carries 4 marks

1. With the neat block diagram, explain the fuel system of a CI engine.
2. Illustrate the working of an epicyclic gear train.
3. Explain velocity ratio in belt drive.
4. Explain Arc welding and Gas welding with suitable sketches.
5. Define: Casting and forging processes.

PART B

Answer all questions. Each question carries 10 marks

Module 4

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

OR

7. Derive the air standard efficiency of Diesel Cycle 10

Module 5

8. (a) What are the different modes of power transfer? 5
   (b) What is slip in belt drive? Why it is an undesirable effect? 5

OR

9. (a) Explain the working of a torque convertor. 4
   (b) Compare manual and automatic transmission in automobiles 6

Module 6

10. (a) How summer air conditioners differ from winter air conditioners. 5
    (b) Explain the working of summer air conditioner with a neat sketch 5

OR

11. With a neat sketch, Explain the different components of a Lathe. 10

B24ME1T01	ENGINEERING GRAPHICS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	2	4	4	2024

Preamble

This course aims at equipping students with the ability to communicate technical concepts through global-standard graphical representation. Students learn to interpret existing engineering drawings accurately and convey design information effectively. Emphasis is placed on mastering graphical communication techniques to meet industry standards. By the end of the course, students will have the skills to articulate complex engineering information visually and interpret engineering drawings with precision.

Prerequisites

Nil

Course Outcomes

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

CO 1	Draw the projection of points and lines located in different quadrants. (Cognitive Knowledge Level: Analyse)
CO 2	Prepare multi view orthographic projections of objects by visualizing them in different positions. (Cognitive Knowledge Level: Apply)
CO 3	Draw sectional views and develop surfaces of a given object.(Cognitive Knowledge Level: Apply)
CO 4	Prepare pictorial drawings using the principle of isometric projections and convert 3D views to orthographic views. (Cognitive Knowledge Level: Analyse)
CO 5	Prepare pictorial drawings using the principle of perspective projections.(Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

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

SYLLABUS

MODULE 1 (12 hours)

Introduction: Relevance of technical drawing in engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.
Orthographic projection of Points and Lines: Projection of points in different quadrants, Projection of straight lines inclined to one plane and inclined to both planes. Trace of line. Inclination of lines with reference planes True length of line inclined to both the reference planes.

MODULE 2 (12 hours)

Orthographic projection of Solids: Projection of Simple solids such as Triangular, Rectangle, Square, Pentagonal and Hexagonal Prisms, Pyramids, Cone and Cylinder. Projection of solids in simple position. Projection of solids with axis inclined to one of the reference planes and with axis inclined to both 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. Also locating the section plane when the true shape of the section is given.
Development of Surfaces: Development of surfaces of the above solids and solids cut by different section planes. Also finding the shortest distance between two points on the surface.

MODULE 4 (10 hours)

Isometric Projection: Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone, Sphere, Hemisphere and their combinations.
Conversion of Pictorial Views: Conversion of pictorial views into orthographic views.

MODULE 5 (10 hours)

Perspective Projection: Perspective projection of Prisms and Pyramids with axis perpendicular to the ground plane and axis perpendicular to picture plane.
Intersection of surfaces: Methods of determining lines of intersection - Intersection of prism in prism and cylinder in cylinder.

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.

2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.

3. K.N. Anilkumar, Engineering Graphics, Adhyuth Narayan Publishers.

4. P I. Varghese, Engineering Graphics, VIP Publishers

Reference Books

1. Agrawal, B. and Agrawal, C.M., Engineering Drawing, Tata McGraw Hill Publishers.

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

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

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

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Module 1	**12**
1.1	**Introduction:** Relevance of technical drawing in Engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.	1
1.2	Concept of principal planes of projection, different quadrants, locating points on different quadrants	2
1.3	Projection of lines, inclined to one plane and Lines inclined to both planes,	4
1.4	Problems on lines using trapezoid method	2
1.5	Line rotation method of solving, problems on line rotation method	3
	Module 2	**12**
2.1	Introduction of different solids, Simple position plan and elevation of solids	3
2.2	Problems on views of solids inclined to one plane	2
2.3	Problems on views of solids inclined to both planes	4
2.4	Practice problems on solids inclined to both planes	3
	Module 3	**11**
3.1	Introduction to section planes. Principle of locating cutting points and finding true shape	2
3.2	Problems on sections of different solids and Problems when the true shape is given	4
3.3	Principle and development of simple solids	2
3.4	Development of solids and sectioned solids	3
	Module 4	**10**
4.1	Principle of Isometric View and Projection, Isometric Scale. Problems on simple solids	2
4.2	Isometric problems on Frustum of solids, Sphere and Hemisphere	3
4.3	Problems on combination of different solids	3
4.4	Practice on conversion of pictorial views into orthographic views	2
	Module 5	**10**
5.1	Introduction to perspective projection, different planes, station point etc. Perspective problems on pyramids	2
5.2	Perspective problems on prisms	4
5.3	Intersection of surfaces: methods of determining lines of intersection - intersection of prism in prism and cylinder in cylinder.	4
	Total Hours	**54 Hours**

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 location and inclination of cutting plane given 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 combination of solids
3. Draw Orthographic views of solids from given three-dimensional view

Course Outcome 5 (CO 5):

1. Draw Perspective views of Solids
2. Draw Intersection of surfaces of two identical solids

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: B24ME1T01

Course Name: ENGINEERING GRAPHICS

Max. Marks: 100 Duration: 3 hours

Answer any one question from each module. Each question carries 20 marks

Instructions: Retain construction lines. Show necessary dimensions

Module I

1. The end point A of a line is 20mm above HP and 10mm in front of VP. The other end of the line is 50mm above HP and 15mm behind VP. The distance between the end projectors is 70mm. Draw the projections of the line. Find the true length and true inclinations of the line with the principal planes. Also locate the traces of the line.
2. One end of a line is 20mm from both the principal planes of projection. The other end of the line is 50mm above HP and 40mm in front of VP. The true length of the line is 70mm. Draw the projections of the line. Find its apparent inclinations, elevation length and plan length. Also locate its traces.

Module II

3. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30^0 to VP. Draw the projections of the solid.
4. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30^0 to HP and 45^0 to VP. Draw the projections of the solid.

Module III

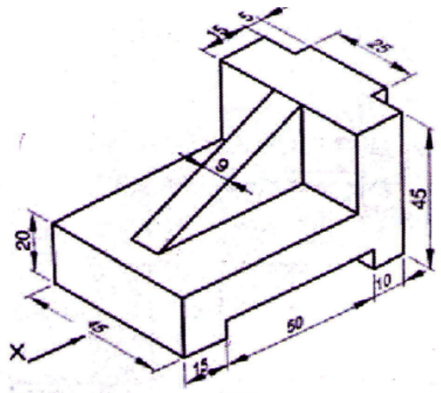
5. A triangular prism of base side 40mm and height 70mm is resting with its base on the ground and having an edge of the base perpendicular to VP. Section the solid such that the true shape of the section is a trapezium of parallel sides 30mm and 10mm. Draw the projections showing the true shape. Find the inclination of the cutting plane with the ground plane

6. Draw the development of a pentagonal pyramid of base side 30mm and height 50mm. A string is wound from a corner of the base round the pyramid and back to the same point through the shortest distance. Show the position of the string in the elevation and plan.

Module IV

7. The frustum of a cone has base diameter 50mm and top diameter 40mm has a height of 60mm. It is paced centrally on top of a rectangular slab of size 80x60mm and of thickness 20mm. Draw the isometric view of the combination.

8. Draw three orthographic views with dimensions of the object shown in figure below.



Module V

9. Draw the perspective view of a pentagonal prism, 20mm side and 45mm long lying on one of its rectangular faces on the ground and having its axis perpendicular to picture plane. One of its pentagonal faces touches the picture plane and the station point is 50mm in front of PP, 25mm above the ground plane and lies in a central plane, which is 70mm to the left of the center of the prism.

10. A square prism 50mm side and height 100 mm stands vertically with its base on HP with two of its adjacent rectangular faces inclined equally to VP. Another horizontal square prism of the same size penetrates the vertical prism such that the axes of the two prisms bisects each other at right angles. If the two adjacent faces of the horizontal prism are inclined equally to HP, draw the projections showing the lines of intersections.

B24ES1L04B	BASIC CIVIL AND MECHANICAL WORKSHOP	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

Preamble

The aim of this course is to help students to gain practical knowledge with a correlation to theoretical studies and encourage them to understand physical problems. Students will demonstrate an understanding of various disciplines of civil and mechanical engineering while acquiring hands-on training with various tools and processes. The course is designed to train students to identify and manage the tools, materials, and methods required to execute an engineering project.

Prerequisite

NIL

Course Outcomes

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

CO 1	Identify and select appropriate plumbing materials for different applications and Familiarize with a range of building materials, their properties, and applications in construction. (Cognitive Knowledge Level: Apply)
CO 2	Develop proficiency in using standard measuring tape and digital distance measuring devices to accurately calculate the area of built-up spaces and small parcels of land and compute the area and or volume of various features in a structure. (Cognitive Knowledge Level: Apply)
CO 3	Develop skills in drawing foundation plans, indicating wall thickness and foundation width, emphasizing the importance of accurate planning in construction. (Cognitive Knowledge Level: Analyse)
CO 4	Identify 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. (Cognitive Knowledge Level: Apply)
CO 5	Identify and use various tools in smithy & foundry and to practice forging, moulding, and casting. (Cognitive Knowledge Level: Apply)
CO 6	Identify and use various tools used in fitting and welding and perform operations such as chipping, filing, cutting, drilling, etc., and prepare multiple joints and welds. (Cognitive Knowledge Level: Analyse)

Mapping of Course Outcomes With Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2				2	1		3	1	1	2
CO 2	3	3	2		2	1			3	1	1	3
CO 3	3	3	2		2	1			3	1	1	3
CO 4	1	1	1						2	1	1	2
CO 5	1	1	1						2	1	1	2
CO 6	1	1	1						2	1	1	2

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 the Civil workshop and the 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 Civil and Mechanical workshops.

SYLLABUS

LIST OF EXPERIMENTS

PART 1

CIVIL WORKSHOP

Sl.No.	Topic
1	Plumbing: Introduction to plumbing and sanitary fittings.
2	Building Materials: Familiarization of various building materials- bricks, wood, steel and concrete with demonstration of its testing for fitness.
3	Calculate the area of a built-up space and a small parcel of land using standard measuring tape and digital distance measuring device.
4	Compute the area and/or volume of various building elements - door and window, quantity of bricks required to construct a wall of a building, quantity of steel bars used in windows (to create an awareness of measurements and units).
5	Prepare line sketch of a building showing the position of doors, windows and ventilators
6	Prepare the foundation plan (not to scale) of a small single storey building showing its cross section.

Reference Books

1. J. Paul Guyer," Plumbing Engineering Services Design Guide"
2. S. K. Duggal, "Building Materials", New Age International, 2019.
3. B. N. Dutta," Estimating and Costing in Civil Engineering", UBS Publishers, 2016.
4. Ralph B. Peck, Walter E. Hanson, Thomas H. Thornburn, "Foundation Engineering", John Wiley & Sons
5. Varghese P.C, "Design of Reinforced Concrete Foundations", PHI, 2009.
6. J.L. Meriam and L.G. Kraige, "Engineering Mechanics: Statics", John Wiley & Sons, 2017.
7. S. Timoshenko and D.H. Young, "Engineering Mechanics", McGraw Hill Education, 2017.

PART 2

MECHANICAL WORKSHOP

(Five models from exercises 1 to 8 are mandatory. Additionally, the study and demonstration of the remaining exercises are also required.)

Sl.No.	Topic
1	Carpentry: Study of Carpentry tools, Carpentry joints practices: T-Lap joint, Cross lap joint / Cross halving joint, Dove tail halving joint, Mortice & Tenon Joint
2	Sheetmetal: - Study of sheet metal tools, Forming and joint practices: Cylindrical shape, Conical shape, Rectangular Tray
3	Smithy: - Study of different tools & forged models in Smithy shop, Forging Practices: Square prism, Hexagonal headed bolt, octagonal prism
4	Foundry: - Study of Foundry tools, Molding practices: Bench molding, Floor molding, Core making, Casting
5	Fitting: - Study of Fitting tools in a workshop, Fitting shop joints practices: Square Joint, V-Joint, Male and Female fitting
6	Welding: - Study of Welding tools, equipment's and methods, Welding practices: Arc Welding, MIG Welding, Oxy-Acetylene Gas Welding
7	Conventional Machines: Study and demonstration of conventional machines like Shaping and Slotting machine, Lathe, Milling machine, Grinding machines & Radial drilling machine
8	Advanced Manufacturing Methods: Study and demonstration of CNC machines and 3D printing

Reference Books

1. Chapman, W. A. J, Workshop Technology - Parts 1 and 2, 4^{th} ed., New Delhi, India, CBS Publishers & Distributors Pvt. Ltd, 2007.
2. O'Bren, A. (Editor), Welding Handbook. 9^{th} ed., Miami, American Welding Society, 2001.
3. Anderson, J., Shop Theory, New Delhi, India, Tata McGraw Hill, 2002.
4. Douglass, J. H., Wood Working with Machines, Illinois, McKnight & McKnight Pub. Co., 1995.
5. Tuplin, W. A., Modern Engineering Workshop Practice, Odhams Press, 1996.
6. Jain, P. L., Principles of Foundry Technology, 5^{th} ed., New Delhi, India, Tata McGraw Hill, 2009.
7. S.K. Hajra Choudhury, Workshop Technology Vol II, Media Promoters & Publishers, 2010.

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.
	SET2
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

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: Analyze)
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 hour
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 de-sign thinking methodology. (Cognitive Knowledge Level: Understand)
CO 2	Utilize diverse techniques effectively to generate creative concepts, adopting in-novation 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 a nd exercise:

Meaning and importance of physical fitness and w ellness. 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 a id.First a id m easure f or t he f ollowing: B leeding 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 MECHANICAL 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

1. J. Stewart, "Essential Calculus", Cengage,2^{nd} edition, 2017.
2. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9^{th} Edition, Pearson, Reprint,2002.
3. Peter O Neil, "Advanced Engineering Mathematics", 7^{th} Edition, Thomson, 2007.
4. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6^{th} edition, 2003.
5. Veerarajan T,"Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
6. B.S. Grewal,"Higher Engineering Mathematics", Khanna Publishers, 43 Edition, 2015.
7. 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

1. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6th Edition 2003
2. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015
3. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016
4. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015
5. 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

B24CY1T01A	ENGINEERING CHEMISTRY (A)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble:

This basic science course will assist the students to acquire understanding in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like electrochemistry, nanomaterials, energy production, energy storage, OLED etc. Moreover, the students will be able to know analytical methods like various spectroscopic techniques, SEM etc. This will empower them to develop abilities and skills that are relevant to 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	Learn about the basics of energy harvesting methods and its application. Apply the knowledge of battery, hydrogen generation and fuel cells in engineering. (Cognitive Knowledge Level: Apply)
CO 5	Apply the knowledge of conducting polymers and advanced materials 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	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	3	2	3	2	3	3	3	1	1			2
CO 5	2	1	3	1	3	1	2	1				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)

Energy Storage and Harvesting Technologies

Cells and batteries – Primary and secondary cells – Na-ion battery and Li-ion battery - Construction, working, advantages and applications – Hydrogen generation – Electrolysis of water - Fuel cells – Introduction - Construction and advantages of H_2-O_2 fuel cell, Phosphoric acid fuel cell and Polymer Electrolyte Membrane Fuel Cell (PEMFC) - Supercapacitors - Classification - Construction and applications in hybrid vehicles.

MODULE 5 (7 hours)

Advanced Materials and Devices for Engineering Applications

Conducting polymers – Introduction - Classification - Intrinsically and extrinsically conducting polymers - Conduction mechanism – Band theory - Polyaniline and polypyrrole - Synthesis, properties and applications – Molecular devices based on conducting polymers – Diodes, Field Effect Transistor and Actuators - Introduction and applications - OLED

– Construction, working and advantages - Smart materials - Thermo and light responsive materials - Introduction and examples - Sensors – Physical, chemical and biosensors – Introduction 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

1. T. Pradeep, "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw-Hill, 2008.
2. B. Rogers, J. Adams, S. Pennathur, "Nanotechnology: Understanding Small Systems" , CRC Press, 2014.
3. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
4. J. Goldstein, "Scanning Electron Microscopy and Microanalysis", Springer, 2012.
5. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7^{th} Edition, 2005.
6. Samuel Glasstone, "An Introduction to Electrochemistry", East-West Press Pvt. Ltd., 2006.
7. Pietro Pedeferri, "Corrosion Science and Engineering", Springer Link, 2018.
8. B. Sunden, "Hydrogen, Batteries and Fuel Cells", Elsevier Inc., 2019.
9. B. Sorensen and G. Spazzafumo, "Hydrogen and Fuel Cells - Emerging Technologies and Applications", Elsevier Ltd., 2018.
10. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction",Marcel Dekker Inc; 4^{th} Revised Edition,1996.

11. J. Janata, "Principles of Chemical Sensors" Springer, New York, NY, 2009.

12. F-G. Banica, "Chemical Sensors and Biosensors: Fundamentals and Applications", John Wiley and Sons, 2012.

13. M. Schwartz, "Smart Materials", CRC Press, 2008.

14. Y. Zhao, T. Ikeda, "Smart Light-Responsive Materials", Wiley, 2009.

15. V. Khutoryanskiy, T. Georgiou, "Temperature-Responsive Polymers: Chemistry, Properties and Applications", Wiley, 2018.

16. P. W. Atkins, "Physical Chemistry", Oxford University Press, 10^{th} edn., 2014.

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 (Energy Storage and Harvesting Technologies)	7
4.1	Cells and batteries – Primary and secondary cells – Na-ion battery and Li-ion battery - Construction, working, advantages and applications.	2
4.2	Hydrogen generation – Electrolysis of water - Fuel cells – Introduction - Construction and advantages of H_2-O_2 fuel cell, Phosphoric acid fuel cell and Polymer Electrolyte Membrane Fuel Cell (PEMFC).	3
4.3	Supercapacitors - Classification - Construction and applications in hybrid vehicles.	2
	Module 5 (Advanced Materials and Devices for Engineering Applications)	7
5.1	Conducting polymers – Introduction - Classification - Intrinsically and extrinsically conducting polymers - Conduction mechanism – Band theory - Polyaniline and polypyrrole - Synthesis, properties and applications.	3
5.2	Molecular devices based on conducting polymers – Diodes, Field Effect Transistors, and Actuators - Introduction and applications - OLED – Construction, working and advantages.	2
5.3	Smart materials - Thermo and light responsive materials - Introduction and examples - Sensors – Physical, chemical and biosensors – Introduction and applications.	2

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. What are carbon nanotubes? Give two applications.

2. Comment on the structure of graphene.
3. How nanomaterials are classified based on structural composition?

Course Outcome 2 (CO 2):

1. State Beer-Lambert's law.
2. Calculate and sketch the vibrational modes of CO_2.
3. What are the limitations of SEM?

Course Outcome 3 (CO 3):

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

Course Outcome 4 (CO 4):

1. Compare Na-ion and Li-ion batteries.
2. List the applications of PEM fuel cell.
3. Discuss the classification of supercapacitors.

Course Outcome 5 (CO 5):

1. Explain the preparation and properties of polypyrrole.
2. Discuss the working of OLED.
3. Compare physical and chemical sensors.

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: B24CY1T01A

Course Name: ENGINEERING CHEMISTRY (A)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Discuss the properties and applications of quantum dots.
2. How carbon nanotubes are classified based on structure?
3. State Beer-Lambert's law.
4. List the important applications of IR spectroscopy.
5. Explain how galvanic series can be used in corrosion control?
6. What is calomel electrode? Give the reduction reaction.
7. How does a PEM fuel cell differ from the other types of fuel cells?
8. Distinguish between primary and secondary cells with examples.
9. Give example and explain the importance of light responsive smart materials.
10. What are biosensors? Give their applications.

PART B

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

11. (a) Explain two methods of chemical synthesis for nanomaterials. 8

(b) Discuss the classification of nanomaterials based on dimension. 6

OR

12. (a) What are nanoscale materials? Give the properties and applications of quantum dots and graphene. 9

(b) Explain the sputtering method for the synthesis of nanomaterials. 5

13. (a) Explain the principle, instrumentation and working of SEM. 8

(b) Calculate the force constant of HCl molecule, if it shows IR absorption at 2138 cm^{-1}. Given that atomic masses of hydrogen and chlorine are 1 u and 35 u respectively. 6

OR

14. (a) Illustrate the vibrational modes of CO_2 and H_2O. Justify its IR activity. 9

(b) Explain the various energy levels associated with a molecule. 5

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

(b) Write the cell reactions and calculate the emf of the cell Cu/Cu^{2+} (1M) // Ag^{+} (0.01M) // Ag at 30^{o}C. Given E^{0} $Cu^{2+}/Cu = 0.34$ V and E^{0} $Ag^{+}/Ag = 0.8V$. 6

OR

16. (a) What is cathodic protection? Explain two methods. 9

(b) Write the Nernst equation for Daniel cell and explain the effect of temperature on emf. 5

17. (a) Discuss the construction, working and advantages of Li-ion battery. 9

(b) What is electrolysis of water? 5

OR

18. (a) With a neat diagram explain the construction and working of Hydrogen-Oxygen fuel cell. 8

(b) Explain the classification of supercapacitors. 6

19. (a) Discuss the construction and working of OLED with a diagram. 9

(b) Explain the synthesis, properties and applications of polyaniline. 5

OR

20. (a) Elaborate the classification and applications of conducting polymers. 8

(b) What are smart materials? Give examples for heat responsive materials. 6

B24ES1T08	FUNDAMENTALS OF ELECTRONICS ENGINEERING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

This course is designed to give an overview of the evolution of electronics and to explain the working principles and examples of essential electronic devices and circuits. It also aims to introduce students to the basics of signal processing and provide an introduction to digital electronics.

Prerequisites

Nil

Course Outcomes

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

CO 1	Identify the active and passive electronic components and their specifications. (Cognitive Knowledge Level-Remember).
CO 2	Understand the working principle of semiconductor devices and Analyze different types of rectifier circuits (Cognitive Knowledge Level-Apply).
CO 3	Comprehend the structure and operation of bipolar junction transistors and Explain the working principle of amplifiers (Cognitive Knowledge Level-Understand).
CO 4	Identify and describe the basic functions and types of operational amplifiers filters, and signal converters (Cognitive Knowledge Level-Apply).
CO 5	Demonstrate proficiency in electronic instrumentation and digital electronics (Cognitive Knowledge Level-Understand).

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	1	1	1								1
CO 2	3	2	2	2								1
CO 3	3	2	2	2								1
CO 4	3	2	2	2								1
CO 5	3	2	2	2								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 (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 the student should answer anyone. Each question can have a maximum of 2 sub-divisions and carry 14 marks.

SYLLABUS

MODULE 1 (7 hours)

Introduction to Electronics Components :
Passive components: Resistors - Types of resistors - Fixed Resistors - Variable resistors, resistor tolerance, colour coding, power rating of resistors.
Capacitors: Types of capacitors: Fixed capacitors, Mica, Paper, Ceramic and Electrolytic capacitors, Variable capacitors, voltage rating of capacitors.
Inductors: Fixed and Variable inductors. Transformers, and Electro-mechanical components.

MODULE 2 (8 hours)

Introduction to Semiconductor devices and circuits:
Working of PN Junction diode: Structure and Principle of Operation, V-I Characteristics, Diode Current Equation
Rectifiers: Half wave, full wave, Bridge circuits,
DC Power supply: Block diagram, Capacitor filter, simple Zener regulator.

MODULE 3 (8 hours)

Basics of Semiconductor Devices and Circuits :
Bipolar junction Transistor: NPN, PNP Structure, Principle of operation of NPN transistor
Transistor circuits: Common Emitter Configuration Characteristics
Basic principle of N channel FET and Enhancement MOSFET
Amplifiers, common emitter RC coupled amplifier, Frequency response, Bandwidth.

Analogue Integrated Circuits: Operational amplifier, inverting and non-inverting amplifier (No Analysis required)

MODULE 4 (7hours)

Basics of Signal Processing :
Operational amplifier, inverting and non-inverting amplifier -Open loop and closed loop response (no analysis required)

Filters- Active and passive filters-RC passive filter -Low pass-high Pass-First order active filter- Low pass-high pass (no analysis required)
Concept of ADC- flash type-DAC-Weighted network

MODULE 5 (6 hours)

Basic instrumentation and Digital electronics:
Electronic instrumentation: Transducers: Basic principles of Strain gauge, LVDT, Thermistor, Photodiode, microphones, Loud speaker.
Measurements: Multimeter and X-Y recorder.
Digital electronics: number systems - binary, octal and hexadecimal - conversion - representation of negative numbers using 1's compliment and 2's compliment method. Logic gates – truth table.

Text Books

1. Bell, D. A., Electronic Devices and Circuits, Oxford University Press
2. Chimney Saha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.
3. S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.
4. Wayne Tomasi and Neil Storey, A Textbook on Basic Communication and Information Engineering, Pearson, 2010
5. Ramakant A. Gayakwad ,Op-Amps and Linear Integrated Circuits, Pearson Education ,Fourth Edition

Reference Books

1. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education, 2015.
2. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.
3. Bernard Grob, Basic Electronics, McGraw Hil
4. A. Bruce Carlson, Paul B. Crilly, Communication Systems: An Introduction to Signals and Noise in Electrical Communication, Tata McGraw Hill, 5th Edition.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Module 1: Introduction to Electronics Components	**7**
1.1	Passive components: Resistors - Types of resistors - Fixed Resistors - Variable resistors, resistor tolerance, color coding, power rating of resistors	3
1.2	Capacitors: Types of capacitors: Fixed capacitors, Mica, Paper, Ceramic and Electrolytic capacitors, Variable capacitors, voltage rating of capacitors.	2
1.3	Inductors: Fixed and Variable inductors. Transformers, and Electro-mechanical components	2
	Module 2:Introduction to Semiconductor devices and circuits	**8**
2.1	Working of PN Junction diode: Structure and Principle of Operation	2
2.2	V-I Characteristics, Diode Current equation	1
2.3	Rectifiers: Half wave, full wave, Bridge circuits,	3
2.4	DC Power supply: Block diagram, Capacitor filter, simple Zener regulator,	2
	Module 3: Basics of Semiconductor Devices and Circuits	**8**
3.1	Bipolar junction Transistor: NPN , PNP Structure, Principle of operation of NPN transistor	2
3.2	Transistor circuits: Common Emitter Configuration Characteristics	1
3.3	Basic principle of N channel FET and Enhancement MOSFET	1
3.4	Amplifiers, common emitter RC coupled amplifier, Frequency response, Bandwidth.	2
3.5	Analogue Integrated Circuits: Operational amplifier, inverting and non-inverting amplifier (No Analysis required)	2
	Module 4: Basics of Analog Circuits and Signal Processing	**7**
4.1	Operational amplifier, inverting and non-inverting amplifier (No Analysis required)-Open loop and closed loop response (no analysis required)	3
4.2	Filters- Active and passive filters-RC passive filter -Low pass-high Pass-First order active filter- Low pass-high pass (no analysis required)	3
4.3	Concept of ADC- flash type-DAC-Weighted network	1
	Module 5: Basic instrumentation and Digital electronics	**6**
5.1	Electronic instrumentation: Transducers: Basic principles of Strain guage, LVDT, Thermistor, Photodiode, microphones, Loud speaker.	2

5.2	Measurements: Multimeter and X-Y recorder.	1
5.3	Digital electronics: number systems - binary, octal and hexadecimal - conversion – representation of negative numbers using 1's compliment and 2's compliment method. Logic gates – truth table.	3
	Total Hours	**36 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Explain the significance of color coding in identifying the values of resistors.
2. What are the different types of capacitors and Give any two applications of capacitors?
3. Find the capacitance values for the following codes 1) 2n2 2) 104K

Course Outcome 2 (CO 2):

1. Describe the structure of a PN junction diode and its principle of operation
2. What is a regulated power supply? With neat block diagram Summarize the working of DC power supply
3. Narrate the working of capacitor filter.

Course Outcome 3 (CO 3):

1. Compare and contrast the structures of NPN and PNP bipolar junction transistors.
2. What is the need of voltage divider biasing in an RC coupled amplifier?
3. Analyze the importance of selection of operating point in the context of a BJT amplifier.

Course Outcome 4 (CO 4):

1. Describe the key differences between an inverting amplifier and a non-inverting amplifier using operational amplifiers.
2. Compare and contrast active and passive filters, providing examples of each.
3. Discuss the principle of operation of a Digital-to-Analog Converter (DAC) using a weighted network.

Course Outcome 5 (CO 5):

1. Convert 255.5210 to binary and hexadecimal.
2. Implement an AND gate using NOR gate
3. Define logic gates and explain their fundamental role in digital electronics

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: B24ES1T08

Course Name: FUNDAMENTALS OF ELECTRONICS ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Identify the color code for the given resistor values
   (a) 1Ω + 5
   (b) 3.3kΩ + 1
   (c) 1 M Ω+ 5
2. Identify the capacitor value with unit.
   (a) 333
   (b) Brown, Black, Red, Brown, Brown
   (c) 103
3. The reverse saturation current of Germanium diode at room temperature is 0.4 micro ampere. Determine the current flowing through the diode when 0.2V is applied at room temperature.
4. Draw the circuit diagram of a full wave bridge rectifier
5. How to calculate the bandwidth of an RC coupled Amplifier?
6. Illustrate the structure of Enhancement MOSFET.
7. Draw the circuit of an inverting amplifier for a gain of 10.
8. Explain the working of an RC high pass filter.

9. Which gates are called universal gates and why?

10. Explain the principle of operation of photo diode

PART B

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

11. Explain the specifications of resistors, capacitors and Inductors

OR

12. With a neat diagram explain the working of electromechanical relay.

13. Explain Half wave rectifier with capacitor filter and draw the output waveforms with high value capacitor and low value capacitors

OR

14. Explain the working of Zener voltage regulator with the help of a neat circuit diagram? What is load regulation and line regulation

15. (a) Discuss in detail the working of a NPN transistor (7)
    (b) Explain the output characteristics of a common emitter configuration (7)

OR

16. Draw the circuit diagram of a typical RC Coupled amplifier with voltage divider bias. Explain the functions of each component.

17. What is the purpose of an Analog-to-Digital Converter (ADC)? Describe and illustrate how a Flash type ADC works.

OR

18. Explain a Digital-to-Analog Converter (DAC). How a DAC using a weighted network operates?

19. Explain the basic principle of LVDT with neat diagram. Give any one application of LVDT.

OR

20. Describe the working of

    (a) Multimeter (7)
    (b) X-Y Recorder (7)

B24ME1T02	STATICS AND DYNAMICS FOR ENGINEERS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		3	1	0	3	4	2024

Preamble

This course aims to impart the students with a solid comprehension of the fundamental concepts of mechanics. By bridging theory and application, students learn to tackle real-world challenges using reasoned assumptions. Emphasizing problem-solving, the course cultivates and sharpens students' analytical skills. Through theoretical instruction and practical exercises, students gain the ability to analyze and solve engineering problems effectively. Ultimately, the course aims to empower students with the knowledge and skills essential for addressing complex engineering dynamics and statics scenarios with confidence and proficiency.

Prerequisites

NIL

Course Outcomes

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

CO 1	Understand the rigid body mechanics theorems and principles. (Cognitive Knowledge Level: Apply)
CO 2	To apply the conditions of equilibrium to various practical problems involving different force systems. (Cognitive Knowledge Level: Apply)
CO 3	Determine the centroid and moment of inertia of various surfaces and solids. (Cognitive Knowledge Level: Apply)
CO 4	To apply principles of kinematics to bodies in motion. (Cognitive Knowledge Level: Apply)
CO 5	To solve problems involving rigid bodies, applying the properties of distributed areas and Masses. (Cognitive Knowledge Level: Apply)

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

Bloom's Category	Continuous Assessment		End Semester Examination (% Marks)
	Test 1 (%Marks)	Test 2 (%Marks)	
Remember	10	10	20
Understand	30	30	40
Apply	60	60	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 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 (8 hours)

Laws of mechanics- System of forces, System of concurrent forces, Resultant of a force system, Free body diagrams , Principle of transmissibility, Conditions of equilibrium - System of non-concurrent forces, Moment of a force, Varignon's Theorem, Couple, Resultant of non-concurrent forces- Equilibrium of system of forces, Conditions of equilibrium.

MODULE 2 (10 hours)

Analysis of Trusses, Method of joints, Method of sections, Support reactions of beams- Friction, Coulomb's law, Coefficient of friction, Angle of friction, Impending motion of connected bodies- Applications of friction, Screw friction, Belt friction.

MODULE 3 (8 hours)

Centre of Gravity and Centroid- Centroid, Centre of mass, Centre of Gravity, Relationship Between Centre of Gravity, Centre of Mass and Centroid- Moment of inertia, Second moment of area, Radius of gyration- Mass moment of inertia, Parallel axis theorem

MODULE 4 (9 hours)

Kinematics of Rectilinear motion, Displacement, velocity and acceleration, rectilinear motion- Kinematics of Curvilinear motion, Tangential and Normal Components of Acceleration, Radial and Transverse Components of Acceleration.

MODULE 5 (10 hours)

Kinetics of particles, Motion of Bodies in Rectangular Coordinates, Motion of Connected Bodies, D'Alembert's Principle. Planar Kinematics and Kinetics of rigid bodies-Rotation,

Absolute motion, Relative motion, Instantaneous Center of Zero Velocity, Relative Acceleration, Motion relative to rotating axes, Work-energy relations, Impulse and momentum, Impulse-momentum principle. Basics of three-dimensional dynamics of rigid bodies (only theory)

Text Books

1. J.L. Meriam, "Engineering Mechanics: Volume 1: Statics, Volume 2: Dynamics", Wiley.

Reference Books

1. Irving H Shames, "Engineering mechanics: Statics and Dynamics", Pearson Education.
2. Michael E. Plesha, Gary L. Gray, et al, "Engineering mechanics: Statics and Dynamic", McGraw Hill Education.
3. S Timoshenko, D H Young, et al, "Engineering mechanics", McGraw Hill Education.
4. Russell Hibbeler, "Engineering mechanics: Statics and Dynamics", Pearson Education.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Module 1:	**8**
1.1	Laws of mechanics-system of forces.	1
1.2	System of concurrent forces: Resultant of a force system, Free body diagrams, Conditions of equilibrium, Principle of transmissibility.	2
1.3	System of non-concurrent forces: Moment of a force.	2
1.4	Varignon's Theorem, Couple.	1
1.5	Resultant of non-concurrent forces, Equilibrium conditions of system of forces.	2
	Module 2:	**10**
2.1	Analysis of Trusses: Method of joints	2
2.2	Method of sections	2
2.3	Support reactions of beams	2
2.4	Friction: Coulomb's law, Coefficient of friction,	1
2.5	Angle of friction, Impending motion of connected bodies.	1
2.6	Applications of friction: Screw friction, Belt friction.	2
	Module 3:	**8**
3.1	Centre of Gravity and Centroid: Centroid, Centre of mass, Centre of Gravity.	2
3.2	Relationship Between Centre of Gravity, Centre of Mass and Centroid.	1
3.3	Moment of inertia: Second moment of area.	2

3.4	Radius of gyration.	1
3.5	Mass moment of inertia, Parallel axis theorem	2
	Module 4	**9**
4.1	Kinematics of Rectilinear motion: Displacement, velocity and acceleration	1
4.2	Rectilinear motion Problems	2
4.3	Kinematics of Curvilinear motion: Tangential and Normal Components of Acceleration	2
4.4	Radial and Transverse Components of Acceleration.	2
4.5	Curvilinear motion problems	2
	Module 5:	**10**
5.1	Kinetics of particles: Motion of Bodies in Rectangular Co-ordinates.	2
5.2	Motion of Connected Bodies, D'Alembert's Principle.	2
5.3	Planar Kinematics and Kinetics of rigid bodies-Rotation, Absolute motion, Relative motion.	1
5.4	Instantaneous Center of Zero Velocity, Relative Acceleration, Motion relative to rotating axes.	2
5.5	Work-energy relations, Impulse and momentum, Impulse-momentum principle.	2
5.6	Basics of three dimensional dynamics of rigid bodies (only theory).	1
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. State and explain Lami's theorem

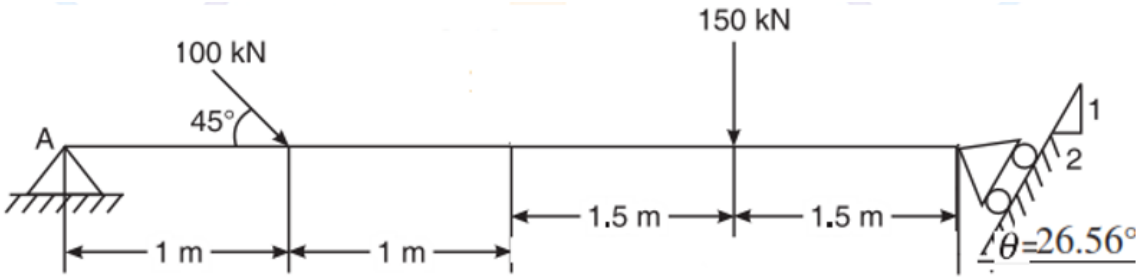
2. What are the conditions of equilibrium in concurrent and non-concurrent force system?

3. State and explain Varignon's theorem for concurrent coplanar forces.

Course Outcome 2 (CO 2):

1. A small block of weight 1000 N as shown in Figure, is placed on a 30° inclined plane with $= 0.25$. Determine the horizontal force to be applied for impending motion down the plane.

2. For the beam with loading shown in Fig, determine the reactions at the supports.

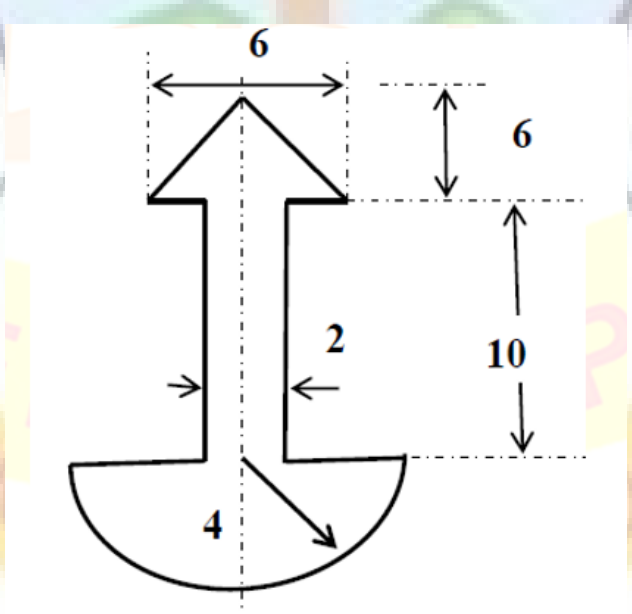


3. A simply supported beam AB of span 4m is carrying point loads 10N, 6N & 4N at 1m, 2m & 3m respectively from support A. Calculate reactions at supports A and B.

Course Outcome 3 (CO 3):

1. Calculate the area moment of inertia of a rectangular cross-section of breadth 'b' and depth 'd' about the centroidal horizontal axis

2. Find the moment of inertia of shaded area about the horizontal and vertical centroidal axis. All dimensions in cm.



3. Write the formula for moment of inertia of a semi-circle about the centroidal axis parallel to the base and hence derive the formula for MI about an axis through its base.

Course Outcome 4 (CO 4):

1. The position of a particle moving along a straight line is defined by the relation . Determine the time taken by the particle when its velocity becomes zero.

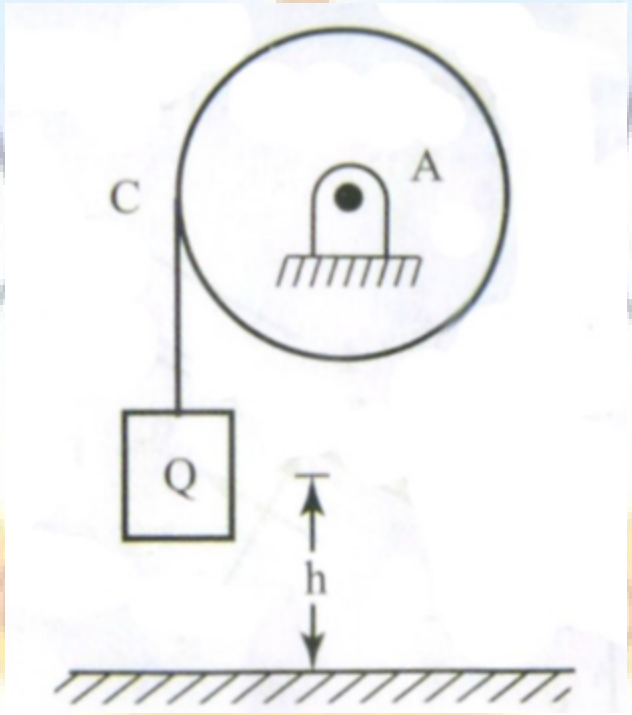
2. A block of mass M1 resting on an inclined plane is connected by a string and pulleys to another block of mass M2 as shown in Fig. Find the tension in the string and acceleration of the blocks. Assume the coefficient of friction between the blocks M1 and the plane to be 0.2. M1 =1500N, M2 = 1000N. Angle of inclined plane = 45^o.

3. A 50 kg mass has a velocity of 10m/s horizontally on a smooth surface. Determine the magnitude of horizontal force required to bring the mass to rest in 5 seconds.

Course Outcome 5 (CO 5):

1. A flywheel weighing 500N and having radius of gyration 0.4 m loses it speed from 300rpm to 180 rpm in 1 minute. Calculate the torque acting on it.

2. A circular disc of radius r=30cm and weight W=145N is free to rotate about its geometric axis. A flexible cord carrying a weight of Q= 45N, is wound around the circumference of the disc as shown in Fig. If the weight Q is released from rest, find (a) the time t required for it to fall through the height h=300cm (b) with what velocity v will it strike the floor?



3. Explain instantaneous centre of zero velocity

MODEL QUESTION PAPER

QP CODE: **Pages: 4**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24ME1T02

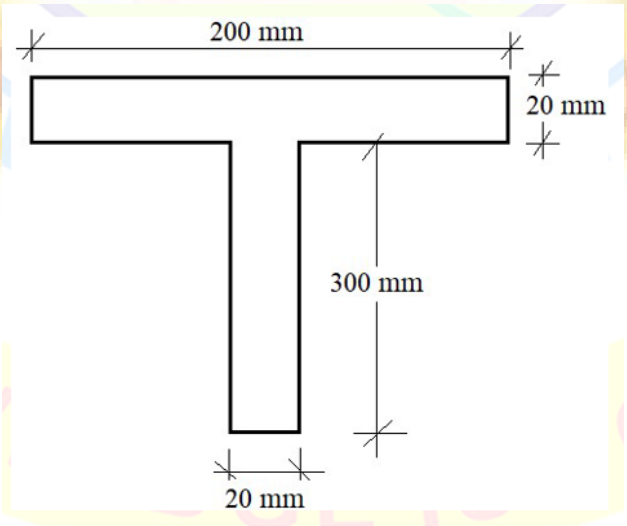
Course Name: STATICS AND DYNAMICS FOR ENGINEERS

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Define a couple and explain its characteristics.
2. The resultant of two forces, one of which is double the other, is 490 N. If the direction of the larger force is reversed and the other remains unaltered, the resultant reduces to 100N. Determine the magnitude of the forces and the angle between them.
3. A simply supported beam AB of span 5 m is carrying point loads 5 kN, 3 kN and 2 kN at 1m, 3m and 4m respectively from support A. Calculate the support reaction at B.
4. Distinguish static friction from dynamic friction
5. State and explain parallel axis theorem.
6. Find the centroid of the T section shown



7. The angular acceleration of a particle $= 5t$ rad/s^2. Determine expression for angular velocity w at any instant 't' of the motion, if the particle starts from rest.

8. State D'Alembert's principle

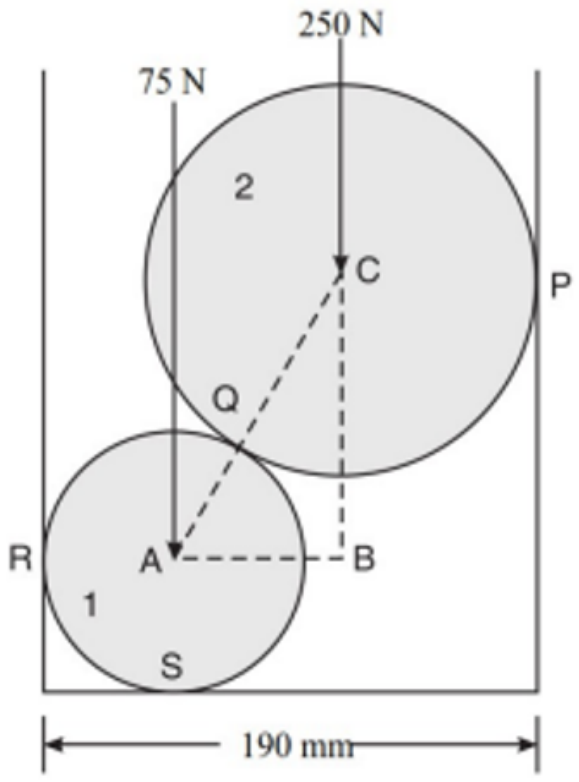
9. While you are riding your bike, you turn a corner following a circular arc. Illustrate the forces that act on your bike to keep you along the circular path

10. Illustrate the significance of instantaneous centre in the analysis of rigid body undergoing rotational motion.

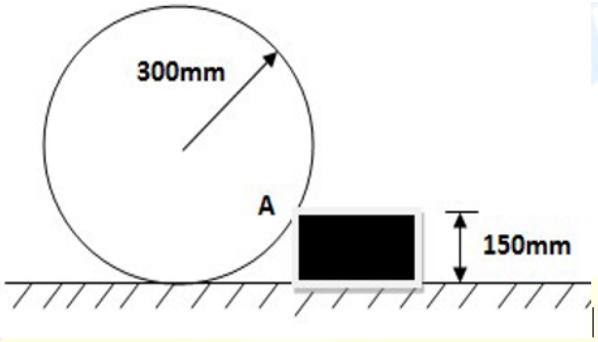
PART B

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

11. Determine the reactions at contact points P, Q, R, and S for the system shown in Figure. The radii of spheres 1 and 2 are, respectively, 40 mm and 60 mm (14 marks)

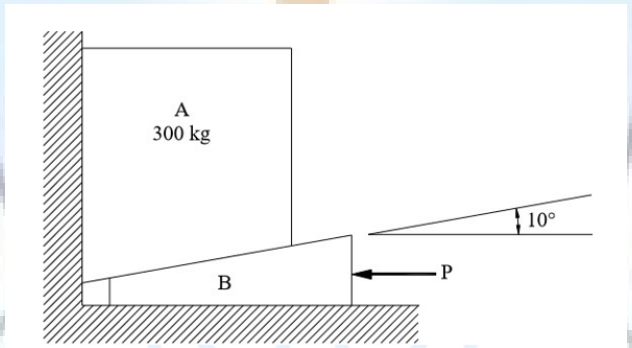


12. A roller of radius 300 mm and weight 1000N is to be pulled over a rectangular block of height 150mm as shown in fig. Determine (i) the horizontal force required to be applied through the centre and (ii) the required horizontal force when it is applied through the top end of vertical diameter. (14 marks)



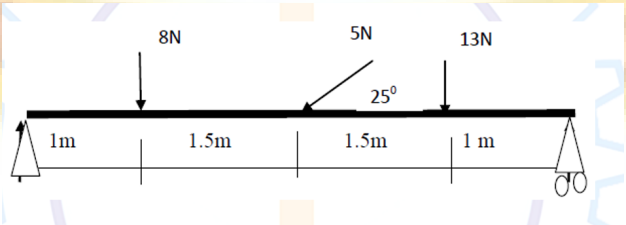
Module 2

13. If the coefficient of static friction equals 0.3 for all surfaces of contact, determine the smallest value of force P necessary to raise the block A of mass 300kg. Neglect the weight of the wedge B. Angle of wedge is 10°. (14 marks)



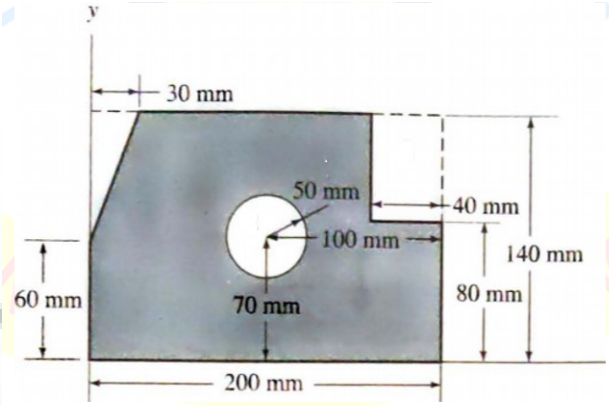
14. (a) What do you understand by the reactions at supports? (4 marks)

    (b) Find the reactions at the supports of the beam given. A is a hinged support and B is a roller support. (10 marks)

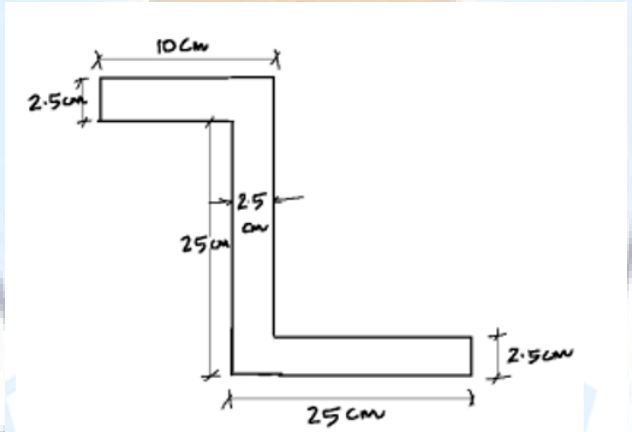


Module – 3

15. Find the centroid of the shaded area shown. (14 marks)

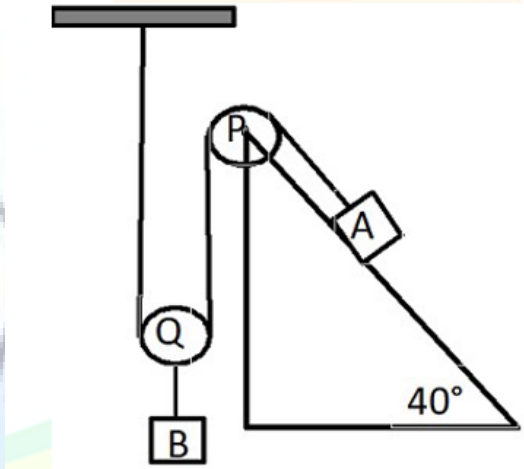


16. Find the centroid of the cross-sectional area of a Z section shown in figure. (14)



Module – 4

17. Determine the tension in the inextensible string and the acceleration of the masses. Consider the pulley as massless and coefficient of friction as 0.20. Block A=200 kg and block B=100kg (14 marks)



18. Two cars A and B travelling in same direction get stopped at a traffic signal. When signal turns green, car A accelerates at 0.75 m/s^2 and 1.75 seconds later, car B starts and accelerates at 1.1 m/s^2. Determine i) when and where B will overtake A and ii) the speed of each car at that time. (14 marks)

Module 5

19. (a) A flywheel rotates with a constant retardation due to breaking, in the first 10 seconds, it made 300 revolutions. At t = 7.5 sec, its angular velocity was 40 rad/s. Determine
    i. The value of constant retardation
    ii. The total time taken to come to rest and
    iii. The total revolutions made till it comes to rest (7marks)

    (b) Two blocks of masses 10 kg and 25 kg are attached to the two ends of a flexible rope. The rope passes over a pulley of diameter 500mm. The mass of the pulley is 7.5 kg and its radius of gyration is 200 mm. Find the acceleration of the masses and the tension on either side of the rope. (7marks)

20. A flywheel is made of steel ring 30mm thick 300 mm wide plate with mean diameter of 1.5m. If initially the flywheel is rotating at 250 rpm, find the time taken by the wheel in coming to rest due to frictional couple of 150 Nm. Take mass density of steel as 7900 kg/m^3. Neglect the effect of spokes. (14 marks)

B24ES1L05	ELECTRICAL AND ELECTRONICS WORKSHOP	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

Preamble

This course is designed to equip students with the foundational knowledge and practical skills necessary to navigate the intricate world of electrical and electronics engineering. It aims to impart the fundamentals of electrical wiring, safety measures, and troubleshooting to students, and exposes them to the concepts of DC and AC electrical machines, allowing them to analyze their performances. The course also provides a basic introduction to electronic hardware systems and offers hands-on training in familiarization, identification, testing, assembling, dismantling, fabrication, and repairing such systems using various tools and instruments available in the electronics workshop.

Prerequisite

Nil

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. (Cognitive Knowledge Level: Apply)
CO 2	Understand the distribution system and safety measures against electrical shocks and select the fuse unit for a given electrical circuit. (Cognitive Knowledge Level – Understand)
CO 3	Analyze the performance of AC and DC machines. (Cognitive Knowledge Level – Analyze)
CO 4	Demonstrate proficiency in identifying various electronic components, including active, passive, electrical, electronic, and electromechanical components. (Cognitive Knowledge Level-Understand)
CO 5	Develop and illustrate electronic circuit diagrams using recognized standards such as BIS/IEEE symbols and utilize Electronic Design Automation (EDA) tools for schematic capture and simulation. (Cognitive Knowledge Level-Apply)
CO 6	Design and fabricate electronic circuits on boards, trouble shooting of minor problems in electronic equipment and handling of test and measuring equipment. (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	3	1		3	1	1	3	3	3	3
CO 2	3	2	3	1		3	1	1	3	3	2	3
CO 3	3	3	3	2		3	1	1	3	3	2	3
CO 4	3	1	1	1					1	1		2
CO 5	3	2	2	1	2				2	1		2
CO 6	3	2	2	1	2				2	1		1

Mark Distribution

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

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 the Electrical workshop and the Electronics 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 Electronics workshops.

SYLLABUS

LIST OF EXPERIMENTS
PART I

ELECTRICAL

1	(a) Familiarization with electrical symbols, measuring instruments, lighting and wiring accessories, tools, and various wiring systems. (b) To familiarize earthing in electrical installations, precautions against electric shock phenomenon and safety procedures.
2	Realization of domestic wiring (a) Wiring of one lamp controlled by two switches (Staircase wiring). (b) Wiring of three lamps controlled by three switches (Godown wiring).
3	(a) Study of fuse, MCB, ELCB, RCCB and selection of fuse rating for circuits with medium and high power. (b) Wiring of the distribution board, including the power plug, an isolator, MCB, and ELCB for 1000 W power.
4	Load test on DC shunt motor and to plot the performance characteristics.
5	(a) Load test on single-phase induction motor and to plot performance characteristics. (b) Load test on single-phase transformer and to plot performance characteristics.
6	Load test on a three-phase squirrel cage induction motor and to plot performance characteristics.
7	Regulation of a three-phase alternator by direct loading at full load upf.

Reference Books

1. D P Kothari & I J Nagrath, Basic Electrical Engineering, 4^{th} Edition, McGraw-Hill 2019.
2. EW. Golding, Electrical Measurements and Measuring Instruments, 5^{th} ed. Reem Publications, 2011.

3. Suresh Kumar K.S, Electrical Circuit and Networks, Pearson Education, New Delhi, 2009.

4. D P Kothari and I J Nagrath, Electric machines, 5^{th} edition ,2017.

5. V K Mehta, Basic Electrical Engineering, Revised edition, S. Chand & Company, New Delhi, 2012

6. J B Gupta, A course in electrical installation estimating and costing, 9^{th} edition, 2012

7. H Cotton, Advanced Electrical Technology, Reem Publications, 2011.

8. Bimbra P. S., Electrical Machinery, 7/e, Khanna Publishers, 2011.

PART II
ELECTRONICS

1	Familiarization/Identification of electronic components with specification (Functionality, type, size, colour coding, package, symbol, cost etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Relays, Crystals, Displays, Heat sink etc.) .
2	Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools (such as Dia ,XCircuit, LT SPICE).
3	Familiarization/Application of testing instruments and commonly used tools. [Multimeter, Function generator, Power supply, DSO etc.] [Soldering iron, Desoldering pump, Pliers, Cutters, Wire strippers, Screw drivers, Tweezers etc.
4	Testing of electronic components [Resistor, Capacitor, Diode, Transistor and JFET using multimeter.
5	Inter-connection methods using Bread board and soldering practice. [Soldering - types - selection of materials and safety precautions, soldering practice in connectors and general purpose PCB] .
6	Design and fabrication of a single sided PCB for a simple circuit with manual etching (Ferric chloride) and drilling.

7	Assembling of electronic circuit/system on general purpose PCB or breadboard, test and show the functioning (Any Two circuits). (a) Fixed voltage power supply with transformer, rectifier diode, capacitor filter, Zener/IC regulator. (b) Astable Multivibrator using Transistor (c) Sine wave generation using IC 741 OP-AMP in IC base. (d) RC coupled amplifier with transistor BC107. .

Reference Books

1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, 2015.
2. Charles K. Alexander, Matthew N.O. Sadiku, Fundamentals of Electric Circuits, Mc-Graw Hill Education Limited, 2022
3. M.W. Schwartz, The Soldering Handbook
4. Thomas L. Floyd, Electronic Devices Conventional current version, Pearson Education, 2015.

B24ME1L01	COMPUTER AIDED MACHINE DRAWING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	3	2024

Preamble

The course in Computer-Aided Machine Drawing aims to familiarize students with industrial drafting practices and instill a comprehensive understanding of production drawings, preparing them for the demands of industry. Additionally, the course introduces Computer-Aided Drafting techniques and 2D Modeling to enhance students' proficiency in modern design methodologies. Through practical application and theoretical instruction, students will develop the skills necessary to produce industry-standard production drawings and navigate the complexities of machine drawing in a digital environment. By the conclusion of the course, students will be equipped with the knowledge and practical experience to excel in the field of computer-aided machine drawing and contribute effectively to the industry.

Prerequisites

Nil

Course Outcomes

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

CO 1	Apply the knowledge of engineering drawings and standards to prepare standard dimensioned drawings of machine parts and other engineering components. (Cognitive Knowledge Level: Apply)
CO 2	Apply limits and tolerances to components and choose appropriate fits for given assemblies, surface roughness required. (Cognitive Knowledge Level: Apply)
CO 3	Draw the machine elements detachable joints. (Cognitive Knowledge Level: Understand)
CO 4	Draw the machine elements permanent joints. (Cognitive Knowledge Level: Understand)
CO 5	Prepare part and assembly drawings and Bill of Materials of machine components and valves using CAD software. (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	1						1		3		2
CO 2	3	3		3				1		3		2
CO 3	3	2	3		3				1	3		2
CO 4	3	2	3		3				1	3		2
CO 5	3	3	3		3				1	3		2

Assessment Pattern

Bloom's Category	**Continuous Assessment**	**End Semester Examination (% Marks)**
	Test 1 (%Marks)	
Remember	10	10
Understand	40	30
Apply	50	60
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	**CIE Marks**	**ESE Marks**	**ESE Duration**
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern

Attendance 10 marks
Classwork /Assesment viva voce 50 marks
Assignment/Quiz/Course Project 15 marks

End Semester Examination Pattern

ESE will be of 2.5-hour duration and will be for 75 marks. The question paper contains two parts. In part A, the first question is compulsory and will be based on modules 1 & 2, carrying 10 marks. The second and third questions will carry 15 marks (the student need to answer only one of these) and will be from module 3 and 4 respectively. Part A should be answered in the A4 size answer booklet provided.

Part B Consists of one question from module 5 (compulsory) which carries 50 Marks. The drafting/drawing of the Part B question should be made in a suitable CAD software.

SYLLABUS

Module 1 (3 hours)
Principles of drawing:
Importance of machine Drawing. BIS code of practice for Engineering Drawing, Lines, types of lines, dimensioning, scales of drawing, sectional views.

Module 2 (6 hours)
Fits and Tolerances: Limits, fits, and tolerances of size and form; Types and grade, use of tolerance tables and specification of tolerances, form and cumulative tolerances, tolerance dimensioning, general tolerances.
Surface Roughness: Preparation of production drawings and reading of part and assembly drawings, surface roughness, indication of surface roughness, etc. Surface quality symbols, terminology and representation on drawings.

Module 3 (6 hours)
Detachable Fasteners:
Screw threads, approximate and conventional representations; Specifications.
Threaded fasteners: Types, forms, standard, and specifications;
Drawing of temporary connections;
Foundation bolts; Locking Devices: Classification, principles of operation, standard types and their proportions.

Module 4 (6 hours)
Permanent Fastenings:
Rivets: Standard forms and proportions; Riveted Joints: Common types of joints, terminology, proportions and representation.
Welds: Types of welds and welded joints, edge preparation, specifications, and representation of welds on drawings.

Module 5 (15 hours)
Introduction to drafting software Auto CAD: Basic commands, keyboard shortcuts. Coordinate and unit setting, Drawing, Editing, Measuring, Dimensioning, Plotting Commands, Layering Concepts, Matching, Detailing, Detailed drawings.
Assembly drawings (2D) with Bill of materials: Drawing of Shaft couplings and Oldhams couplings , Lathe Tailstock and Universal joint , Connecting rod and Plummer block , Rams Bottom Safety Valve, steam stop valve.

Reference Books

1. N. D. Bhatt, *Machine Drawing*, Charotar Publishing House Pvt Ltd, 2016.
2. N. Sidheswar, P. Kanniah and V.V.S. Sastry, *Machine Drawing*, Tata McGraw Hill, 2001
3. SP 46: 1988 *Engineering Drawing Practice for School & Colleges*. Bureau of Indian Standards
4. K. R. Gopalakrishna, *Machine Drawing*, 9th Ed., Subhas Stores, Bangalore, 2005.
5. P I Varghese and K C John, *Machine Drawing*, VIP Publishers.

COURSE CONTENTS AND LAB SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Module 1	**3**
1.1	Importance of machine Drawing	1
1.2	BIS code of practice for Engineering Drawing, Lines, types of lines, dimensioning	1
1.3	Scales of drawing, sectional views	1
	Module 2	**6**
2.1	Limits, fits, and tolerances of size and form	1
2.2	Types and grade, use of tolerance tables and specification of tolerances, form and cumulative tolerances	2
2.3	Tolerance dimensioning, general tolerances	1
2.4	Preparation of production drawings and reading of part and assembly drawings	1
2.5	Surface roughness, indication of surface roughness, etc. Surface quality symbols, terminology and representation on drawings	1
	Module 3	**6**
3.1	Screw threads, approximate and conventional representations; Specifications, Threaded fasteners: Types, forms, standard, and specifications	3
3.2	Drawing of temporary connections, Foundation bolts; Locking Devices: Classification, principles of operation, standard types and their proportions	3
	Module 4	**6**
4.1	Rivets: Standard forms and proportions, Riveted Joints: Common types of joints, terminology, proportions and representation	3

4.2	Welds: Types of welds and welded joints, Edge preparation, specifications, and representation of welds on drawings	3
	Module 5	**15**
5.1	Introduction to drafting software Auto CAD, basic commands, keyboard shortcuts. Coordinate and unit setting, Drawing, Editing, Measuring, Dimensioning, Plotting Commands, Layering Concepts, Matching, Detailing, Detailed drawings.	3
5.2	Assembly drawings (2D) with Bill of materials: Drawing of Shaft couplings and OldhamS coupling	3
5.3	MAssembly drawings (2D) with Bill of materials: Lathe Tailstock, Universal joint	3
5.4	Assembly drawings (2D) with Bill of materials: Connecting rod , Plummer block	3
5.5	Assembly drawings (2D) with Bill of materials: Rams Bottom Safety Valve, steam stop valve	3
	Total Hours	**36 Hours**

MODEL QUESTION PAPER

QP CODE: **Pages: 3**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24ME1L01

Course Name: COMPUTER AIDED MACHINE DRAWING

Max. Marks: 75 Duration: 2.5 hours

All dimensions in mm. If required, assume missing data appropriately

PART A (SKETCHING) – 25 Marks

(To be answered in A4 sheet)

Question No. 1 is compulsory. From questions 2 and 3 you may answer any one question.

1. Explain surface texture nomenclature with a neat sketch (10 marks)
2. Draw three views of a hexagonal nut having size M30. (15 marks)

or

3. Draw a top half sectional elevation of a Socket and spigot joint which is suitable for shaft having diameter 24 mm. (15 marks)

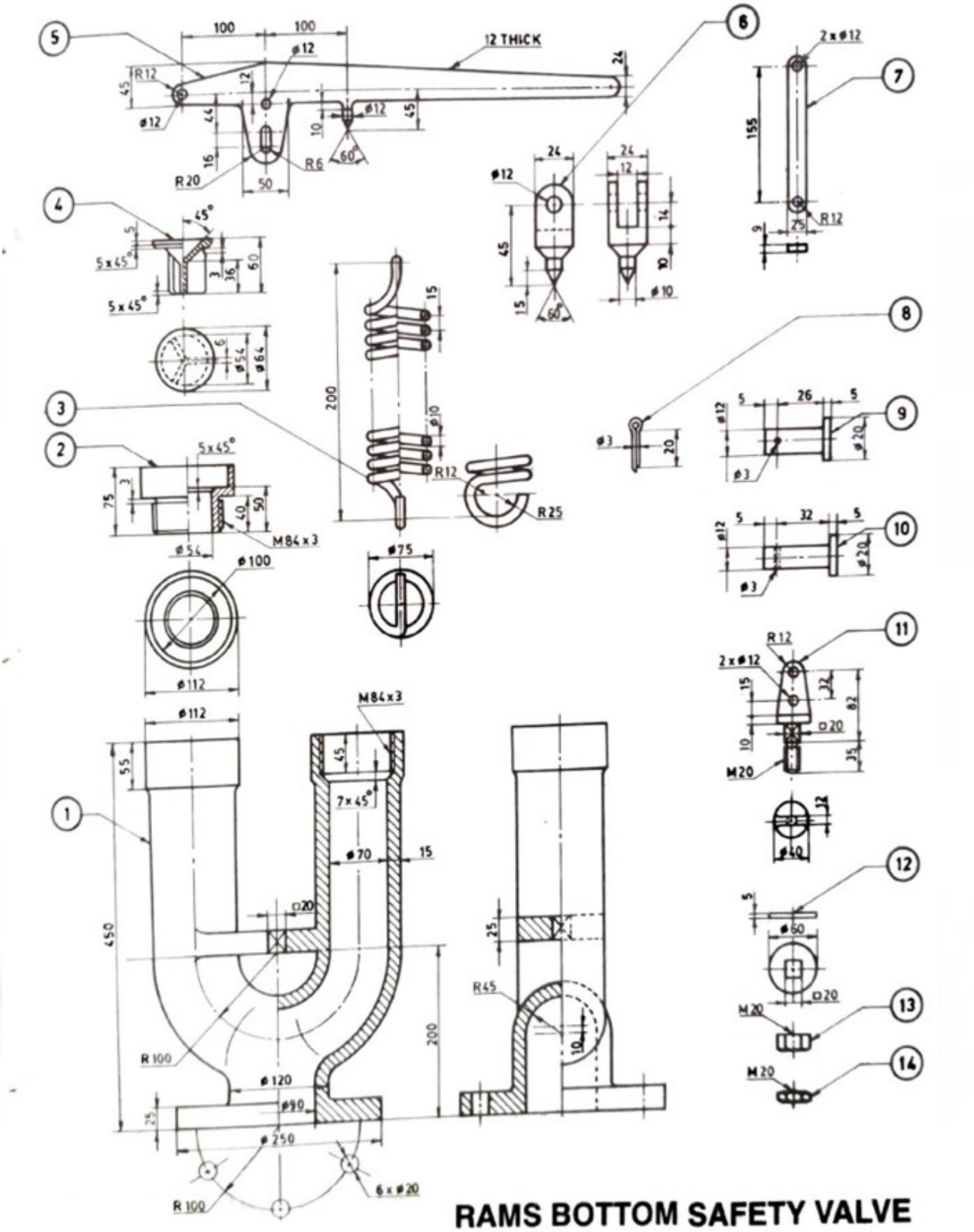
PART B (CAD DRAWING) - 50 Marks

To be drawn/ drafted using any CAD software

4. Draw the assembled view of Rams bottom safety valve as per the given data using any suitable CAD software.

ITEM LIST

Item	Description	Qty.	Material
1	Body	1	C.I.
2	Valve seat	2	G.M.
3	Spring	1	Steel
4	Valve	2	G.M.
5	Lever	1	M.S.
6	Pivot	1	M.S.
7	Link	2	M.S.
8	Split pin	3	M.S.
9	Pin for link	2	M.S.
10	Pin for pivot	1	M.S.
11	Shackle	1	M.S.
12	Washer	1	M.S.
13	Nut	1	M.S.
14	Lock nut	1	M.S.


RAMS BOTTOM SAFETY VALVE
12 THICK
M84x3
2x ø12
R12
R25
R20
R6
R100
R45
5x45°
7x45°
ø112
ø100
ø75
ø70
ø120
ø90
ø250
6x ø20
M20
ø40
ø60
□20

B24PH1L01B & B24CY1L01A	ENGINEERING PHYSICS LAB (B) & ENGINEERING CHEMISTRY LAB (A)	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 (A)

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	Determination of molar absorptivity of a compound.
2	Potentiometric redox titration.
3	Verification of Nernst equation using Daniel cell.
4	Determination of wavelength of absorption maximum and colorimetric estimation of Fe^{3+} ions in the solution.
5	Electroplating with copper.
6	Synthesis of iron oxide nanoparticles.
7	Estimation of sodium ions by flame photometry.
8	Synthesis of conducting polyaniline from aniline.

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. Ulrich Schubert, Nicola Hüsing, "Material Synthesis: A Practical Guide", Springer Vienna, 2008.
8. Anu Tresa Sunny, Prajitha Velayudhan, Sabu Thomas, "Colloidal metal Oxide Nanoparticles: Synthesis, Characterization and Applications", Elsevier Science, 2019.

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- G D Vs D ebate-Dynamics o f P rofessional P resentation (Individual and Group)- Format of Report, Proposal and Minutes.
Activity- Public Speaking, Podcast preparation, Resume preparation, Video profile creation, Company profiling, G roup d iscussion, T echnical P roposal, S tructured F low A nalysis 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 - S enses 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, C onflicts of In terest, an d Oc cupational Cr ime - Ri ghts 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

1. English for Engineers and Technologists (Combined edition, Vol. 1 and 2), Orient Blackswan 2010.
2. Training in Interpersonal Skills: Tips for Managing People at Work, Pearson Education, India, 6^{th} edition, 2015.
3. Mike W Martin and Roland Schinzinger, Ethics in Engineering,4^{th} edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi,2014.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
5. 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.