MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution
Kothamangalam, Kerala, India

B.TECH ELECTRONICS AND COMMUNICATION ENGINEERING

CURRICULUM AND SCHEME

MAR ATHANASIUS COLLEGE OF ENGINEERING KOTHAMANGALAM
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
UG CURRICULUM 2024

SEMESTER 1

SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA1T01	LINEAR ALGEBRA AND MULTI VARIABLE CALCULUS	3-1-0-3	4	4
B	B24ES1T01A	PROBLEM SOLVING AND PROGRAMMING TECHNIQUES	2-1-0-2	3	3
C	B24PH1T01A	ENGINEERING PHYSICS	2-1-0-2	3	3
D	B24CY1T01A	ENGINEERING CHEMISTRY	2-1-0-2	3	3
E	B24ES1T02	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	2-2-0-2	4	4
F	B24ES1L02	BASIC ELECTRICAL AND ELECTRONICS WORKSHOP	0-0-2-2	2	1
G	B24ES1L01	PROGRAMMING LAB	0-0-3-3	3	2
H	B24PH1L01A	ENGINEERING PHYSICS LABORATORY	0-0-1-1	2	1
	B24CY1L01A	ENGINEERING CHEMISTRY LABORATORY	0-0-1-1		
I	B24MC1T01	LIFE SKILLS	1-0-1-2	2	P/F
J	B24MC1T02	DESIGN THINKING	1-1-0-1	2	P/F
K	B24MC1L03	YOGA AND SPORTS	0-0-2-2	2	-
			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	B24ES1T03A	COMPUTER AIDED ENGINEERING GRAPHICS	2-0-2-4	4	3
C	B24EC1T02	ELECTRICAL CIRCUIT THEORY	3-1-0-3	4	4
D	B24EC1T03	LOGIC CIRCUIT DESIGN	2-1-0-2	3	3
E	B24EC1T04	ANALOG CIRCUITS 1	3-1-0-3	4	4
G	B24EC1L01	BASIC ELECTRONICS LAB	0-0-3-3	3	2
H	B24EC1L02	SCIENTIFIC COMPUTING LAB	0-0-3-3	3	2
I	B24MC1T03	PROFESSIONAL COMMUNICATION & ETHICS	2-0-1-3	3	P/F
J	B24MC1L02	IDEA LAB	0-0-2-0	2	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	B24EC2T01	NETWORK THEORY	3-1-0-3	4	4
C	B24EC2T02	COMPUTER ARCHITECTURE AND MICROCONTROLLERS	3-1-0-3	4	4
D	B24EC2T03	ANALOG CIRCUITS 2	2-1-0-2	3	3
E	B24HU2T01	BUSINESS ECONOMICS AND FINANCIAL MANAGEMENT	3-0-0-3	3	3
G	B24EC2L03	LOGIC CIRCUIT DESIGN LAB	0-0-3-3	3	2
H	B24EC2L04	ELECTRONIC CIRCUITS 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	
		TOTAL		32	22
SEMESTER 4					
SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24MA2T04A	STOCHASTIC PROCESSES AND NUMERICAL METHODS	3-1-0-3	4	4
B	B24EC2T04	SOLID STATE DEVICES	3-1-0-3	4	4
C	B24EC2T05	SIGNALS AND SYSTEMS	3-1-0-3	4	4
D	B24EC2T06	LINEAR INTEGRATED CIRCUITS	3-1-0-3	4	3
E	B24HU2T02	ENTREPRENEURSHIP AND MANAGEMENT SKILLS FOR ENGINEERS	2-1-0-2	3	3
F	B24EC2T07	FPGA BASED SYSTEM DESIGN	2-1-0-2	3	3
G	B24EC2L05	MICROCONTROLLER LAB	0-0-3-3	3	2
H	B24EC2L06	HDL LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	
N		HONORS	3-1-0-3	4	
			TOTAL	36	25

SEMESTER 5					
SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24EC3T01	DIGITAL SIGNAL PROCESSING	3-1-0-3	4	4
B	B24EC3T02	CONTROL SYSTEMS	3-1-0-3	4	4
C	B24EC3T03	ANALOG AND DIGITAL COMMUNICATION	3-1-0-3	4	4
D	B24EC3T04	VLSI DESIGN	3-1-0-3	4	4
E	B24EC3T05	EMBEDDED SYSTEMS	2-1-0-2	3	3
F	B24EC3P1X	PROGRAMME ELECTIVE I	2-1-0-2	3	3
G	B24EC3L07	LINEAR INTEGRATED CIRCUITS LAB	0-0-3-3	3	2
H	B24EC3L08	CONTROL SYSTEMS LAB	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	
N		HONORS	3-1-0-3	4	
			TOTAL	36	26
SEMESTER 6					
SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24EC3T06	ELECTROMAGNETIC THEORY	3-1-0-3	4	4
B	B24EC3T07	MACHINE LEARNING	3-1-0-3	4	4
C	B24EC3T08	POWER ELECTRONICS	3-1-0-3	4	4
D	B24EC3T09	WIRELESS COMMUNICATION	3-1-0-3	4	4
E	B24EC3P2X	PROGRAMME ELECTIVE II	2-1-0-2	3	3
F	B24EC3G1X	OPEN ELECTIVE I	2-1-0-2	3	3
G	B24EC3L09	DIGITAL SIGNAL PROCESSING LAB	0-0-3-3	3	2
H	B24EC3L10	MINI PROJECT	0-0-3-3	3	2
M		MINOR	3-1-0-3	4	
N		HONORS	3-1-0-3	4	
			TOTAL	36	26

SEMESTER 7					
SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A	B24EC4T01	INFORMATION THEORY AND CODING	2-1-0-2	3	3
B	B24EC4P3X	PROGRAMME ELECTIVE III	2-1-0-2	3	3
C	B24EC4P4X	PROGRAMME ELECTIVE IV	2-1-0-2	3	3
D	B24EC4G2X	OPEN ELECTIVE II	2-1-0-2	3	3
E	B24HU4T04	DISASTER MANAGEMENT AND INDUSTRIAL SAFETY	2-1-0-2	3	3
G	B24EC4L11	COMMUNICATION LAB	0-0-3-3	3	2
H	B24EC4L12	PROJECT PHASE I	0-0-6-6	6	3
J	B24EC4L13	SEMINAR	0-0-4-4	4	2
K	B24EC4T02	VIVA VOCE	0-0-0-0	-	1
M		MINOR	3-1-0-3	4	
N		HONORS	3-1-0-3	4	
			TOTAL	36	23
SEMESTER 8					
SLOT	COURSE NO.	COURSES	L-T-P-S	HOURS	CREDIT
A, B, C		INTERNSHIP & MOOC COURSES (3 NUMBERS)			9
OR					
A	B24EC4P5X	PROGRAMME ELECTIVE V	2-1-0-2	3	3
B	B24EC4P6X	PROGRAMME ELECTIVE VI	2-1-0-2	3	3
C	B24EC4G3X	OPEN ELECTIVE III	2-1-0-2	3	3
AND					
H	B24EC4L14	PROJECT PHASE 2	0-0-12-12	12	6
M		MINOR PROJECT	0-0-3-3	3	
N		HONORS PROJECT	0-0-6-6	6	
			TOTAL	30	15

PROGRAM ELECTIVE I	
B24EC3P11	SCIENTIFIC COMPUTING USING PYTHON
B24EC3P12	INSTRUMENTATION AND INDUSTRIAL AUTOMATION
B24EC3P13	OPTICAL FIBER COMMUNICATION
B24EC3P14	DIGITAL SYSTEM DESIGN
B24EC3P15	CHIP FABRICATION TECHNOLOGY
PROGRAM ELECTIVE II	
B24EC3P21	DATA STRUCTURES
B24EC3P22	MECHATRONICS
B24EC3P23	MODERN COMMUNICATION SYSTEMS
B24EC3P24	INTERNET OF THINGS
B24EC3P25	ARM SYSTEM ARCHITECTURE
PROGRAMME ELECTIVE III	
B24EC4P31	OBJECT ORIENTED PROGRAMMING IN JAVA
B24EC4P32	ROBOTICS
B24EC4P33	DIGITAL IMAGE PROCESSING
B24EC4P34	MIXED SIGNAL CIRCUIT DESIGN
B24EC4P35	RF CIRCUIT DESIGN

PROGRAMME ELECTIVE IV	
B24EC4P41	EMBEDDED NETWORKS
B24EC4P42	MICROWAVE AND ANTENNAS
B24EC4P43	SECURE COMMUNICATION
B24EC4P44	ANALOG CMOS DESIGN
B24EC4P45	OPTO-ELECTRONIC DEVICES
PROGRAMME ELECTIVE V	
B24EC4P51	REAL TIME OPERATING SYSTEMS
B24EC4P52	MEDICAL ELECTRONICS
B24EC4P53	RADIATION AND PROPAGATION
B24EC4P54	OPTIMIZATION TECHNIQUES
B24EC4P55	ERROR CONTROL CODES
PROGRAMME ELECTIVE VI	
B24EC4P61	DATA ANALYTICS
B24EC4P62	PATTERN RECOGNITION
B24EC4P63	LOW POWER VLSI
B24EC4P64	COMPUTER VISION
B24EC4P65	SATELLITE COMMUNICATION

OPEN ELECTIVE I	
B24EC3G11	RENEWABLE ENERGY SYSTEMS
B24EC3G12	SCIENTIFIC COMPUTING USING PYTHON
B24EC3G13	POWER ELECTRONICS
B24EC3G14	VLSI DESIGN
B24EC3G15	EMBEDDED SYSTEMS
OPEN ELECTIVE II	
B24EC4G21	INTERNET OF THINGS
B24EC4G22	BIOMEDICAL ENGINEERING
B24EC4G23	SECURE COMMUNICATION
B24EC4G24	ENTERTAINMENT ELECTRONICS
B24EC4G25	DIGITAL IMAGE PROCESSING
OPEN ELECTIVE III	
B24EC4G31	MACHINE LEARNING
B24EC4G32	ROBOTICS
B24EC4G33	REAL TIME OPERATING SYSTEMS
B24EC4G34	MECHATRONICS
B24EC4G35	ENTREPRENEURSHIP

SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
III	ELECTRONIC CIRCUITS	3-1-0-3	4	4
IV	MICROCONTROLLERS	3-1-0-3	4	4
V	EMBEDDED SYSTEM DESIGN	3-1-0-3	4	4
VI	VLSI CIRCUITS	3-1-0-3	4	4
VII	MINIPROJECT	0-0-3-3	3	3
VIII	MINIPROJECT	0-0-3-3	3	3
MINOR - BASKET 2				
SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
III	ANALOG COMMUNICATION	3-1-0-3	4	4
IV	DIGITAL COMMUNICATION	3-1-0-3	4	4
V	COMMUNICATION SYSTEMS	3-1-0-3	4	4
VI	DATA NETWORKS	3-1-0-3	4	4
VII	MINIPROJECT	0-0-3-3	3	3
VIII	MINIPROJECT	0-0-3-3	3	3
MINOR - BASKET 3				
SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
III	INTRODUCTION TO SIGNALS AND SYSTEMS	3-1-0-3	4	4
IV	INTRODUCTION TO DIGITAL SIGNAL PROCESSING	3-1-0-3	4	4
V	INTRODUCTION TO DIGITAL IMAGE PROCESSING	3-1-0-3	4	4
VI	INTRODUCTION TO COMPUTER VISION	3-1-0-3	4	4
VII	MINIPROJECT	0-0-3-3	3	3
VIII	MINIPROJECT	0-0-3-3	3	3

HONOURS - BASKET 1				
SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
IV	NANO ELECTRONICS	3-1-0-3	4	4
V	SYSTEM VERILOG FOR DESIGN AND VERIFICATION	3-1-0-3	4	4
VI	ELECTRONIC DESIGN AND AUTOMATION TOOLS	3-1-0-3	4	4
VII	RF MEMS	3-1-0-3	4	4
VIII	PROJECT	0-0-3-3	3	3
HONOURS - BASKET 2				
SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
IV	STOCHASTIC PROCESSES FOR COMMUNICATION	3-1-0-3	4	4
V	DETECTION AND ESTIMATION THEORY	3-1-0-3	4	4
VI	MIMO AND MULTIUSER COMMUNICATION SYSTEMS	3-1-0-3	4	4
VII	DESIGN AND ANALYSIS OF ANTENNAS	3-1-0-3	4	4
VIII	PROJECT	0-0-3-3	3	3
HONOURS - BASKET 3				
SEMESTER	COURSES	L-T-P-S	HOURS	CREDIT
IV	STOCHASTIC SIGNAL PROCESSING	3-1-0-3	4	4
V	COMPUTATIONAL TOOLS FOR SIGNAL PROCESSING	3-1-0-3	4	4
VI	DETECTION AND ESTIMATION THEORY	3-1-0-3	4	4
VII	MULTIRATE SIGNAL PROCESSING AND WAVELETS	3-1-0-3	4	4
VIII	PROJECT	0-0-3-3	3	3

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Kothamangalam, Kerala, India

B.TECH ELECTRONICS AND COMMUNICATION 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

B24ES1T01A	PROBLEM SOLVING AND PROGRAMMING TECHNIQUES(A)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble

This course shall prepare Engineering Graduates to write versatile C programs for solving computational problems that they come across in their professional life. The subject covers the basics of C programming, array handling, string manipulations, function creation, structure and pointer operations and file processing. On completing this course a learner will be able to write efficient C programs to solve real world computational problems.

Prerequisites

Nil

Course Outcomes

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

CO 1	Analyze a computational problem and try to solve it using algorithms, flowcharts and also develop C programs from them using Arithmetic, Logical, Relational and Bitwise operators. (Cognitive Knowledge Level: Understand)
CO 2	Develop C programs with branching and looping statements for processing arrays and matrices (Cognitive Knowledge Level: Apply)
CO 3	Divide a given computational problem into a number of modules and develop functions to find the solution to the computational problem and also create programs for string processing (Cognitive Knowledge Level: Apply)
CO 4	Develop C programs which use structures and pointers for data processing and parameter passing (Cognitive Knowledge Level: Apply)
CO 5	Develop C programs for file processing (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	3	3		1		1				1
CO 2	3	3	3	3		1		1				1
CO 3	3	3	3	3		1		1				1
CO 4	3	3	3	3		1		1				1
CO 5	3	3	3	3		1		1				1

Assessment Pattern

Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (%Marks)	**Test 2 (%Marks)**	
Remember			
Understand	40	40	40
Apply	60	60	60
Analyse			
Evaluate			
Create			

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

End Semester Examination Pattern

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

SYLLABUS

MODULE 1 (6 hours)

Problem solving:

Problem solving using Algorithms, Pseudocode and Flowcharts.

C fundamentals:

Character set, Constants, Identifiers, Keywords, Basic data types, Variables, Operators and its precedence, Bitwise operators, Expressions, Statements, Input and Output statements– Structure of a C program– simple programs.

MODULE 2 (9 hours)

Control statements:

If, if-else, nested if, switch , while, do-while, for, break continue, nested loops. Single dimensional arrays – defining an array, array initialization, accessing array elements, Enumerated data type, Two-dimensional arrays – defining a two-dimensional array – Programs for matrix processing - Programs for Sequential search, Bubble sort.

MODULE 3 (8 hours)

Strings:

Declaring a string variable, reading and displaying strings, string related library functions – Programs for string matching.

Functions:

Function definition, function call, function prototype, parameter passing – Recursion – Passing array to function. Macros: Defining and calling macros.

MODULE 4 (8 hours)

Structures:

Defining a structure variable, accessing members, array of structures, passing structure to function. Union, Pointers: declaration, operations on pointers, passing pointer to a function, accessing array elements using pointers, processing strings using pointers, pointer to pointer, array of pointers, pointer to function, pointer to structure, Dynamic memory allocation.

MODULE 5 (5 hours)

Files:

Different types of files in C – Opening Closing a file – Writing to and Reading from a file – Processing files – Library functions related to file – fseek(), ftell(), fread(), fwrite(). Storage Class associated with variables: automatic, static, external and register.

Text Books

1. Programming with C - Byron S. Gottfried, Tata McGraw Hill
2. Computer Programming in C - Kerninghan Ritchie, PHI

Reference Books

1. Programming in C - Stephen C. Kochan, CBS publishers.
2. Programming in C – E. Balaguruswamy , Mc Graw Hill.
3. Let us C – Yashwant Kanetkar, BPB.
4. A Book on C – Al Kelley and Ira Pohl, Addison-Wesley.
5. Mastering Turbo C - Stan Kelly Bootle, BPB Publications.
6. Pointers in C - Yashwant Kanetkar, BPB.
7. The Spirit of C- by Munish cooper, Jaico Books.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	36 Hours
	Module 1: C fundamentals	6
1.1	Problem solving using Algorithms, Pseudocode and Flowcharts.	1
1.2	C fundamentals: Character set, Constants, Identifiers.	1
1.3	Keywords, Basic data types, Variables.	1
1.4	Operators and its precedence, bitwise operators.	1
1.5	Expressions, Statements, Input and Output statements.	1
1.6	Structure of a C program– simple programs.	1

	Module 2: Control statements:	9
2.1	Control statements: if, if-else, nested if .	1
2.2	Switch, while loop, do-while loop.	1
2.3	For loop, break & continue statements, nested loops.	1
2.4	Single dimensional arrays – defining an array, array initialization, accessing array elements.	1
2.5	Two-dimensional arrays – defining a two-dimensional array.	1
2.6	Programs for matrix processing.	1
2.7	Programs for sequential search.	1
2.8	Bubble sort.	1
2.9	Enumerated data type.	1
	Module 3: Strings and Funtions	8
3.1	Strings: declaring a string variable, reading and displaying strings.	1
3.2	String related library functions.	1
3.3	Programs for string matching.	1
3.4	Functions: Function definition, Function call.	1
3.5	Function prototype, Parameter passing.	1
3.6	Recursion.	1
3.7	Passing array to function.	1
3.8	Macros: Defining and calling macros.	1
	Module 4: Structures	8
4.1	Structures: defining a structure variable, accessing members.	1
4.2	Array of structures, passing structure to function.	1
4.3	Union.	1
4.4	Pointers: declaration, operations on pointers, pointer to a function.	1
4.5	Accessing array elements using pointers, Processing strings using pointers.	1
4.6	Pointer to pointer, Array of pointers.	1
4.7	Pointer to function, Pointer to structure.	1
4.8	Dynamic memory allocation.	1
	Module 5:Files	5
5.1	Different types of files in C, Opening & Closing a file.	1
5.2	Writing to and Reading from a file, Processing file.	1
5.3	Library functions related to file – fseek(), ftell().	1
5.4	Library functions related to file – fread(), fwrite().	1
5.5	Storage Class associated with variables: automatic, static, external and register.	1

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Write an algorithm and pseudocode to check if a given number is an Armstrong number or not
2. Draw a flow chart to check if a given number is an Armstrong number or not.

Course Outcome 2 (CO 2):

1. Write a C program to find the smallest number, largest number and the number of occurrences from a set of numbers.
2. Write a C program to add two matrices.

Course Outcome 3 (CO 3):

1. Write a C program to find whether a string is present in another string.
2. Write functions to accept an N X N matrix and find the row sum and column sum of the matrix.

Course Outcome 4 (CO 4):

1. Write a C program to find the difference between two time intervals using structure.
2. Write a C program to check if a given string is palindrome using pointers.

Course Outcome 5 (CO 5):

1. Write a C program to count the number of lines in a file.
2. The name of some students and their marks in 5 subjects are given in a file. Write a C program to read the student details and calculate the total marks and write the name and total marks to another file.

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: B24ES1T01A

Course Name: PROBLEM SOLVING AND PROGRAMMING TECHNIQUES

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Draw a flow chart to find the largest of three numbers.
2. Write a C program to convert Fahrenheit temperature to Celsius.
3. Differentiate between while loop and do-while loop.
4. Write a C program to find all the factors of a number.
5. Explain any 3 string handling functions using examples.
6. Differentiate between macros and functions.
7. What are the advantages of using structure in C language..
8. Explain pointer to a pointer with an example.
9. Write any three file handling functions in C.
10. What is a static variable? When should it be used?

PART B

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

11. Explain linear search with an example. Draw a flowchart and write pseudo code to perform linear search on an array of numbers. 14

OR

12. (a) Write a C program to find the area of a triangle given the length of three sides of the triangle. 7

    (b) Write a C program to find the Area and Circumference of a Circle given the radius of the circle. 7

13. (a) Write a C program to find the transpose of a matrix. 7

    (b) Write a C program to sort an array of numbers using bubble sort 7

OR

14. (a) Write a C program to find the sum of first and last digit of a number. 7

    (b) Write a C program to print all the prime numbers between 100 to 200. 7

15. (a) Explain any 4 string handling functions in C programming. 7

    (b) Write a C program to reverse a string without using string handling functions. 7

OR

16. (a) What is the purpose of function declaration and function definition and function call? With examples illustrate their syntax 7

    (b) What is recursion? Write a C program to display Fibonacci series using recursive function. 7

17. (a) Write a C program to: 7

        i. Create a structure with fields: Name, Address, Date of Birth.

        ii. Read the above details for five students from user and display the details.

    (b) Differentiate between array of pointers and pointer to an array.. 7

OR

18. (a) What are the different dynamic memory allocation functions available in C language. 7

    (b) Write a C program to reverse a string using pointers. 7

19. (a) What are different storage classes in C? Give examples for each. . 7

    (b) Explain any 5 file handling functions in C? 7

OR

20. (a) Write a C program to count number of lines in a text file. 7

    (b) Write a C program to read a text file and replace all vowels in the text file with character 'x' and write it to another file.. 7

B24PH1T01A	ENGINEERING PHYSICS (A)	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	Understand the principle and structure of lasers and the working of optical fibers. (Cognitive Knowledge Level: Apply)
CO 2	Analyze the behavior of matter in the atomic and subatomic level through the principles of quantum mechanics to perceive the microscopic processes in electronic devices. (Cognitive Knowledge Level: Apply)
CO 3	Quantitatively grasp fundamental semiconductor principles such as energy band theory, carrier statistics and transport phenomena and thus explain the structure and conduction in intrinsic semiconductors. (Cognitive Knowledge Level: Apply)
CO 4	IUnderstand the influence of doping on the energy structure, carrier statistics and transport phenomena and thus explain the structure and conduction in extrinsic semiconductors. (Cognitive Knowledge Level: Apply))
CO 5	WUnderstand the formation and structure of junctions and explain the working of solid state lighting devices. (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					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	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	20 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)

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.

MODULE 2 (8 hours)

Quantum Mechanics:

Introduction - Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only), Wave function, its properties and physical interpretation, Formulation of time dependent and time independent Schrodinger equations, Particle in a one dimensional box - Derivation of energy eigenvalues and normalized wave function.

MODULE 3 (8 hours)

Semiconductor Physics I :

Electrical Conduction in solids - Density of states function (no derivation), the Fermi-Dirac Probability function, Fermi energy and its physical significance, Charge carriers in semiconductors - Equilibrium distribution of electrons and holes, the n0 and p0 equations, Intrinsic carrier concentration ni, Intrinsic Fermi level position and its dependence on temperature.

MODULE 4 (7 hours)

Semiconductor Physics II :

Extrinsic semiconductors - P type semiconductor, N type semiconductor, Carrier concentration in N type semiconductor, Variation of fermi level with temperature, Variation of fermi level with donor concentration, Carrier concentration in P type semiconductor, Variation of fermi level with temperature, Variation of fermi level with acceptor concentration.

MODULE 5 (6 hours)

Semiconductor Devices:

Formation of PN junction, Energy band diagram of PN junction - Qualitative description of charge flow across a PN junction - Forward and reverse biased PN Junctions, Photonic devices (Qualitative treatment only) - Light Emitting Diode, Photo detectors (Junction and PIN photodiodes), Solar cells.

Text Books

1. 1. Aruldhas G., “Engineering Physics”, PHI Pvt. Ltd., 2015.
2. 2. M.N. Avadhanulu, P.G. Kshirsagar, TVS Arun Murthy, “A Textbook of Engineering Physics”, S.Chand & Co., Revised Edition, 2019.
3. Flask: 3. Donald A. Neamen, “Semiconductor Physics and Devices - Basic Principles”, McGraw Hill, 4^{th} Edition, 2012.

Reference Books

4. Arthur Beiser, "Concepts of Modern Physics ", Tata McGraw Hill Publications, 6^{th} Edition 2003.

5. D.K. Bhattacharya, Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.

6. Md.N.Khan & S.Panigrahi "Principles of Engineering Physics 1&2", Cambridge University Press, 2016.

7. Aruldhas G., "Engineering Physics", PHI Pvt. Ltd., 2015.

8. S.M. Sze, "Physics of Semiconductor Devices", John Wiley & Sons, 1969.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	36 Hours
	Module 1: Laser and Fibre Optics	7
1.1	Optical processes - Absorption, Spontaneous emission and stimulated emission, - Einstein's relations	2
1.2	Principle of laser - conditions for sustained lasing - components of laser - Population inversion - energy source - Pumping, Metastable states - active medium, optical resonator.	2
1.3	Construction and working of Ruby laser.	1
1.4	Optic fiber-Principle of propagation of light, Numerical aperture – Derivation	1
1.5	Applications of fibers - Intensity modulated sensors .	1
	Module 2: Quantum Mechanics	7
2.1	Introduction - Concept of uncertainty and conjugate observables (qualitative), Uncertainty principle (statement only),	1
2.2	Wave function, its properties and physical interpretation.	1
2.3	Formulation of time dependent and time independent Schrodinger equations, Particle in a one dimensional box - Derivation of energy eigenvalues and normalized wave function, Numerical Problems.	5
	Module 3: Semiconductor Physics I	8
3.1	Electrical Conduction in solids - Density of states function (no derivation), the Fermi-Dirac Probability function, Fermi energy and its physical significance	2

3.2	Charge carriers in semiconductors - Equilibrium distribution of electrons and holes, the n0 and p0 equations.	3
3.3	Intrinsic carrier concentration ni, Intrinsic Fermi level position and its dependence on temperature.	3
	Module 4: Semiconductor Physics II	8
4.1	Extrinsic semiconductors - P type semiconductor, N type semiconductor.	2
4.2	Carrier concentration in N type semiconductor, Variation of fermi level with temperature, Variation of fermi level with donor concentration	3
4.3	Carrier concentration in P type semiconductor, Variation of fermi level with temperature, Variation of fermi level with acceptor concentration	3
	Module 5: Semiconductor Devices	6
5.1	Formation of PN junction, Energy band diagram of PN junction - Qualitative description of charge flow across a PN junction - Forward and reverse biased PN Junctions, the ideal diode equation (no derivation).	3
5.2	Photonic devices (Qualitative treatment only) - Light Emitting Diode, Photo detectors (Junction and PIN photodiodes), Solar cells.	3

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

1. Describe the physical significance of wave function.
2. State HUP for position and momentum.
3. How does the size of a box affect the permitted energy levels of a particle?

Course Outcome 3 (CO 3):

1. Determine the number of quantum states in silicon between $(E_V - kT)$ and E_V at T=300K.
2. Describe the concept of Fermi level and its physical significance..
3. Calculate the probability that an energy state above E_F is occupied by an electron. Let T= 300 K. Determine the probability that an energy level 3kT above the Fermi energy is occupied by an electron.

Course Outcome 4 (CO 4):

1. Describe the variation of Fermi level with temperature in an extrinsic semiconductor.
2. Determine the Fermi level and the max. doping concentration for which the Boltzmann approximation is still valid.
3. Sketch a graph of n_0 versus temperature for an n-type material.

Course Outcome 5 (CO 5):

1. Describe the formation of the depletion region.
2. Draw the I-V characteristics of a solar cell..
3. Describe the advantage of a PIN diode over a PN diode when used as a photo detector.

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: B24PH1T01A

Course Name:ENGINEERING PHYSICS (A)

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Explain the term population inversion.
2. Describe the principle of operation of optic fibers.
3. State Heisenberg's Uncertainty principle for conjugate variables.
4. Write the time independent Schrodinger equation.
5. What is meant by Fermi level?.
6. Write the Fermi-Dirac distribution function..
7. What are the factors affecting the Fermi level in an extrinsic semiconductor?
8. Plot the variation in E_F against donor concentration in an n-type semiconductor.
9. Sketch the energy bands in an unbiased, reverse-biased and forward-biased PN junction.
10. What is meant by a space charge region?

PART B

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

1. (a) Define numerical aperture of an optic fiber and derive an expression for the NA of a step index fiber with a neat diagram.. 10

   (b) Calculate the numerical aperture and acceptance angle of a fiber with a core refractive index of 1.54 and a cladding refractive index of 1.50 when the fiber is inside water of refractive index 1.33. 4

OR

2. (a) Outline the construction and working of Ruby laser. 10

   (b) Calculate the N.A. of an optic fiber having core index of 1.54 and cladding index of 1.5 4

3. (a) Derive time dependent Schrodinger equation. 10

   (b) An electron is confined to a one dimensional potential box of length 2Å. Calculate the energies corresponding to the first and second quantum states in eV. 4

OR

4. (a) Derive the expression for the energy eigenvalues for a particle confined within a box of width L. 10

   (b) b. Find the de-Broglie wavelength of an electron whose kinetic energy is 15eV. 4

5. (a) Derive the equations for the thermal equilibrium concentrations of electrons and holes in terms of the Fermi energy 10

   (b) b. Calculate the density of states per unit volume with energies between 0 eV and 1 eV. 4

OR

6. (a) Derive the equation for the intrinsic carrier concentration. 10

   (b) b. Let T=300 K. Determine the probability that an energy level 3kT above the Fermi energy is occupied by an electron 4

7. (a) Derive the fundamental relationship $n_0 p_0 = n_i^2$. 10

   (b) Consider silicon at T=300 K and assume that $N_c = 2.8 \times 10^{19} cm^{-3}$ and $N_v = 1.04 \times 10^{19} cm^{-3}$. Assuming that the Fermi energy is 0.25 eV below the conduction band and that the bandgap energy of silicon is 1.12 eV, determine the type of silicon under consideration. 4

OR

8. (a) Derive the equations for n_0 and p_0 in terms of impurity doping concentrations.10

   (b) Silicon at T=300 K contains an acceptor impurity concentration of $N_a = 10^{16} cm^{-3}$. Determine the concentration of donor impurity atoms that must be added so that the silicon is n type and the Fermi level is 0.20 eV below the conduction-band edge. 4

9. (a) Describe the structure of energy bands in a PN junction under zero bias, forward bias and reverse bias and explain why conduction is possible only when it is forward-biased. 10

(b) b. Write the ideal diode equation and draw the corresponding I-V characteristics. 4

OR

10. (a) Explain the structure of an LED and explain the process of emission of light from the same with the help of the energy band diagram. 10

(b) b. Briefly describe the working of a PIN junction photodiode and explain its advantage over a PN junction photodiode. 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

8. T. Pradeep, "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw-Hill, 2008.
9. B. Rogers, J. Adams, S. Pennathur, "Nanotechnology: Understanding Small Systems" , CRC Press, 2014.
10. Donald L. Pavia, "Introduction to Spectroscopy", Cengage Learning India Pvt. Ltd., 2015.
11. J. Goldstein, "Scanning Electron Microscopy and Microanalysis", Springer, 2012.
12. H. H. Willard, L. L. Merritt, "Instrumental Methods of Analysis", CBS Publishers, 7^{th} Edition, 2005.
13. Samuel Glasstone, "An Introduction to Electrochemistry", East-West Press Pvt. Ltd., 2006.
14. Pietro Pedeferri, "Corrosion Science and Engineering", Springer Link, 2018.
15. B. Sunden, "Hydrogen, Batteries and Fuel Cells", Elsevier Inc., 2019.
16. B. Sorensen and G. Spazzafumo, "Hydrogen and Fuel Cells - Emerging Technologies and Applications", Elsevier Ltd., 2018.
17. Raymond B. Seymour, Charles E. Carraher, "Polymer Chemistry: An Introduction", Marcel Dekker Inc; 4^{th} Revised Edition,1996.
18. J. Janata, "Principles of Chemical Sensors" Springer, New York, NY, 2009.
19. F-G. Banica, "Chemical Sensors and Biosensors: Fundamentals and Applications", John Wiley and Sons, 2012.

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

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

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

23. 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

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

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

B24ES1T02	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	2	0	2	4	2024

Preamble

This course aims to provide fundamentals of circuit analysis, electrical components, machines, power systems, and safety practices. It also provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and circuits.Course also aims to provide an introduction to digital electronics. Completing the course, students gain the necessary knowledge for more advanced courses and practical applications

Prerequisites

Nil

Course Outcomes

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

CO 1	Understand the essential circuit components and the fundamental circuit laws governing electrical circuits. (Cognitive Knowledge Level: Understand)
CO 2	Recall the basics of electromagnetism and the fundamentals of electrical machines and three-phase systems. (Cognitive Knowledge Level:Understand)
CO 3	Apply the basic knowledge of household wiring components and analyze electrical wiring layout for small residential buildings. (Cognitive Knowledge Level: Apply)
CO 4	identify the active and passive electronic component and their specifications (Cognitive Knowledge Level: Understand)
CO 5	Design and analyze Rectifiers and Voltage amplifiers (Cognitive Knowledge Level: Apply)
CO 6	Explain the elements of digital system abstractions such as digital representations of information, digital logic and Boolean algebra (Cognitive Knowledge Level: Understand)

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

	BASIC ELECTRICAL			**BASIC ELECTRONICS**		
Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (%Marks)	**Test 2 (%Marks)**		**Test 1 (%Marks)**	**Test 2 (%Marks)**	
Remember	15	15	15	15	15	30
Understand	20	20	20	25	25	50
Apply	15	15	15	10	10	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 I – Basic Electrical Engineering and Part II – Basic Electronics Engineering. Part I and PART II carries 50 marks each. For the end semester examination, 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 subdivisions. The pattern for end semester examination for part II is same as that of part I.

SYLLABUS

MODULE 1 (7 hours)

DC Electric Circuits

Passive components - R, L, and C, Sources - current and voltage sources, Resistances in series and parallel, current and voltage division rule, Ohm's Law, Kirchoff's Laws (Numerical problems).

Alternating Current Fundamentals

Generation of single-phase voltage - frequency, time period, average value, RMS value (sine wave concept only), Form and peak factors-Phasor representation of R,L,C, RL, RC, and RLC circuits - concept of impedance, power - active, reactive, and apparent, power factor (Numerical problems).

MODULE 2 (8 hours)

DC Machines and Transformers

Faraday's laws, Lenz's law, statically and dynamically induced EMF. DC Generator- construction and working principle, types, applications. DC motor - working principle, types of DC motors, applications. Transformer (single-phase only) - Construction, types-Working principle. Construction types

Three-Phase AC Systems

Generation of three-phase voltages - phase sequence, Y-Δ connection (balanced only), relation between line and phase quantities, three-phase power, Single line diagram of a power system from generation to distribution.

MODULE 3 (8 hours)

Electrical wiring design

Electrical wiring system in domestic building - types of wiring, cables, Conduits, Switches and Outlets, switch boards, and distribution boards. Common power ratings of domestic

gadgets, Codes and standards- Salient features of NEC, NBC and IE rule, NEC Symbols used in electrical wiring layout. Electrical lay out (single line diagram) for low- class domestic installation. Electrical load calculation- connected load method (Numerical problems).

Electrical Installation in Buildings

Protection devices - MCB, MCCB, ELCB/RCCB and RCBO- Principle of Operation-Rating and Specification, fuses-working and types. Electrical hazards and safety Precautions-Earthing need of earthing, types.

MODULE 4 (8 hours)

Introduction to Electronics Components

Overview of the Evolution and Applications of Electronics. Familiarization of basic electronic components: Resistors, Capacitors, Inductors: Types, Specifications, Standard values, Color Coding.

Introduction to Semiconductor devices

Understanding PN Junction diode: Structure and Principle of Operation, V-I Characteristics, Diode Current equation (Simple problems), Special Diode: Zener Diode, Break down mechanisms, Bipolar junction Transistor: NPN and PNP Structure, Principle of operation of NPN Transistor

MODULE 5 (7 hours)

Introduction to Basic electronic circuits:

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator, Input and Output Characteristics of Common Emitter Configuration, Amplifier: RC Coupled Amplifier using Voltage divider bias- Frequency Response-Bandwidth

MODULE 6 (7 hours)

Introduction to Digital Electronics

Number Systems: Decimal, Binary, Octal, and Hexadecimal number systems, Number Base Conversions, Binary Arithmetic: Addition, Subtraction, Multiplication, Logic gates, Universal Gates, Truth table, Realization of NOT gate using transistor

Text Books

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering," 3^{rd} Edition, Tata McGraw Hill."Electric Circuits & Networks", Pearson Education, 2009.
2. J. B. Gupta, "Theory and Performance of Electrical Machines" 15^{th} Edition, S. K. Katarina Sons.
3. M.K. Giridharan, Electrical System Design.

4. Chinmoy Saha, Arindham Halder and Debarati Ganguly, Basic Electronics - Principles and Applications, Cambridge University Press, 2018.

5. M.S.Sukhija and T.K.Nagsarkar, Basic Electrical and Electronics Engineering, Oxford University Press, 2012.

Reference Books

1. C. L. Wadhwa, "Basic Electrical Engineering," 4^{th} Edition, New Age International Publisher

2. V. N. Mittle, "Basic Electrical Engineering," Tata McGraw Hill.

3. V. K. Mehta Rohit Mehta, "Principles of Electrical Engineering," 6^{th} Edition, S. Chand Co. PVT. LTD

4. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering," 2^{nd} Edition, Pearson Education.

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

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

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

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

9. Anant Agarwal, Jeffrey Lang, Foundations of Analog and Digital Electronic Circuits, Morgan Kaufmann Publishers, 2005.

10. Bernard Grob, Basic Electronics, McGraw Hil

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	45 Hours
	Module 1: DC Electric Circuits & Alternating Current Fundamentals:	7
1.1	DC Electric Circuits: Passive Components - R, L, and C, sources - current and voltage sources	1
1.2	Resistances in series and parallel, current and voltage division rule (Numerical problems).	1
1.3	Ohm's Law, Kirchoff's Laws (Numerical problems).	2

1.4	Alternating Current Fundamentals: Representation of sinusoidal waveforms - frequency, time period, average value, RMS value.	1
1.5	Phasor representation of R, RL, RC, RLC circuits - concept of impedance, power - active, reactive and apparent, power factor (Numerical problems).	2
	Module 2:DC Machine and Three-Phase AC Systems:	8 .
2.1	Electromagnetic Induction: Faraday's laws, Lenz's law, statically and dynamically induced EMF	1
2.2	DC Machines: Construction and working principle - DC Generator – Types-applications.	2
2.3	DC motor - Construction and working principle- Types-applications	1
2.4	Transformers (single phase only): Working principle.	1
2.5	Three-Phase AC Systems: Generation of three-phase voltages - phase sequence.	1
2.6	Y-Δ connection (balanced only), relation between line and phase quantities, three phase power.	2
	Module 3: Electrical wiring design & Electrical Installation in Buildings:	8
3.1	Electrical wiring design: Electrical wiring system in domestic building - types of wiring, cables, Conduits, Switches and Outlets, switch boards, and distribution boards.	1
3.2	Common power ratings of domestic gadgets, Codes and standards- Salient features of NEC, NBC and IE rule, NEC Symbols used in electrical wiring layout.	1
3.3	Electrical lay out (single line diagram) for low- class domestic installation. Electrical load calculation- connected load method (Numerical problems).	2
3.4	Electrical Installation in Buildings: Protection devices - MCB, MCCB, ELCB/RCCB and RCBO- Principle of operation, fuses-working and types	2
3.5	lectrical hazards and safety precautions-Earthing & need of earthing, types, Electrical Safety & Precautions	2
3.6	Average value, rms value, form and peak factors of trapezoidal and sinusoidal waveforms - Numerical problems.	2
3.7	Phasor representation of sinusoidal quantities - phase difference, addition and subtraction of sinusoids.	1
3.8	Symbolic Representation: cartesian, polar and exponential forms.	1
	Module 4: Introduction to Semiconductor devices	8
4.1	Overview of the Evolution and Applications of Electronics.	1
4.2	Familiarization of basic electronic components: Resistors, Capacitors, Inductors: Types, Specifications, Standard values, Color Coding.	3

4.3	Understanding PN Junction diode: Structure and Principle of Operation	1
4.4	V-I Characteristics, Diode Current equation (Simple problems	1
4.5	Special Diode: Zener Diode, Break down mechanisms	1
4.6	Bipolar junction Transistor : NPN and PNP Structure, Principle of operation of NPN Transistor	1
	Module 5: Introduction to Basic electronic circuits:	7
5.1	Rectifiers and power supplies: Block diagram description of a dc power supply, Working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator.	4
5.2	Input and Output Characteristics of Common Emitter Configuration	1
5.3	Amplifier: RC Coupled Amplifier using Voltage divider bias- Frequency response-Bandwidth .	2
	Module 6: Introduction to Digital Electronics:	7
6.1	Number Systems: Decimal ,Binary, Octal, and Hexadecimal number systems, Number Base Conversions	2
6.2	Binary Arithmetic : Addition, Subtraction, Multiplication	2
6.3	Logic gates, Universal Gates, Truth table .	2
6.4	Realization of NOT gate using transistor .	1

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

1. Construction and working of DC generator and DC motor.
2. Different types and applications of DC generator and DC motor.

3. Working principle of single-phase transformer.
4. Problems on three-phase line phase quantities for a balanced load.

Course Outcome 3 (CO 3):

1. Electrical wiring system in domestic building.
2. Codes and standards .
3. Electrical lay out (single line diagram).
4. Electrical load calculation- connected load method (Numerical problems).
5. Protection devices and its principle of operation.
6. Electrical hazards and safety Precautions-Earthing & need of earthing, types, Electrical Safety & Precautions.

Course Outcome 4 (CO 4):

1. Explain the significance of color coding in identifying the values of resistors.
2. Describe the structure of a PN junction diode and its principle of operation
3. Describe the structure of a PN junction diode and its principle of operation

Course Outcome 5 (CO 5):

1. What is the need of voltage divider biasing in an RC coupled amplifier?
2. Analyze the importance of selection of operating point in the context of a BJT amplifier.
3. Why is it required to have a voltage amplifier in a public address system?

Course Outcome 6 (CO 6):

1. Convert 203:5210 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: 3**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: : B24ES1T02

Course Name:BASICS OF ELECTRICAL ENGINEERING

Max. Marks: 100 Duration: 3 hours

PART 1:BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

PART A

Answer all questions. Each question carries 4 marks.

1. State and explain Kirchhoff's laws with examples.
2. Differentiate between statically and dynamically induced emf.
3. Derive the relation between line and phase current in a 3-phase delta-connected system.
4. Distinguish between MCB and MCCB.
5. What is the need for earthing? Describe the different types of earthing.

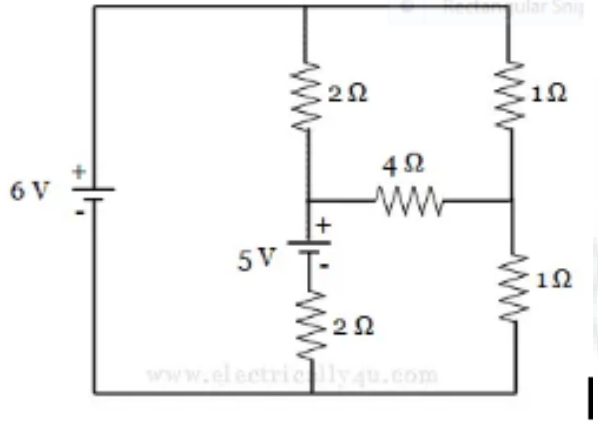
PART B

Answer any one full question . Each question carries 10 marks.

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

OR

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



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

OR

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

.

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

OR

11. (a) Explain the different types of wiring. 5
    (b) What are the different NEC symbols used in electrical wiring layout? 5

PART 2:BASICS OF ELECTRONICS ENGINEERING

PART A

Answer all questions. Each question carries 4 marks.

1. (a) Identify the colour code for the given resistor values.
       i. 1Ω + 5
       ii. 3.3kΩ + 1
   (b) Identify the capacitor value with unit.

2. Explain the break down mechanisms of Zener diode

3. Briefly Discuss the block diagram of a DC power supply.
4. For a NPN transistor =0.98 and I_B=100 A . Find I_E and I_C
5. Which gates are called universal gates and why?

PART B

Answer any one full question . Each question carries 10 marks.

6. (a) Explain with necessary diagrams the principle of operation of NPN transistor 5
   (b) Write the diode current equation, If 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. 5

OR

7. (a) Plot and explain the V-I characteristics of a PN junction Diode 5
   (b) Describe the color coding of a resistor with suitable example. 5
8. With necessary diagrams explain the working of a full wave bridge rectifier 10

OR

9. Describe the input and output characteristics of Common emitter configuration. 10
10. Convert the following numbers to binary 10
    (a) $EE9_{16}$
    (b) $FD654 - 1_6$
    (c) 33_{10}
    (d) 17_{10}
    (e) 1142_8

OR

11. Draw the symbol and truth table of AND, OR, NAND, NOR and XOR 10

B24ES1L02	BASIC ELECTRICAL AND ELECTRONICS WORKSHOP	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

Preamble

The course aims to impart fundamentals of electrical wiring, safety measures, and troubleshooting to students. The course will expose student to the concepts various wiring methods and distribution systems. It also gives the basic introduction of electronic hardware systems and provides hands-on training with familiarization, identification, testing, assembling, dismantling, fabrication and repairing such systems by making use of the 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 substation, distribution system, and safety measures against electrical shocks and select the fuse unit for a given electrical circuit.(Cognitive Knowledge Level – Understand)
CO 3	Estimate and develop the electric circuits for wiring domestic and industrial buildings. .(Cognitive Knowledge Level – Apply)
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

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO 1	3	2	3	1		3	1	1	3	3	2	3
CO 2	3	2	3	1		3	1	1	3	3	2	3
CO 3	3	3	3	3		3	1	1	3	3	3	3
CO 4	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
Viva voce / test	30 marks

End Semester Examination Pattern

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

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) Familiarization with earthing in electrical installations ,precautions against electric shock phenomenon and safety procedures .
2	Realization of domestic wiring (a) Wiring of one lamp controlled by one switch and a 3-pin plug socket controlled independently. (b) Wiring of one lamp controlled by two switches (Staircase wiring).
3	(a) Realization of Industrial wiring - Wiring of three lamps controlled by three switches (Godown wiring). (b) Study of fuse, MCB, ELCB,RCCB and selection of fuse rating for circuits with medium and high power.
4	Wiring of the distribution board, including the power plug, an isolator, MCB, and ELCB for 1000 W power.
5	Measurement of low-medium-high resistance using the megger and voltmeter-ammeter method.
6	Visit the on-campus substation and familiarize with the supply system, transformer, HT Panel, and distribution system.

Reference Books

1. H Cotton, Advanced Electrical Technology, Reem Publications, 2011.
2. Suresh Kumar K.S, Electrical Circuit and Networks, Pearson Education, New Delhi, 2009.
3. EW. Golding, Electrical Measurements and Measuring Instruments,5^{th} ed. Reem Publications, 2011.
4. A course in electrical installation estimating and costing, J Bh Gupta, 9^{th} editon , 2012

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. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky.
2. "Fundamentals of Electric Circuits" by Charles K. Alexander and Matthew N.O. Sadiku .
3. "The Soldering Handbook" by M.W. Schwartz.
4. "Electronic Devices Conventional current version", by Floyd 9^{th} Edition.

B24ES1L01A	PROGRAMMING LAB(A)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

The course aims to provide students with exposure to problem solving through C Programming. The students will have hands on experience in C programming, array handling, string manipulations, function creation, structure and pointer operations and file processing. After the lab sessions the student will be able to analyze complex problems and find solutions for real word problems.

Prerequisite

Nil

Course Outcomes

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

CO 1	C programs with branching and looping statements for processing arrays and matrices. (Cognitive Knowledge Level: Apply)
CO 2	Divide a given computational problem into a number of modules and develop functions to find the solutions to the computational problem and also create programs for string processing (Cognitive Knowledge Level: Apply)
CO 3	Construct C programs for searching and sorting (Cognitive Knowledge Level: Apply)
CO 4	Develop C programs which use structures and pointers for data processing and parameter passing (Cognitive Knowledge Level: Apply)
CO 5	Develop C programs for file processing (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	3	3		1		1				1
CO 2	3	3	3	3		1		1				1
CO 3	3	3	3	3		1		1				1
CO 4	3	3	3	3		1		1				1
CO 5	3	3	3	3		1		1				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

1	Familiarization of Linux Commands.
2	Familiarization of IO console. a) Write a C program to display the Personal details. b) Write a C program to Add two numbers c) Write a C program to evaluate the arithmetic expression using command line arguments
3	Familiarization of Operators. a) Write a C program to evaluate bitwise operations on given numbers. b) Write a C program to swap two numbers using XOR operation. c) Write a C program to find the largest of three numbers using conditional operator.
4	Write a C program for the salary increment of an employee (eg: if the given salary is > 50000, 20 % increment)

5	Write a menu driven program to perform the Calculator operations, namely addition, subtraction, multiplication, division and square of a number.
6	Write a C program to check the given number is Armstrong or not and find the reverse of the number
7	Write a C program to find the sum of first N natural numbers using array.
8	Write a C program a) To read an array of size n and display in reverse order. b) Display the sum and average of the array elements.
9	Write a C program to read an array of size n and display the prime numbers in the array.
10	Write a C program to read n integers, store them in an array and search for an element in the array using Linear Search.
11	Write a C program to read n integers, store them in an array and sort the elements using Bubble Sort.
12	Write a C program to read a string (word), store it in an array and check whether it is a palindrome word or not.
13	Write a C program to read two strings (each one ending with a $ symbol), store them in arrays and concatenate them without using library functions.
14	Write a C program to read a string (ending with a $ symbol), store it in an array and count the number of vowels, consonants and spaces in it.
15	Write a C program to read a string (word), store it in an array and obtain its reverse by using a user defined function.
16	Write a menu driven program for performing matrix addition, multiplication and finding the transpose. Use functions to a) Read a matrix. b) Find the sum of two matrices. c) Find the product of two matrices d) Find the transpose of a matrix and e) Display a matrix.
17	Find the factorial of a given Natural Number n using recursive and non-recursive functions.
18	Write a C Program to find the largest of three numbers using Macros.
19	Using structure, read and print data of n employees (Name, Employee Id and Salary).
20	Write a C program to declare a union containing 5 string variables (Name, House Name, City Name, State and Pin code) each with a length of C_SIZE (user defined constant).Then, read and display the address of a person using a variable of the union.
21	Write a C program to read the student details using structure and display the information through the user defined function.

22	Do the following using pointers a) add two numbers. b) swap two numbers using a user defined function.
23	Read and display the elements of an array using pointers, Compute the sum of the elements stored in the array using pointers and user defined function.
24	Define a structure for student with fields roll no, name and age. Create a pointer to this structure, assign values to the fields, and print the values using pointer.
25	Write a C program to concatenate two strings using pointers.
26	Create a file and perform the following a) Write data to the file. b) Read the data in a given file & display the file content on console . c) append new data and display on console
27	Open a text file and count the number of characters, words and lines in it; and store the result in another file.
28	Find the substring from the given text file and replace it with another string.

Reference Books

1. Programming in C - Stephen C. Kochan, CBS publishers.
2. Programming in C – E. Balaguruswamy , Mc Graw Hill.
3. Let us C – Yashwant Kanetkar, BPB.
4. A Book on C – Al Kelley and Ira Pohl, Addison-Wesley.
5. Mastering Turbo C - Stan Kelly Bootle, BPB Publications.
6. Pointers in C - Yashwant Kanetkar, BPB.
7. SThe Spirit of C- by Munish cooper, Jaico Books.

B24PH1L01A & B24CY1L01A	ENGINEERING PHYSICS LAB (A) & ENGINEERING CHEMISTRY LAB (A)	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	1	2024

PART I
ENGINEERING PHYSICS LAB (A)

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	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			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	WDSO-Measurement of frequency and amplitude of wave forms.
2	Optic Fiber -Measurement of Splice Loss.
3	Junction Diode - Measurement of E_R.
4	Photoelectric cell - Calculation of Planck's constant.
5	Optic Fiber - Measurement of Numerical Aperture.
6	I-V characteristics of solar cells.
7	Optic Fiber - Measurement of Bending Loss.
8	LED Characteristics.

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.

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

Preamble

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

Prerequisites

Nil

Course Outcomes

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

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

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

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

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

Regular assessment

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

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

Presentation Skills (Marks: 6)
Identify a suitable topic and ask the students to prepare presentation (preferably a powerpoint presentation) for about 10 minutes. Parameters to be used for evaluation are as follows

1. Communication Skills: 2 marks

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

End Semester Examination Pattern

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

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

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

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

SYLLABUS

MODULE 1 (6 hours)

Overview of Life Skills:

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

MODULE 2 (6 hours)

Life Skills for Professionals:

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

MODULE 3 (6 hours)

Leadership:

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

MODULE 4 (6 hours)

Financial Literacy:

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

Reference Books

1. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
2. Barun K. Mitra, "Personality Development Soft Skills", Oxford Publishers, Third impression, 2017.
3. ICT Academy of Kerala, "Life Skills for Engineers", McGraw Hill Education (India) Private Ltd.,2016.

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

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

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

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

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

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

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

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

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

13. Edward de Bono, "Lateral Thinking"

14. Howard Gardener, "Multiple Intelligences"

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	24 Hours
	Module 1	6
1.1	Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making	1
1.2	Problem solving, Effective communication, interpersonal relationship, coping with stress- Four A's of stress management.	1
1.3	Gratitude Training, Coping with emotion- PATH method and relaxation techniques	1
1.4	Activity- Presentation, Group discussion	3
	Module 2	6

2.1	Life skills for professionals: positive thinking, right attitude, Experience, attention to detail, having the big picture, learning skills, research skills, setting goals and achieving them, perseverance, motivation, self-motivation, and motivating others,	1
2.2	IQ, EQ, and SQ, Collaboration, continuous learning, unlearning and relearning, cross cultural communication, social media etiquettes, Financial Literacy.	1
2.3	Time management: Prioritizing tasks, setting realistic goals and managing time effectively, work life balance.	1
2.4	Holistic Thinking: imagination, intuition, lateral thinking, Multiple intelligence, spirituality, family bonding, living peacefully.	1
2.5	Activity- Presentation, Group discussion.	2
	Module 3:	6
3.1	Leadership: Leadership traits, Styles of Leadership, VUCA Leadership, Transactional vs Transformational Leaders, managing diverse stakeholders, crisis management, Effective Leaders.	1
3.2	Group and Team Dynamics: Group vs Team, Team Dynamics, Virtual teams, managing team performance and managing conflicts, Intrapreneurship	1
3.3	Activity- Presentation, Group discussion	4
	Module 4:	6
4.1	Financial Literacy: Time value of money, power of compounding, Future value of a single cash flow.	1
4.2	Effective versus nominal rate, Future value of an annuity.	1
4.3	Present value of a single cash flow, Present value of an annuity.	1
4.4	Activity- Presentation, Group discussion	3

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

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

Course Outcome 3 (CO 3):

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

Course Outcome 4 (CO 4):

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

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24MC1T01

Course Name: LIFE SKILLS

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 5 marks.

1. Stress is the emotional or physical tension the body creates when presented with events or thoughts that cause worry, frustration, anger or nervousness. When stress exceeds the ability to cope, balance in the mind and body need to be restored. Discuss how stress management can act as an effective tool to accomplish this.
2. "The only limit to our realization of tomorrow is our doubts of today." – Franklin D. Roosevelt. Critically assess how cultivating positive thinking and maintaining a right attitude can transform professional challenges into opportunities for growth.
3. Discuss leadership styles that are effective for successful management of multicultural groups and teams.
4. Mr. Vinay plans to send his son for higher studies abroad after 10 years. He expects the cost of these studies to be Rs. 100000. How much should he save annually to have a sum of Rs. 100000 at the end of 10 years if the interest rate is 12 percent?

PART B

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

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

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

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

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

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

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

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

Preamble

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

Prerequisites

Nil

Course Outcomes

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

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

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern Assessment Pattern

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

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

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

SYLLABUS

MODULE 1 (5 hours)

Design Thinking Approach:

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

Developing concepts:

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

MODULE 2 (6 hours)

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

MODULE 3 (6 hours)

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

MODULE 4 (7 hours)

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

Text Books

1. Yousef Haik Tamer M Shahin, "Engineering design process", Course Technology, 2010.
2. Clive L Dym, Patrick Little Elizabeth J Orwin, "Engineering Design-A Project based Introduction", Wiley, 2014.
3. Don Norman, "The Design of Everyday Things", Basic Books; 2nd edition, 2013.
4. Christian Mueller-Roterberg, "Handbook of Design Thinking: Tips and Tools for how to design thinking", 2018.

Reference Books

1. Daniel Kahneman, "Thinking Fast and Slow", Farrar, Straus Giroux, 201.
2. Rod Judkins, "The art of Creative Thinking", Penguin Publishing Group, 2016.

3. Donella H Meadows, “Thinking in Systems”, Chelsea Green Publishing, 2008.

4. Tim Brown, “Change by Design”, HarperCollins, 2019.

5. V.N.Mittle & Arvind Mittal, ”Basic Electrical Engineering ” 2^{nd} Edition, McGraw Hill, 2006.

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	24 Hours
	Module 1	5
1.1	Design Thinking Approach: Introduction to Design Thinking; Iterative Design Thinking Process Stages: Empathize, Define, Ideate, Prototype and Test	1
1.2	The double-diamond Model of design by British Design Council	1
1.3	Developing concepts: Steps to develop concepts from functions	1
1.4	Brainstorming: Mechanism of brainstorming, Ideation	1
1.5	Creativity: How to increase level of creativity	1
	Module 2	6
2.1	Design Process: Requirements: Identifying customer needs and requirements, market analysis, defining goals	1
2.2	Product concepts: establishing functions, task specifications	2
2.3	Solution Concept: conceptualization, evaluating alternatives	1
2.4	Embodiment design; Analysis and optimization; experiment; marketing	1
2.6	Human centred design process	1
	Module 3:	6
3.1	Concepts Evaluation: Evaluating conceptual alternatives: Pugh’s Evaluation matrix, decision matrix with examples.	2
3.2	Prototypes, Models and Proofs of concepts	1
3.3	What is Prototype? Why Prototype? Building models and prototypes, Rapid Prototyping	1
3.4	Lean startup method for prototype development; Testing prototypes and models and proving concepts	2
	Module 4:	7

4.1	Ethics in Design: Understanding obligations, code of ethics, familiarity with several code of ethics such as ASCE, IEEE, VDI etc. code of ethics and moral frameworks	1
4.2	Challenges in Desing thinking	1
4.3	Design thinking case studies detailing the various aspects	5

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

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

Course Outcome 3 (CO 3):

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

Course Outcome 4 (CO 4):

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

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

FIRST SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24MC1T02

Course Name: DESIGN THINKING

Max. Marks: 50 Duration: 2 hours

PART A

Answer all questions. Each question carries 5 marks.

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

PART B

Answer any one question from each module.

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

OR

6. Summarize different stages of design thinking process using appropriate examples.. 8
7. Illustrate different phases of extensive prescriptive model of design process. 8

OR

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

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

OR

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

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

OR

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

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

Preamble

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

Prerequisites

Nil

Course Outcomes

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

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

Mapping of Course Outcomes With Program Outcomes

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

Mark Distribution

Total Marks	CIE Marks
50	50

Continuous Internal Evaluation Pattern

Attendance 10 marks
Regular assessment 40 marks

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

SYLLABUS

MODULE 1 (6 hours)

Yoga Lifestyle:

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

MODULE 2 (6 hours)

Physical fitness and exercise:

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

MODULE 3 (6 hours)

First aid:

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

MODULE 4 (6 hours)

Postures and nutrition:

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

Text Books

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

Reference Books

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

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	24 Hours
	Module 1	6
1.1	Meaning and importance of Yoga.Introduction-Asanas, Pranayama, Meditation and Yogic Kriyas.Yoga for concentration and related Asanas (Sukhasana; Tadasana; Padmasana and Shashankasana) Relaxation Techniques for improving concentration-Yog-nidra. Asanas as preventive measures.	2
1.2	Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana.	1
1.3	Obesity: Procedure, Benefits and contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.	1

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

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

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

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

Course Outcome 3 (CO 3):

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

Course Outcome 4 (CO 4):

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

MAR ATHANASIUS COLLEGE OF ENGINEERING

Government Aided, Autonomous Institution

Kothamangalam, Kerala, India

B.TECH ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER 2

SYLLABUS

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

Preamble:

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

Prerequisites: Nil

Course Outcomes:

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

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

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

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

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

End Semester Examination Pattern

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

SYLLABUS

MODULE 1 (Ordinary Differential Equations)

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

Homogenous linear differential equation of second order, superposition principle, general solution, homogenous linear ODEs with constant coefficients-general solution. Solution of Euler-Cauchy equations (second order only). Existence and uniqueness (without proof).

Non homogenous linear ODEs-general solution, solution by the method of undetermined coefficients(for the right hand side of the form x^n,e^{kx},$sinax$, $cosax$ and their linear combinations) , methods of variation of parameters. Solution of higher order equations-homogeneous and non-homogeneous with constant coefficients using method of undetermined coefficients.

MODULE 2 (Sequences and Series)

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

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

MODULE 3 (Fourier Series)

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

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

MODULE 4 (Fourier Transforms)

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

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

MODULE 5 (Laplace Transforms)

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

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

Text Books

1. H. Anton, I. Biven, S. Davis, "Calculus", Wiley, 10^{th} edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10^{th} edition, John Wiley& Sons, 2016.

Reference Books

3. J. Stewart, "Essential Calculus", Cengage,2^{nd} edition, 2017.
4. G.B. Thomas and R.L. Finney, "Calculus and Analytic geometry", 9^{th} Edition, Pearson, Reprint,2002.
5. Peter O Neil, "Advanced Engineering Mathematics", 7^{th} Edition, Thomson, 2007.
6. Louis C Barret, C Ray Wylie, "Advanced Engineering Mathematics", Tata McGraw Hill, 6^{th} edition, 2003.
7. Veerarajan T,"Engineering Mathematics for first year", Tata McGraw - Hill, 2008.
8. B.S. Grewal,"Higher Engineering Mathematics", Khanna Publishers, 43 Edition, 2015.
9. Ronald N. Bracewell, "The Fourier Transform and its Applications", McGraw – Hill International Editions, 2000.

COURSE CONTENTS AND LECTURE SCHEDULE

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

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

CO ASSESSMENT QUESTIONS

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

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

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

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

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

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

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

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

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

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

1. What is the inverse Laplace Transform of $\frac{3s+2}{(s-1)(s^2+2s+5)}$?
2. Find the Laplace Transform of:
   (i) $e^{-t}\sin^2 t$
   (ii) $\delta(t-a)$
3. Solve the differential equation $y'' + 4y = f(t)$, with initial conditions $y(0) = 1$ and $y'(0) = 0$, 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

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) $\sum_{k=1}^{\infty} (\frac{4k-5}{2k+1})^k$

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 $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots = \frac{\pi^2}{12}$. 7

    (b) Find the half range cosine series for $f(x) = (x-1)^2$in $0 \leq x \leq 1$. 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 $f(x) = \begin{cases} sinx & , 0 \leq x \leq \pi \\ 0 & , x > \pi \end{cases}$ 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

B24ES1T03A	COMPUTER AIDED ENGINEERING GRAPHICS	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	0	2	4	3	2024

Preamble

This course aims to equip students with the skills for precise technical communication using global standards. Through this course, students learn to proficiently use CAD software and interpret engineering drawings accurately. Emphasis is placed on conveying design intent and specifications effectively. By mastering these skills, students develop a critical eye for detail and enhance their ability to communicate complex engineering concepts visually. Ultimately, the course prepares students to excel in the global engineering landscape by fostering proficiency in graphical communication and CAD expertise.

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	Familiarize the tools and features of CAD software (Cognitive Knowledge Level: Understand)
CO 5	Prepare pictorial drawings using the principle of isometric projections and convert 3D views to orthographic views using CAD Software (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	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	1	1	1	2			1		2		1
CO 5	3	2	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	100	50	2 hours

Continuous Internal Evaluation Pattern

Attendance	20 marks
Continuous Assessment Test (2 numbers)	40 marks
Assignment/Class work	40 marks

Continuous Assessment Test 1 will have 20 marks and will be from Part A. Test 2 will be from Part B and will also carry 20 marks. Regarding Assignments/Class work, 15 marks will be awarded for Part A and the remaining 25 marks should be based on class works/assignments from Part B (minimum 5 exercises).

End Semester Examination Pattern

ESE will have questions only from Part A and with a duration of 2-hours. The exam will be for 50 marks and will have to be drawn on A4 size answer booklets. The question paper shall contain two parts; Part I contains three questions, one question each from the three modules, each carrying 12 marks. Part II contains two questions (from any of the three modules) carrying 14 marks each. The student has to answer all the three questions from Part I and any one question from Part II.

SYLLABUS

PART A

MODULE 1 (11 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 (10 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 both reference planes.

MODULE 3 (10 hours)

Sections of Solids:

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

Development of Surfaces:

Development of surfaces of the Prisms, Pyramids, Cone, Cylinder cut by different section planes.

PART B

MODULE 4 (6 hours)

Introduction to Computer Aided Drawing:

Role of CAD in design and development of new products, Advantages of CAD- Create a new drawing, Set model environment i.e., units, limits etc., Set interface settings e.g., snap, grid, ortho, Create and save an AutoCAD drawing template, Use zooming tools, Drawing commands as line, spline, circle, arc, rectangle, polygon, ellipse, Hatch a closed entity to represent sections, Erase & oops, Copy and Move objects, Rotate, Scale, Stretch Extend & Offset, Mirror and array, Apply Chamfers and Fillets, Edit polylines and spline, decurve, fit, thickness join & explode, Trim, break, explode, Create layers and assign properties as line weights, line types, colour, Modify status: On, Off, Freeze, Thaw, Lock, Unlock, Set layer current, Modify layer attributes, Text and Dimensions, Plotting, Extrusion.

MODULE 5 (8 hours) Isometric Projection using CAD:

Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder, Frustum of Pyramid, Frustum of Cone.

Conversion of Pictorial Views using CAD:
Creating two-dimensional drawing from pictorial views.

Text Books

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House Pvt. Ltd.
2. John, K.C. Engineering Graphics, Prentice Hall India Publishers.
3. K.N. Anilkumar, Engineering Graphics, Adhyuth Narayan Publishers.
4. P. I. Varghese, Engineering Graphics, Tata McGraw Hill Education.

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 Auto-CAD, 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
	Total Hours	45 Hours
	Module 1: Introduction and Orthographic projection of Points and Lines	11
1.1	Relevance of technical drawing in Engineering field. Types of lines, Dimensioning, BIS code of practice for technical drawing.	1
1.2	Concept of principle 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.	2
	Module 2: Orthographic projection of Solids	10
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.	3
2.4	Practice problems on solids inclined to both planes.	2
	Module 3: Sections of solids and development of surfaces	10
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.	3
3.3	Principle and development of simple solids.	2
3.4	Development of solids and sectioned solids.	3
	Module 4: Introduction to Computer Aided Drawing	6
4.1	Role of CAD in design and development of new products, Advantages of CAD	1
4.2	AutoCAD Fundamentals: Open, (and close) AutoCAD application, Create a new drawing, Set model environment ie units, limits etc, Set interface settings eg snap, grid, ortho, Create and save an AutoCAD drawing template.	1

4.3	Use zooming tools, Drawing commands as line, spline, circle, arc, rectangle, polygon, ellipse, Hatch a closed entity to represent sections, Erase & oops, Copy and Move objects, Rotate, Scale, Stretch Extend & Offset, Mirror and array, Apply Chamfers and Fillets, Edit polylines and spline, decurve, fit, thickness join & explode .	2
4.4	Trim, break, explode, Create layers and assign properties as line weights, line types, colour, Modify status: On, Off, Freeze, Thaw, Lock, Unlock, Set layer current, Modify layer attributes, Text and Dimensions, Plotting, Extrusion. .	2
	Module 5: Isometric Projection using CAD	8
5.1	Isometric View and Projections of Prisms, Pyramids, Cone, Cylinder.	3
5.2	Isometric View and Projections of Frustum of Pyramid, Frustum of Cone..	2
5.3	Creating two-dimensional drawing from pictorial views..	3

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 the given figure including dimensions using 2D software.

Course Outcome 5 (CO 5):

1. Draw Isometric views/projections of solids/combination of solidsusing modelling software.
2. Create 2D model using modelling software from the given 3D figure orfrom real 3D objects.

MODEL QUESTION PAPER

QP CODE: **Pages: 1**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24ES1T03A

Course Name: COMPUTER AIDED ENGINEERING GRAPHICS

Max. Marks: 50 Duration: 2 hours

Instructions: Retain construction lines.Show necessary dimensions.

PART I

Answer all questions. Each question carries 12 marks.

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.
2. 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.
3. 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.

PART II

Answer any one full question. Each question carries 14 marks.

4. 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.
5. A hexagonal prism of base edge 25 mm and height 60 mm is resting on one of its base edges on HP. Draw its projection if the rectangular face carrying that base edge is inclined 35^0 to HP and the base edge at which it is resting is inclined 40^0 to VP.

B24EC1T02	ELECTRICAL CIRCUIT THEORY	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		3	1	0	3	4	2024

Preamble

This course aims to equip the students with an understanding of basic circuit elements and enables the student to analyze electrical circuits.

Prerequisites

Nil

Course Outcomes

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

CO 1	Apply fundamental concepts and circuit laws to solve simple DC electric circuits [Understand , Apply]
CO 2	Develop and solve DC circuits using circuit analysis and network theorems [Apply, Analyze]
CO 3	Apply the fundamental laws of electrical engineering to solve simple ac circuits [Apply, Analyze]
CO 4	Analyze the complex impedance components and solve the ac circuits [Apply, Analyze]
CO 5	Examine the magnetic circuits and its working [Understand, Apply, Analyze]

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

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

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

SYLLABUS

MODULE 1 (7 hours)

Fundamental Concepts of Circuit Elements and Circuit variables: Charge, current, voltage, electromotive force and power. Resistors, Capacitors Inductors- terminal V-I relations.
Voltage and Current sources : Real and Ideal independent voltage and current sources, V-I relations, voltage and current division, source transformation, Star-Delta Transformation.

MODULE 2 (9 hours)

Voltage and Current Laws : Equivalent R,L,C in series and parallel combination, Kirchoff's Voltage Law, Kirchoff's Current Law, Mesh Analysis, Nodal Analysis, Thevinin's theorem and Norton's theorem.

MODULE 3 (10 hours)

Alternating current fundamentals : Generation of Alternating voltages-waveforms, Frequency, Period, RMS and average values, peak factor and form factor of periodic waveforms and composite waveforms, Numerical problems, Phasor Concepts, Complex representation (polar and rectangular forms) of sinusoidal voltages and currents, phasor diagrams, Average Power, Power factor.

MODULE 4 (9 hours)

Complex impedance: series and parallel impedances and admittances, Phasor analysis of series RL, RC, RLC circuits, active, reactive and apparent power, Simple numerical problems.
Basic Circuit Laws applied on AC circuits: Kirchhoff's current and voltage laws, mesh analysis and node analysis. Power and power factor – solution of RLC series and parallel circuits.

MODULE 5 (10 hours)

Magnetic Circuits : Magneto motive force, flux, reluctance, permeability -comparison of electric and magnetic circuits, analysis of series magnetic circuits, Parallel magnetic circuits,

numerical problems, self and mutual inductance – coupling coefficient. Transformer – principle of operation – EMF equation, losses and efficiency, Three phase system – generation of three phase voltage – star and delta system and its relation between line and phase voltages and currents – phasor representation of three phase system - balanced delta connected system.

Text Books

1. Engineering circuit analysis (Seventh Edition) by William H. Hayt, Jr., Jack E. Kemmerly, Steven M. Durbin.

2. Charles K Alexander and Mathew N O Sadiku,Fundamentals of Electric Circuits, Tata McGraw-Hill, 3rd Ed, 2009.

Reference Books

1. Kothari and Nagrath, Basic Electrical Engineering, Tata McGraw Hill, 2nd Edition, 2006.

2. Basic Electrical Engineering, SK Sahadev, Khanna Book Publishing .

COURSE CONTENTS AND LECTURE SCHEDULE

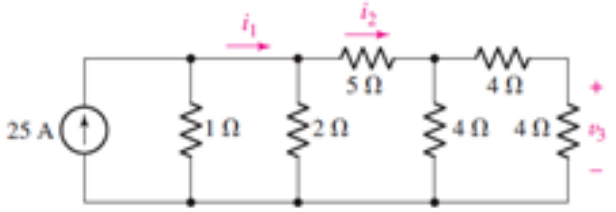
No	Topic	No of Lecture/Tutorial Hours
	Module 1	**7**
1.1	Fundamental Concepts of Circuit Elements and Circuit variables: Charge, current, voltage, electromotive force and power.	1
1.2	Resistors, Capacitors Inductors- terminal V-I relations.	1
1.3	Voltage and Current sources - Real and Ideal independent voltage and current sources, V-I relations	1
1.4	voltage and current division, source transformation	2
1.5	Star-Delta Transformation.	2
	Module 2	**9**
2.1	Equivalent R,L,C in series and parallel combination	2
2.2	Kirchoff's Voltage Law, Kirchoff's Current Law, Mesh Analysis	2
2.3	Nodal Analysis	2
2.4	Thevinin's theorem	2
2.5	Norton's theorem	1
	Module 3	**10**
3.1	Generation of Alternating voltages-waveforms, Frequency, Period, RMS and average values	2
3.2	Peak factor and form factor of periodic waveforms and composite waveforms	2
3.3	Numerical problems, Phasor Concepts	2
3.4	Complex representation (polar and rectangular forms) of sinusoidal voltages and currents phasor diagrams, Average Power, Power factor	4
	Module 4	**9**
4.1	Series and parallel impedances and admittances	1
4.2	Phasor analysis of series RL, RC, RLC circuits, active, reactive and apparent power, Simple numerical problems	4
4.3	Basic Circuit Laws applied on AC circuits: Kirchhoff's current and voltage laws, mesh analysis and node analysis	3
4.4	Power and power factor – solution of RLC series and parallel circuits.	1
	Module 5	**10**
5.1	Magnetic Circuits: Magneto motive force, flux, reluctance, permeability	1
5.2	Comparison of electric and magnetic circuits, analysis of series magnetic circuits, Parallel magnetic circuits, numerical problems	2
5.3	self and mutual inductance – coupling coefficient	2

5.4	Transformer – principle of operation – EMF equation, losses and efficiency	2
5.5	Three phase system – generation of three phase voltage – star and delta system and its relation between line and phase voltages and currents – phasor representation of three phase system - balanced delta connected system	3
	Total Hours	**45 Hours**

CO ASSESSMENT QUESTIONS

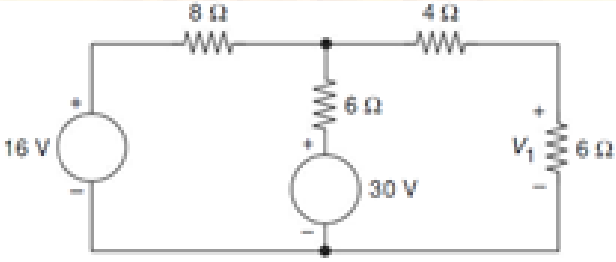
Course Outcome 1 (CO 1):

1. A capacitor is fabricated from two thin aluminum discs with 1 cm diameter separated by 150 m, with air in between. Calculate its capacitance. What voltage should be applied across this capacitor to store 1 mJ of energy?
2. Employing resistance combination and current division as appropriate, determine values for i_1,i_2,and v_3 in the circuit.

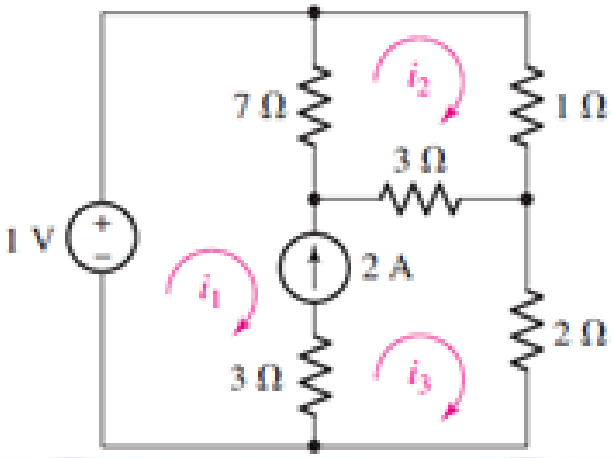


Course Outcome 2 (CO 2):

1. Find the voltage V_1 across the 6ohm resistance using (i) nodal method, and (ii) mesh method of circuit analysis.



2. Determine values for the three mesh currents

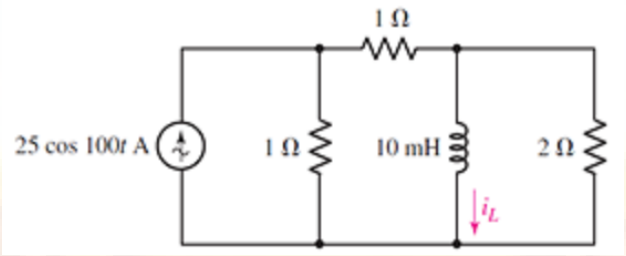


Course Outcome 3 (CO 3):

1. Find the average and rms value of a saw tooth waveform of period T seconds.
2. A coil connected to 100 V DC supply draws 10 and the same coil when connected to 100 V, AC voltage of frequency 50 Hz draws 5 A. Calculate the parameters of the coil and power factor.

Course Outcome 4 (CO 4):

1. A coil resistance 10 and inductance 0.14 H is connected in series with a capacitor of 150 F across a 200 V, 50 Hz supply. Calculate (i) inductive reactance, (ii) capacitive reactance, (iii) impedance, (iv) current, and (v) voltage across coil and capacitor.
2. Calculate the power dissipated in the 2 ohm resistor assuming there are no transients present. Express your answer in terms of a single sinusoidal function.



Course Outcome 5 (CO 5):

1. The design requirements of an 11000/415 V, 50 Hz single-phase core type transformer are approximate emf/turn 15 V, maximum flux density 1.5 T. Find suitable number of primary and secondary turns and net cross-sectional area of core.
2. A 230/110 V single-phase transformer has a core loss of 100 W. If the input under no-load condition is 400 VA, find core loss current, magnetizing current, and no-load power factor angle.

MODEL QUESTION PAPER

QP CODE: **Pages: 5**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B TECH DEGREE EXAMINATION, DECEMBER 2024

Course Code: B24EC1T02

Course Name: ELECTRICAL CIRCUIT THEORY

Max. Marks: 100 Duration: 3 hours

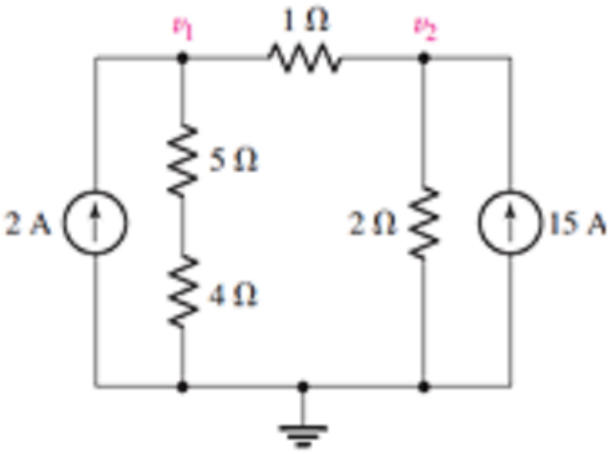
PART A

Answer all questions. Each question carries 4 marks

1. A battery is measured to have an open-terminal voltage of 14.2 V. When this voltage is connected to a 100 ohm load, the voltage measured between the terminals of the battery drops to 6.8 V. Determine the internal resistance of the battery.
2. A voltage source of V volts is connected to a current source of I amperes as shown. Find the power absorbed by the voltage source if V = -6V and I = 4 A.

3. Show how to combine four 100 ohm resistors to obtain an equivalent resistance of 60 ohm.

4. Find v_1 and v_2 using nodal analysis.

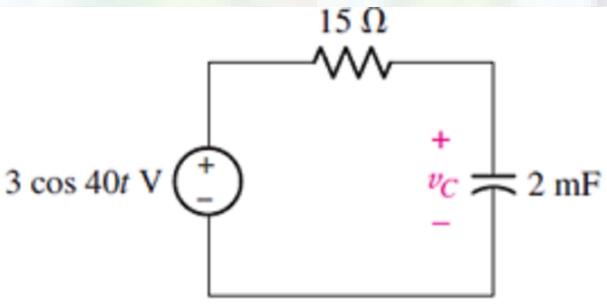


5. Our houses are supplied with alternating voltage whose instantaneous value is given by the equation $V = 325sin(\omega t)$, but we always say that AC voltage at home is 230 V. How do you explain this difference?

6. Distinguish between form factor and peak factor.

7. Define true power, apparent power, and reactive power and draw the power triangle.

8. Obtain an expression for v_c , in terms of a single sinusoidal function. You may assume all transients have died out long before t = 0.



9. A balanced three-phase system with a line voltage of 300 V is supplying a balanced Y-connected load with 1200 W a leading PF of 0.8. Find the line current.

10. The emf per turn for a single-phase 2310/220 V, 50 Hz transformer is approximately 13 volt. Calculate the number of primary and secondary turns.

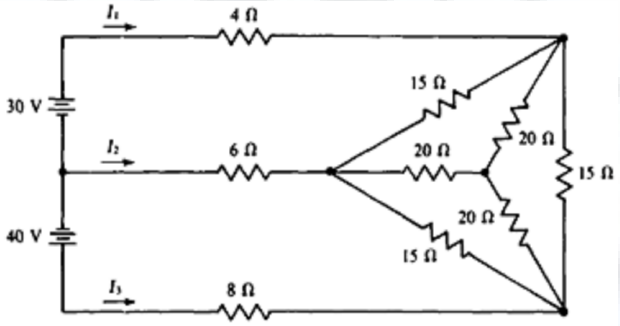
PART B

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

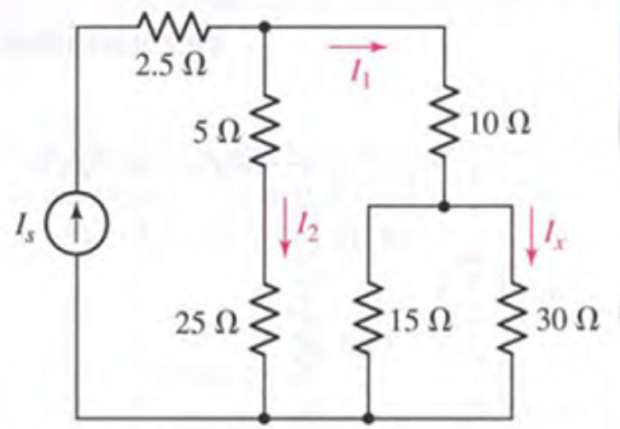
Module I

11. a) Find the power delivered by the 2A source to the rest of the circuit. (7 Marks)

b) Find the currents I_1, I_2, I_3 (7 Marks)

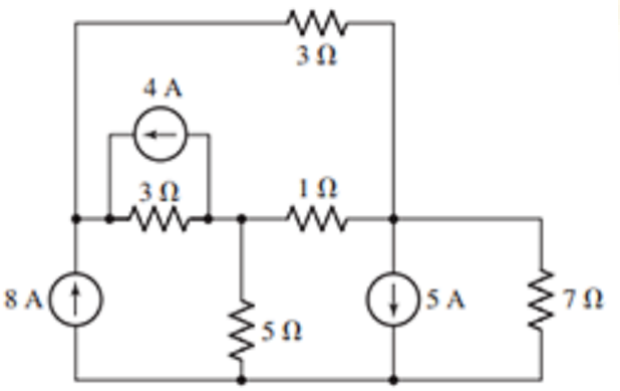


12. For the given circuit, find (i) I_x if I_1 is $12mA$ (ii) I_1 if I_x is $12mA$ (iii) I_x if I_2 is $15mA$ (iv) I_x if I_s is $60mA$ (14 Marks)

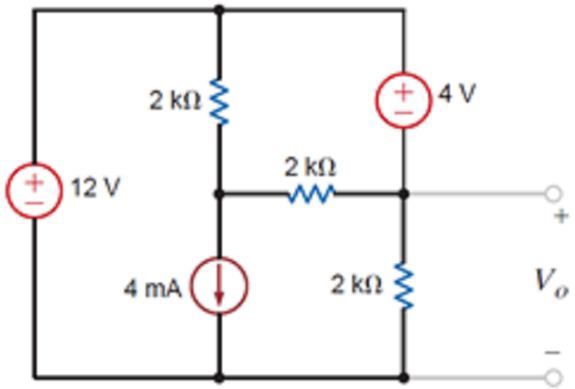


Module II

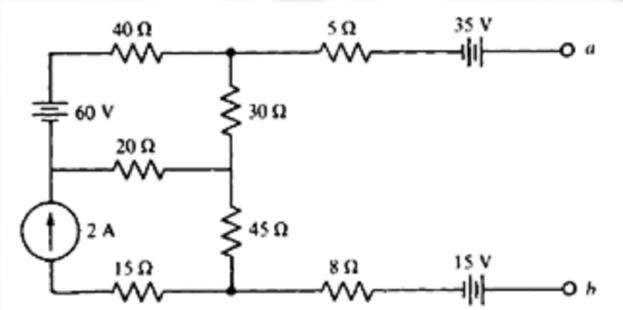
13. a) Determine the voltage across the 5 ohm resistor in the circuit and also calculate the power dissipated by the 7 ohm resistor. (8 Marks)



b) Find V_o using nodal analysis (6 Marks)



14. Determine the Thevenin and Norton equivalent circuit across the terminals a-b . (14 Marks)



Module III

15. a) Three sinusoidal voltages acting in series are given by $v_1 = 10sin(440t)$, $v_2 = 10\sqrt{2}sin(440t - 45^0)$, $v_3 = 20cos(440t)$.Find an expression for the resultant voltage, and then find its frequency and rms value. . (7 Marks)

b) Calculate the average value and rms value of a periodic current wave having values for equal time interval changing suddenly from one value to next: 0, 30, 45, 70, 90, 70, 45, 30, 0, -30, -45, -70, etc. in ampere. What would be the average and the rms value of a sine wave having the same peak value? (7 Marks)

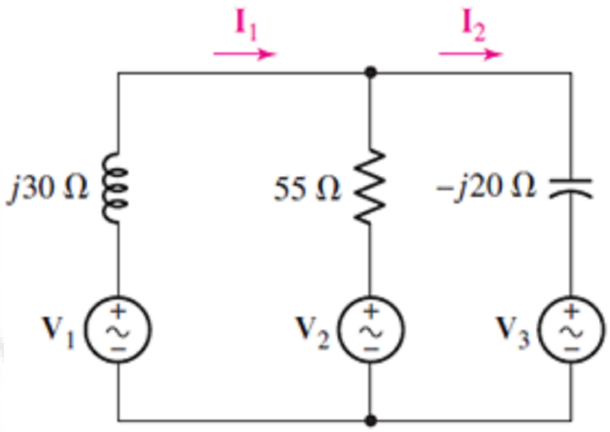
16. a) Find the rms value, average value, and form factor of the voltage waveform. . (7 Marks)

b) Two AC voltages $v_1(t) = 30sin(314t + 45°)$ and $v_2(t) = 60sin(314t + 60°)$ are kept in series. Find the resultant voltage $v(t)$ and express in the form $v(t) = V_msin(314t \pm \phi)$ (7 Marks)

Module IV

17. a) A coil having a resistance of 12 ohms and an inductance of 0.1 H is connected across a 100 V, 50 Hz supply. Calculate the (i) reactance and impedance of the coil, (ii) current, (iii) phase difference between the current and the applied voltage, and (iv) power factor. Draw also the phasor diagram showing voltage and current. (8 Marks)

b) Find I_1 and I_2 given $V_1 = 10\angle -80°V$, $V_2 = 4\angle -0°V$ and $V_3 = 2\angle -23°V$. (6 Marks)

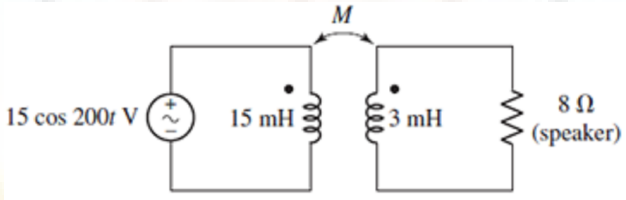


18. An inductive coil takes 10 A and dissipates 1,000 W when connected to a 250 V, 25 Hz supply. Calculate the (i) impedance, (ii) effective resistance, (iii) reactance, (iv) value of the capacitance required to be connected in series with coil to make the power factor of the circuit unity, and (vi) current taken by the coil after connecting capacitor. Further, draw the phasor diagram of the two cases. (14 Marks)

Module V

19. a) Three 100 ohm resistors are connected first in star and then in delta across 415 V, three-phase supply. Calculate the line and phase currents in each case and also the power taken from the source. (7 Marks)

    b) For the below circuit, determine for what value of M results in 1 W of average power being delivered to the speaker? (7 Marks)



20. a) A three-phase, 400 V supply is connected to a three-phase star-connected balanced load. The line current is 20 A and the power consumed by the load is 12 kW. Calculate the impedance of the load, phase current, and power factor. (7 Marks)

    b) Estimate the number of AT necessary to produce a flux of 1,00,000 lines round an iron ring of $6cm^2$ cross section and 20 cm mean diameter having an air gap 2 mm wide across it. The permeability of the iron may be taken as 1,200. Neglect the leakage flux outside the 2 mm air gap. (7 Marks)

B24EC1T03	Logic Circuit Design	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		2	1	0	2	3	2024

Preamble:

The objective of the course is to 1) familiarize students with the basic concepts of Boolean algebra and digital systems 2) enable students to design simple combinational and sequential logic circuits 3) familiarize the representation of Binary and BCD (Binary Coded Decimal) numbers which in turn are helpful in understanding organization & design of a computer system.

Prerequisites:

NIL

Course Outcomes:

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

CO 1	Compare various positional number systems and binary codes (Cognitive Knowledge Level : Understand)
CO 2	Simplify a given Boolean Function and design a combinational circuit to implement the simplified function using logic gates (Cognitive Knowledge Level : Understand)
CO 3	Learn to analyze and understand the behavior of combinational digital circuits (Cognitive Knowledge Level : Apply)
CO 4	Design a sequential logic circuit using the basic building blocks like flip-flops (Cognitive Knowledge Level : Apply)
CO 5	Compare different logic families with respect to efficiency and performance (Cognitive Knowledge Level : Understand)

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (% Marks)	**Test 2 (% Marks)**	
Remember	10	10	10
Understand	20	20	30
Apply	20	20	60
Analyse			
Evaluate			
Create			

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

End Semester Examination Pattern

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

SYLLABUS

MODULE 1 (7 hours)

Number Systems

Decimal, Binary, Octal and Hexadecimal Number Systems- Number Base Conversions. Addition, Subtraction, Multiplication and Division of binary numbers. Addition and subtraction of BCD, Octal and Hexadecimal numbers. Representation of negative numbers- Complements, Subtraction with complements. Binary coded decimal codes; Gray codes; Excess 3 code. Alphanumeric codes: ASCII.

MODULE 2 (8 hours)

Boolean Algebra and Karnaugh Maps

Postulates of Boolean Algebra. Basic theorems and Properties of Boolean Algebra. Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS) - Canonical and Standard forms. Simplification of Boolean Functions- Using Karnaugh- Map Method (upto five variables), Don't care conditions, Product of sums simplification, Tabulation Method.

MODULE 3 (8 hours)

Combinational Circuits

Combinatorial Logic Systems - Binary adders and subtractors-Half adder, Full adder, Half Subtractor, Full Subtractor, Binary Parallel adder, Carry look ahead adder, BCD adder, Comparators – one bit and two bit, Multiplexers-Implementation of combinational circuits using Multiplexers, Demultiplexers, Encoder, Decoder, Code converter-Binary to Gray, BCD to Excess 3.

MODULE 4 (7 hours)

Sequential Circuits

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Conversion of Flipflops, Excitation table and characteristic equation. Shift registers-SIPO, SISO, PISO, PIPO. Shift Registers with parallel Load/Shift, Ring counter and Johnsons counter. Asynchronous and Synchronous counter design, Mod N counter, Up- down counter, BCD counter.

MODULE 5 (6 hours)

TTL and CMOS

TTL, ECL, CMOS - Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product. TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation; Structure and operations of TTL and CMOS gates; NAND in TTL, NAND and NOR in CMOS.

Text Books

1. M. Morris Mano, Digital Logic and Computer Design, 4/e, Pearson Education, 2013
2. Thomas L Floyd, Digital Fundamentals, 10/e, Pearson Education, 2009.
3. D.V. Hall, "Digital Circuits and Systems", Tata McGraw Hill, 1989
4. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009

Reference Books

5. M. Morris Mano, Michael D Ciletti , Digital Design With An Introduction to the Verilog HDL, 5/e, Pearson Education, 2013.
6. Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003.
7. W.H. Gothmann, "Digital Electronics – An introduction to theory and practice", PHI, 2nd edition ,2006
8. Wakerly J.F., "Digital Design: Principles and Practices," Pearson India, 4th 2008
9. A. Ananthakumar, "Fundamentals of Digital Circuits", Prentice Hall, 2nd edition, 2016
10. Fletcher, William I., An Engineering Approach to Digital Design, 1st Edition, Prentice Hall India, 1980

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
	Total Hours	36 Hours
	Module 1 (Number Systems)	7 hours
1.1	Decimal, Binary, Octal and Hexadecimal Number Systems- Number Base Conversions.	2 hour
1.2	Addition, Subtraction, Multiplication and Division of binary numbers.	1 hours
1.3	Addition and subtraction of BCD, Octal and Hexadecimal numbers.	1 hours
1.4	Representation of negative numbers- Complements, Subtraction with complements.	2 hours
1.5	Binary coded decimal codes; Gray codes; Excess 3 code. Alphanumeric codes: ASCII.	1 hours
	Module 2 (Boolean Algebra and Karnaugh Maps)	8 hours
2.1	Postulates of Boolean Algebra. Basic theorems and Properties of Boolean Algebra. .	2 hours
2.2	Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS) - Canonical and Standard forms.	2 hours
2.3	Simplification of Boolean Functions- Using Karnaugh- Map Method (upto five variables), Don't care conditions	2 hour
2.4	Product of sums simplification, Tabulation Method.	2 hours
	Module 3 (Combinational Circuits)	8 hours

3.1	Combinatorial Logic Systems - Binary adders and subtractors -Half adder, Full adder, Half Subtractor, Full Subtractor	2 hours
3.2	Binary Parallel adder, Carry look ahead adder, BCD adder	2 hours
3.3	Comparators – one bit and two bit, Multiplexers-Implementation of combinational circuits using Multiplexers	2 hours
3.4	Demultiplexers, Encoder, Decoder, Code converter-Binary to Gray, BCD to Excess 3.	2 hours
	Module 4 (Sequential Circuits)	7 hours
4.1	Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Conversion of Flipflops, Excitation table and characteristic equation.	3 hours
4.2	Shift registers-SIPO, SISO, PISO, PIPO., Shift Registers with parallel Load/Shift, Ring counter and Johnsons counter.	2 hours
4.3	Asynchronous and Synchronous counter design	2 hours
4.4	Mod N counter, Up- down counter, BCD counter	2 hours
	Module 5 (TTL and CMOS)	6 hours
5.1	TTL, ECL, CMOS - Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product.	2 hours
5.2	TTL inverter - circuit description and operation; CMOS inverter - circuit description and operation;	2 hours
5.3	Structure and operations of TTL and CMOS gates; NAND in TTL, NAND and NOR in CMOS.	2 hours

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Perform the mentioned base conversions for the following numbers. (i) (563.8125)10 to binary (ii) (78.89)10 to octal (iii) (EC.4)16 to decimal
2. Perform the following operations (i)E8AE16-C86516 (ii) A4758-86348

Course Outcome 2 (CO 2):

1. Simplify the function F(A,B,C,D)=Σ(0,1,2,8,12,13,14)+d(3,5,10,15) using Karnaugh map.
2. Express F=(XY+Z)(Y+XZ) in both canonical forms.

Course Outcome 3 (CO 3):

1. Design a BCD to Excess-3 Code Convertor.
2. Implement the following using an 8x1 multiplexer F(A, B, C, D) = Σ m (0, 1, 3, 5, 6, 7, 8, 9, 11, 13, 14)

Course Outcome 4 (CO 4):

1. Design a 4-bit binary asynchronous counter using JK flipflops. Give the state diagram and logic diagram.
2. With a circuit diagram, explain the working of master-slave JK flip-flop.

Course Outcome 5 (CO 5):

1. 1. Define the terms noise margin, propagation delay and power dissipation of logic families. Compare TTL and CMOS logic families showing the values of above-mentioned terms.
2. Draw the circuit and explain the operation of a TTL NAND gate.

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, MAY2025

Course Code: B24EC1T03

Course Name: LOGIC CIRCUIT DESIGN

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Convert the hexadecimal number 2FC3 into binary and decimal.
2. The 2's complement representation of a binary number is 10101100. (i) Determine its decimal value. (ii) Represent it in 1's complement form.
3. Find the dual and complement of the boolean function F = AB'+ B(A + B').
4. Prove that x(x+y) = x using Boolean algebra postulates and rules.
5. Realize a one-bit comparator.
6. Explain the working of a decoder.
7. What is race around condition?
8. Write the excitation table and characteristic equation of SR flip-flop.
9. Define fan-in and fan-out of logic circuits.
10. Draw the circuit of a CMOS inverter and explain its working.

PART B

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

1. (a) Perform the subtraction 43.5 – 67.25 using 1) 2's complement 2)1's complement 8

   (b) Convert the following numbers to the base indicated:
   i. (1234)8 to base 10.
   ii. (23.875)10 to base 2.
   iii. (EC.5)H to base 8 6

OR

2. (a) Solve the following binary arithmetic. 1) 36.25 - 98.625 (using 1's complement) 2) 53.5 – 29.25 (using 2's complement) 8

   (b) Perform the following operations (i) (520)8 + (488)8 (ii) (520)H − (488)H 6

3. (a) Minimize the following using K Map
   i. f = Σm (1, 3, 4, 6, 8, 9, 11, 13, 15) + Σd(0,2,14)
   ii. f = ΠM (0,2,8,9,12,13,15)
   iii. f = Σm (0,4,5,6,8,9,10,11,16,20,22,24,25,26,27) 12

   (b) State and prove De Morgan's theorem. 2

OR

4. (a) Simplify the following Boolean function, f(A,B,C,D)= m(2,6,8,9,10,11,14,15) using Quine-McCluskey tabular method. 10

   (b) Prove that ABC + A'+AB'C = A' + C 4

5. (a) Design a 4-bit BCD adder and draw the block diagram. 8

   (b) Implement full adder using 8:1 Multiplexer. 6

OR

6. (a) Design a 4 bit Binary to Gray code converter. 10

   (b) Implement half adder using decoder. 4

7. (a) Design a Mode 14 Synchronous UP counter using JKFlip-flop 10

   (b) Explain the working of a 4 bit PISO register. 4

OR

8. (a) Design a Mod 7 Asynchronous UP counter with timing diagram 6

   (b) Design Mod 8 Synchronous UP/DOWN counter using T Flip-flop. 8

9. (a) Explain in detail about TTL with open collector output configuration 7

   (b) Draw an ECL basic gate and explain. 7

OR

10. (a) Describe the working of a 3 bit TTL NAND gate in totem pole configuration. 8

    (b) Compare the characteristics features of TTL and ECL digital logic families. 6

B24EC1T04	ANALOG CIRCUITS 1	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		3	1	0	3	4	2024

Preamble

This course aims to equip

1. The students with an understanding of fundamental theory of electronic circuits using diodes and transistors.
2. Familiarization of data sheets, design of discrete electronic circuits and analyze the circuit performance.
3. Familiarize different circuit realization and application using diodes, BJT and FET transistors.

Prerequisites

Nil

Course Outcomes

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

CO 1	Understand the different diodes, diode circuits and applications
CO 2	To study regulated power supplies
CO 3	Design transistor modelling and design amplifiers
CO 4	Understand feedback in BJT amplifiers and improvement in performance
CO 5	Study and analyse different sinusoidal oscillators

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	3	3	2									2
CO 4	3	3	2									2
CO 5	3	3	2									2

Assessment Pattern

Bloom's Category	**Continuous Assessment**		**End Semester Examination (% Marks)**
	Test 1 (%Marks)	**Test 2 (%Marks)**	
Remember	15	15	30
Understand	25	25	50
Apply	10	10	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 mark and can have maximum 2 sub- divisions

SYLLABUS

MODULE 1

Diode basics: Semiconductor diode, Biasing, Diode current equation, Characteristics, Static and Dynamic resistance, Diode equivalent circuit.

Wave shaping circuits: Sinusoidal and non-sinusoidal wave shapes, Principle and working of RC differentiating and integrating circuits, Clipping circuits - Positive, negative and biased clipper. Clamping circuits - Positive, negative and biased clamper.

MODULE 2

Regulated power supplies: Half wave and Full wave rectifiers: Centre tapped transformer and bridge circuits and waveforms. PIV of the diode, simple zener voltage regulator, series and shunt voltage regulator, 3 pin regulators-78XX and 79XX, block diagram and working of SMPS.

MODULE 3

Bipolar Junction Transistors (BJTs Basic construction and operation, Transistor configurations- Common Base, Common Emitter and Common Collector, Transistor currents and relation of and , Transistor amplifying action, detailed study of common emitter characteristics, Input- Output characteristics.

BJT amplifiers: DC biasing of BJT: Operating (Q) point, Load line analysis, Fixed Bias circuit, Emitter biased circuit, Voltage divider biased circuit. Bias stabilisation, Stability factor.

MODULE 4

Feedback Amplifiers: Feedback connection types, Effect of Gain and bandwidth with feedback, hybrid Π and T models of BJT, Zi, Zo, Av, Ai of different feedback amplifiers.

MODULE 5

Oscillators: Classification, criterion for oscillation, RC phase shift oscillator, Wien bridge oscillator, Derivation of gain and frequency of oscillations. Tuned Oscillator circuits: Basics of resonant circuit oscillator, Colpitts and Hartley oscillators, Crystal oscillators: Series and parallel resonance of quartz crystal.

Text Books

1. Robert Boylestad, Electronic Devices and Circuit Theory, Prentice Hall 7th Edition or latest

2. Thomas L Floyd, Electronic Devices, Pearson Education 7th Edition or latest .

Reference Books

1. Integrated Electronics , Millman and Halkias, Mc Graw Hill Publications

2. Razavi B., "Fundamentals of Microelectronics", Wiley, 2015

3. Neamen D., "Electronic Circuits, Analysis and Design", 3/e, TMH, 2007

COURSE CONTENTS AND LECTURE SCHEDULE

No	Topic	No of Lecture/Tutorial Hours
1	Semiconductor diode, Biasing, Diode current equation	**1**
	Characteristics, Static and Dynamic resistance, Diode equivalent circuit1	**1**
	Sinusoidal and non-sinusoidal wave shapes.	**1**
	Principle and working of RC differentiating and integrating circuits.	**2**
	Clipping circuits - Positive, negative and biased clipper.2	**2**
	Clamping circuits - Positive, negative and biased clamper.	**2**
2	Half wave and Full wave rectifiers: Centre tapped transformer and bridge circuits and waveforms. PIV of the diode.	**3**
	Simple zener voltage regulator, series and shunt voltage regulator.	**3**
	3 pin regulators-78XX and 79XX, block diagram and working of SMPS.	**3**
3	Basic construction and operation	**1**
	Transistor configurations- Common Base, Common Emitter and Common Collector	**1**
	Transistor currents and relation of α and β Transistor amplifying action.	**2**
	Detailed study of common emitter characteristics, Input-Output characteristics.	**1**

	DC biasing of BJT: Operating (Q) point, Load line analysis,2.	**2**
	Fixed Bias circuit, Emitter biased circuit, Voltage divider biased circuit.	**1**
	Bias stabilisation, Stability factor.	**1**
4	Feedback connection types.	**3**
	Effect of Gain and bandwidth with feedback.	**1**
	Hybrid Π and T models of BJT.	**1**
	Zi, Zo, Av, Ai of different feedback amplifiers.4.	**4**
5	Classification, criterion for oscillation.	**2**
	RC phase shift oscillator, Wien bridge oscillator, Derivation of gain and frequency of oscillations.	**2**
	Tuned Oscillator circuits: Basics of resonant circuit oscillator, Colpitts and Hartley oscillators.	**3**
	Crystal oscillators: Series and parallel resonance of quartz crystal.	**2**

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

1. Analyse static and dynamic characteristics of pn junctions.
2. Describe the Forward bias and reverse bias in diodes.
3. Describe clipping and clamping using diodes.

Course Outcome 2 (CO 2):

1. Compare the performance of Half wave and Full wave rectifiers.
2. Explain the working of SMPS.

Course Outcome 3 (CO 3):

1. Explain the need of DC biasing of BJT and how operating (Q) point is fixed.
2. How Voltage divider biased circuit is designed in CE transistor circuit.
3. Describe BJT small signal ac analysis.

Course Outcome 4 (CO 4):

1. Which are the different types of feedback amaplifiers?
2. What is the effect of negative feedback in the gain and bandwidth of an amplifier?

Course Outcome 5 (CO 5):

1. Explain the concept of Barkhausen criteria to convert the amplifier as an oscillator.
2. Derive the frequency of oscillations of RC phase shift and Wien bridge oscillator.
3. Describe the resonant circuit operation for Hartley and Colpitts oscillators.

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: B24EC1T04

ANALOG CIRCUITS 1

Max. Marks: 100 Duration: 3 hours

PART A

Answer all questions. Each question carries 3 marks.

1. Draw the dynamic and static resistance of a forward biased diode.
2. Design and draw a positive clipped diode circuit at 3 V level, given Sinewave input at 10 kHz $10V_{pp}$.
3. Derive the expression for PIV of the diode in half wave rectifier.
4. Draw and explain the block diagram of SMPS.
5. How the term "transistor" is formed from "transfer resistor" term.
6. Obtain the relation between α and β in npn transistor.
7. Enumerate different feedback amplifiers.
8. Draw and explain hybrid Pi model of BJT.
9. Show that Aβ=1 in a transistorized oscillator circuit.
10. Draw the circuit diagram of a Colpitts Oscillator.

PART B

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

11. a. Design and draw the circuit diagram of a Clamper circuit with clamping levels at +5 V . Given a sinewave input at 1 kHz 5Vpp. Draw the input and output waveforms to scale. 7

    b. Design and draw the circuit diagram of a Trapezoidal clipper circuit with clipping levels at +3 V and -4V. Given a sinewave input at 1 kHz 12Vpp. Draw the input and output waveforms to scale. 7

OR

12. a. Write down the diode current equation and explain its components. Explain the dynamic and static resistance and represent them in V-I characteristics. 7

    b. Describe the operation of an RC integrated circuit. Derive the expression for the transfer function of the same. 7

13. a. Draw a simple Zener regulator circuit and explain its working. How Zener diode differs from conventional diodes in its operation. 7

    b. Design a Full wave rectifier circuit with a capacitor filter using a center tapped transformer with following specifications. Given Vdc =12V, Ripple voltage < 100mV. Draw the circuit diagram and input output waveforms. 7

OR

14. a. With neat block diagram explain the working of SMPS. 7
    b. Design a half wave rectifier circuit with a capacitor filter using a center tapped transformer with following specifications. Given Vdc =12V, Ripple voltage < 100mV. Draw the circuit diagram and input output waveforms. 7

15. a. Explain with necessary diagrams, the common base npn transistor configuration and show that output current is less than input current. 7

    b. Explain the term "Early effect" with the representation in V-I characteristics of a common emitter transistor configuration. 7

OR

16. a. Draw the basic constructional features of a npn transistor and explain the current components and its relations. 7
    b. Draw the V-I output characteristics of CE transistor configuration and explain the linear region of operation. 7

17. a. Derive the transfer function of a current series feedback amplifier. 7

    b. Derive the input and output impedances of current amplifier. 7

OR

18. a. Derive the transfer function of a voltage shunt feedback amplifier. 7

    b. Derive the input and output impedances of voltage amplifier. 7

19. a. Describe the Barkhausen criteria in converting an amplifier to a sinusoidal oscillator. 7

    b. Draw the circuit diagram of an RC phase shift oscillator and derive the expression for gain of the circuit. 7

OR

20. a. Draw the basic circuit and principle of a resonant circuit oscillator and explain its operation. 7

    b. Draw and explain a Wienbridge oscillator circuit with appropriate waveforms. How sustainable oscillations are maintained based on Barkhausen criteria. 7

B24EC1L01	BASIC ELECTRONICS LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

The following experiments are designed to understand the basic building components of Electronics and evaluate and select appropriate device for various projects/product design.

Prerequisite :Nil

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

CO 1	Make different wave shaping circuits and design DC power supplies **(Apply, Analyze)**.
CO 2	Assess the location of Q point from V-I characteristics and predict the amplifier characteristics **(Apply, Analyze)**
CO 3	Understand different amplifier configurations and analyze the gain parameters. **(Apply, Analyze)**.
CO 4	Assemble different sinusoidal oscillators suitable for various applications. **(Apply, Analyze)**.
CO 5	Evaluate the performance characteristics of FET devices and compare with BJT devices. **(Apply, Analyze)**.

Mapping of Course Outcomes With Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	2	2	0	0	0	3	1	0	3
CO 2	3	3	3	2	2	0	0	0	3	1	0	2
CO 3	3	3	3	1	2	0	0	0	3	1	0	2
CO 4	3	3	3	1	2	0	0	0	3	1	0	2
CO 3	3	3	3	2	2	0	0	0	3	1	0	2

Mark Distribution

Continuous Internal Evaluation Pattern

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

SYLLABUS

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

LIST OF EXPERIMENTS

(All experiments require appropriate design, development of circuit diagrams, plotting waveforms, graphs and necessary calculations wherever necessary)

1	Diode Experiments: Plotting forward bias, Finding dynamic and static resistance .
2	Zener diode biasing: Plotting forward and reverse bias. Simple voltage regulator circuit and output plotting.
3	Diode circuit applications: Wired gate, Clipping and Clamping circuits with fixed and variable voltage levels, Zener diode clippers
4	DC Power Supplies: Half wave and full wave rectifiers with and without capacitor filters,
5	Experiments on CE and CB npn transistor configurations. Determination of α and β
6	Common Emitter (npn) transistor characteristics, determination of Q point
7	RRC Coupled amplifier, Design and implementation, Record of Frequency response, Determination of bandwidth. Transistor switch operation and waveforms.
8	Cascading of amplifiers, Product of gain
9	Design and implementation of RC phase shift and Wien bridge oscillators
10	Design and implementation of Hartley and Colpitts oscillators.
11	Determination of V-I characteristics JFET. Ohmic region and Active Linear regions, Determination of g_m

Reference Books

1. Robert Boylestad, Electronic Devices and Circuit Theory, Prentice Hall 7th Edition or latest

B24EC1L02	SCIENTIFIC COMPUTING LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	3	3	2	2024

Preamble

The following experiments are designed to translate the mathematical concepts into system design. The students shall use Python for realization of experiments. Other softwares such as R/MATLAB/SCILAB/LabVIEW can also be used.

Prerequisite

Linear Algebra and Multi Variable Calculus

Course Outcomes

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

CO 1	Describe the needs and requirements of scientific computing and to familiarize one programming language for scientific computing and data visualization (Cognitive Knowledge Level : Apply).
CO 2	Approximate an array/matrix with matrix decomposition (Cognitive Knowledge Level : Apply).
CO 3	Implement numerical integration and differentiation (Cognitive Knowledge Level : Apply).
CO 4	Solve ordinary differential equations for engineering applications (Cognitive Knowledge Level : Apply).
CO 5	Simulate random processes and understand their statistics (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	3	3	2	3				3	1		3
CO 2	3	3	1	2	3				3			1
CO 3	3	3	1	1	3							1
CO 4	3	3	1	1	3							1
CO 5	3	3	2	2	3				3	1		1

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

SYLLABUS

LIST OF EXPERIMENTS

1	Find the factorial of a given number and display the output.
2	Find the sum of n numbers and display the output.
3	Display Fibinocci series.
4	Display the factors of a given number.
5	Input a row array and column array. Input a square matrix. Find the rank, inverse, transpose, determinant and eigen values of the matrix. Plot the real and imaginary values of eigen vectors.
6	Input a complex number in each quadrant. Find the absolute value, real and imaginary values, argument in degrees. Also perform arithmetic operations using complex numbers.
7	Realize the functions sint, cost, sinht, cosht for the vector a. t = [0, 10] with increment 0.01. b. t =[-4*pi, 4*pi] with increment 0.01*pi Compute the first and second derivatives of these functions. Plot the first derivatives of the above functions in a single window. .
8	Write a program to return the first and second derivative of the function f(t) = 3t4 + 5 for the vector t = [-3; 3].
9	Write a program to return the value of an integral function
10	Write a program to return the value of an integral function using Trapezoidal and Simpson method.
11	Implement and plot the functions using stem plots, line plots, box plots, bar plots and scatter plots. Create legends in plots. f(t) = cos t f(t) = cos t cos 5t + cos 5t
12	Obtain the histogram of a given data and plot it.
13	Simulate a coin toss that maps a head as 1 and tail as 0. Toss the coin N = 100, 500,1000 and 5000 times and compute the probability (p) of head in each case. Compute the absolute error in each case and plot against N and understand the law of large numbers.

14	Create a uniform random vector with maximum magnitude 10, plot and observe. Set a threshold and Count how many times the function has gone above and below the threshold.
15	Write and execute a function to toss three fair coins simultaneously. Compute the probability of getting exactly two heads for 100 and 1000 number of tosses.
16	Write a program to solve the first order and second order differential equation.
17	Two dice are rolled 50 times. Count the occurrence of 5 in both dice.
18	Obtain the sum of the series $f = 1^2 + 2^2 + 3^2 + 4^2 + ...$ such that the sum does not exceed 1000.The program should display how many terms are used in the sum.

Reference Books

1. Holly Moore, MATLAB for Engineers, Pearson.
2. William Palm, MATLAB for Engineering Applications, McGraw Hill.

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

Preamble

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

Prerequisite

Nil

Course Outcomes

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

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

Mapping of Course Outcomes With Program Outcomes

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

Assessment Pattern

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

Mark Distribution

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

Continuous Internal Evaluation Pattern

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

Regular assessment

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

End Semester Examination Pattern

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

SYLLABUS

MODULE 1 (9 hours)

Communication Process

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

MODULE 2 (9 hours)

Professional discipline

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

MODULE 3 (9 hours)

Fundamentals of Ethical Engineering

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

MODULE 4 (9 hours)

Professional Responsibility in a Global Context

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

Text Books

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

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

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

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

Reference Books

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

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

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

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

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

COURSE CONTENTS AND LECTURE SCHEDULE

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

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

CO ASSESSMENT QUESTIONS

Course Outcome 1 (CO 1):

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

Course Outcome 2 (CO 2):

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

Course Outcome 3 (CO 3):

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

Course Outcome 4 (CO 4):

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

Course Outcome 5 (CO 5):

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

MODEL QUESTION PAPER

QP CODE: **Pages: 2**

Reg.No.: .....

Name: .....

MAR ATHANASIUS COLLEGE OF ENGINEERING (AUTONOMOUS), KOTHAMANGALAM

SECOND SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2025

Course Code: B24MC1T03

Course Name: PROFESSIONAL COMMUNICATION AND ETHICS

Max. Marks: 50 Duration:2 hours

PART A

Answer all questions. Each question carries 5 marks.

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

PART B

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

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

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

OR

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

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

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

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

OR

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

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

B24MC1L02	IDEA LAB	L	T	P	S	CREDIT	YEAR OF INTRODUCTION
		0	0	2	2	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.