NEW HORIZON
COLLEGE OF ENGINEERING

DEPARTMENT OF APPLIED SCIENCES

SCHEME & SYLLABUS OF FIRST YEAR BE

AS PER THE NATIONAL EDUCATION POLICY 2020

(COMMON TO ALL BRANCHES)

ACADEMIC YEAR 2024-25

NEW HORIZON
COLLEGE OF ENGINEERING

NEW HORIZON COLLEGE OF ENGINEERING

VISION

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

MISSION

To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

To encourage long-term interaction between the academia and industry through their involvement in the design of the curriculum and its hands-on implementation.

To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

QUALITY POLICY

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at a global level.

VALUES

Academic Freedom
Innovation
Integrity
Professionalism
Inclusiveness
Social Responsibility

DEPARTMENT OF APPLIED SCIENCES

VISION

To build strong and sustainable platform for churning out quality students bearing appreciable conceptual knowledge and engineering mind sets to their respective branch department(s)

MISSION

To develop and nurture dedicated teaching-learning team equipped with strong personality traits towards application driven approach, encompassing all stakeholders

QUALITY POLICY

To provide education services of the highest quality both curricular and co-curricular so that our students can integrate skills and serve industry and society equally well at the Global level.

Program Outcomes as defined by NBA (PO)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

CREDIT SCHEME FOR I SEMESTER BE

AIML/ ECE/DS/ME												Chemistry Cycle		
S. No.	**Course and Course Code**		**Course Title**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	ASC	24MAT11	Applied Mathematics for Engineers – I	AS	2	1	1	0	4	2+2+2	50	50	100
2	ASC	24CHE12	Applied Chemistry for Engineers	AS	3	0	1	0	4	4+2	50	50	100
3	ESC-I	24ESC132/ 24ESC133	Basic Electrical Engineering(AIML/ECE/DS) Basic Mechanical Engineering(ME)	EEE / ME	3	0	0	0	3	4	50	50	100
4	PLC-I	24PLC141	Problem solving using python	CS	2	0	1	0	3	3+2	50	50	100
5	ESC	24CAD15	Computer Aided Engineering Drawing.	ME	2	0	1	0	3	5	50	50	100
6	AEC	24ENG16	Communicative English	HSS	0	0	1	0	1	2	50	50	100
7	HSS	24CIP17	Constitution of India and Professional Ethics	HSS	1	0	0	0	1	2	50	50	100
8	AEC	24EDM18	Environment and Disaster Management	AS	1	0	0	0	1	2	50	50	100
Total									20	32	400	400	800

CSE/EEE												Physics Cycle	
S. No.	**Course and Course Code**		**Course Title**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	ASC	24MAT11	Applied Mathematics for Engineers – I	AS	2	1	1	0	4	2+2+2	50	50	100
2	ASC	24PHY12	Applied Physics for Engineers	AS	3	0	1	0	4	4+2	50	50	100
3	ESC-I	24ESC131	Basic Electronics	ECE	3	0	0	0	3	4	50	50	100
4	PLC-I	24PLC141	Problem solving using python	CS	2	0	1	0	3	3+2	50	50	100
5	ETC-I	24ETC151	Robotics and Automation	ME	3	0	0	0	3	4	50	50	100
6	AEC	24ENG16	Communicative English	HSS	0	0	1	0	1	2	50	50	100
7	HSS	24KSK17 / 24KBK17	Samskrutika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	100
8	AEC	24EIH18	Engineering Innovations in Health Care	AS	1	0	0	0	1	2	50	50	100
Total									20	31	400	400	800

(ESC-I) Engineering Science Courses-I		**(ETC-I) Emerging Technology Courses-I**	
24ESC131	Basic Electronics	24ETC151	Robotics and Automation
24ESC132	Basic Electrical Engineering	24ETC152	Basics of Electric Vehicles
24ESC133	Basic Mechanical Engineering	24ETC153	Fundamentals of Internet of Things
24ESC134	Basic Civil Engineering	24ETC154	Drone Technology
		24ETC155	Fundamentals of Cyber Security
(PLC-I) Programming Language Courses-I		24ETC156	Nano Technology
24PLC141	Problem Solving using Python	24ETC157	Renewable Energy Sources
24PLC142	Problem Solving using C		
24PLC143	Basic Web Programming		

CREDIT SCHEME FOR II SEMESTER BE

CSE/EEE													Chemistry Cycle
S. No	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	24MAT21	Applied Mathematics for Engineers – II	AS	2	1	1	0	4	2+2+2	50	50	100
2	ASC	24CHE22	Applied Chemistry for Engineers	AS	3	0	1	0	4	4+2	50	50	100
3	ESC-II	24ESC232	Basic Electrical Engineering	EEE	3	0	0	0	3	4	50	50	100
4	ESC	24CSE24	Data Structures using C	CS	2	0	0	0	2	3	50	50	100
5	ESC	24CSL24	Data Structures using C Lab	CS	0	0	1	0	1	2	50	50	100
6	ESC	24CAD25	Computer Aided Engineering Drawing	ME	2	0	1	0	3	5	50	50	100
7	AEC	24ENG26	Professional writing skills in English	HSS	1	0	0	0	1	2	50	50	100
8	HSS	24CIP27	Constitution of India and Professional Ethics	HSS	1	0	0	0	1	2	50	50	100
9	AEC	24EDM28	Environment and Disaster Management	AS	1	0	0	0	1	2	50	50	100
Total									20	32	450	450	900

AIML/ DS / ECE/ME													Physics Cycle
S. No.	Course and Course Code		Course Title	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	ASC	24MAT21	Applied Mathematics for Engineers – II	AS	2	1	1	0	4	2+2+2	50	50	100
2	ASC	24PHY22	Applied Physics for Engineers	AS	3	0	1	0	4	4+2	50	50	100
3	ESC-II	24ESC231	Basic Electronics	ECE.	3	0	0	0	3	4	50	50	100
4	ESC	24CSE24	Data Structures using C	CS	2	0	0	0	2	3	50	50	100
5	ESC	24CSL24	Data Structures using C Lab	CS	0	0	1	0	1	2	50	50	100
6	ETC-II	24ETC251	Robotics and Automation	ME	3	0	0	0	3	4	50	50	100
7	AEC	24ENG26	Professional writing skills in English	HSS	1	0	0	0	1	2	50	50	100
8	HSS	24KSK27 / 24KBK27	Samskrutika Kannada/ Balake Kannada	HSS	1	0	0	0	1	2	50	50	100
9	AEC	24EIH28	Engineering Innovations in Health Care	AS	1	0	0	0	1	2	50	50	100
Total									20	31	450	450	900

(ESC-I) Engineering Science Courses-I	
24ESC231	Basic Electronics
24ESC232	Basic Electrical Engineering
24ESC233	Basic Mechanical Engineering
24ESC234	Basic Civil Engineering
(PLC-I) Programming Language Courses-I	
24PLC241	Problem Solving using Python
24PLC242	Problem Solving using C
24PLC243	Basic Web Programming

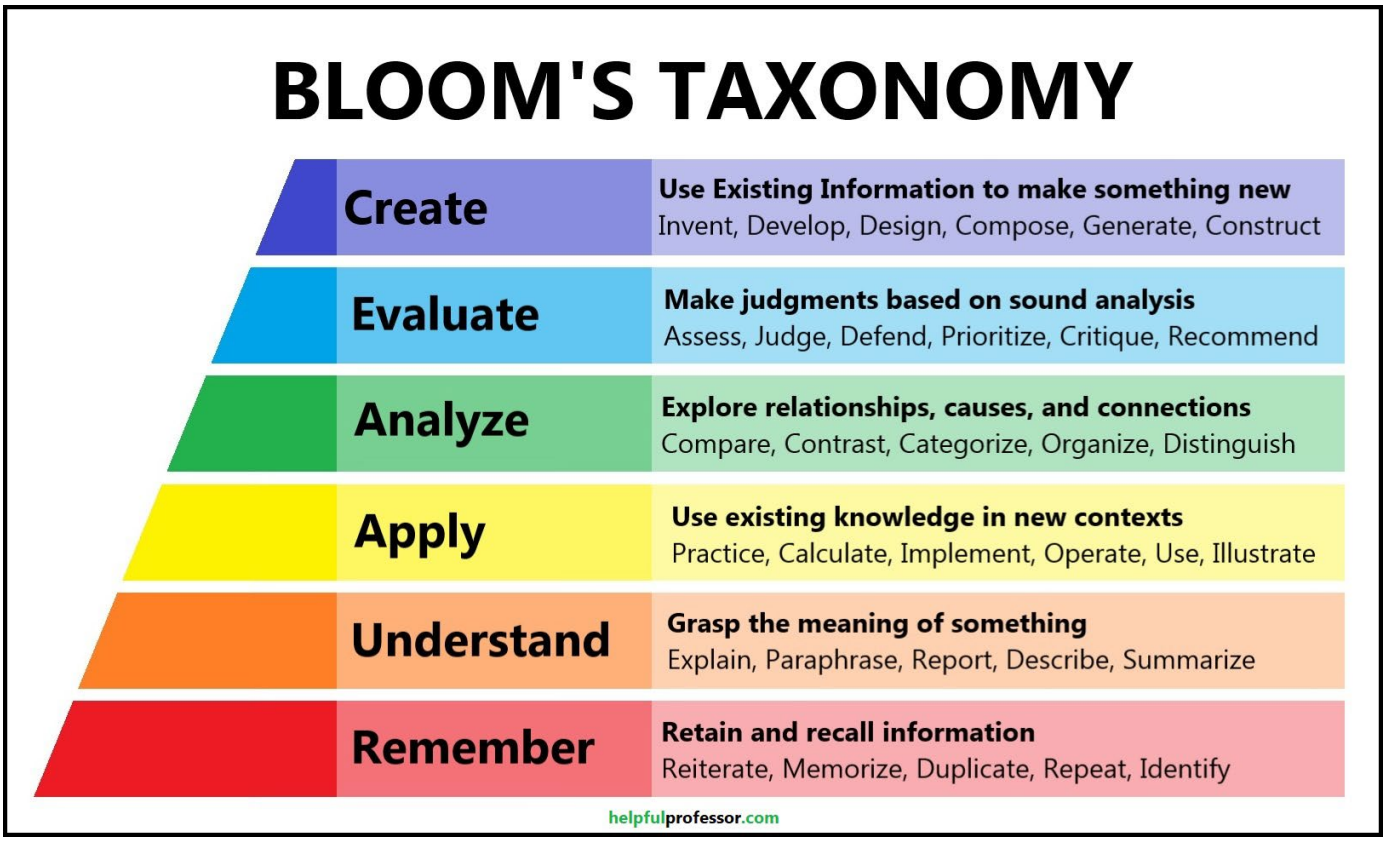
(ETC-I) Emerging Technology Courses-I	
24ETC251	Robotics and Automation
24ETC252	Basics of Electric Vehicles
24ETC253	Fundamentals of Internet of Things
24ETC254	Drone Technology
24ETC255	Fundamentals of Cyber Security
24ETC256	Nano Technology
24ETC257	Renewable Energy Sources

KEY WORDS AND TERMINOLOGY

OBE	Outcome Based Education (Outcome-Based Education is a student-centric teaching and learning methodology in which the course delivery, assessment are planned to achieve stated objectives and outcomes.
BOS	Board of Studies
L: T: P: S	Lecture: Tutorial: Practical: Self study
CIE	Continuous Internal Evaluation
SEE	Semester End Examination
CREDIT	A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture) or two hours of tutorial or two hours practical or two hours self-study per week. Credits of a course are distributed across L: T: P: S
CO	Course outcome (Is a statement that clearly describes what and how much or how well the student will know and be able to do after successfully completing the specified course – the essential knowledge, abilities, and attitudes that constitute the basic learning needed by a graduate of the course.
PO	Programme Outcomes (POs are statements about the knowledge, skills and attitudes (attributes) the graduate of a formal engineering program should have. POs deal with the general aspect of graduation for a particular program, and the competencies and expertise a graduate will possess after completion of the program). (Refer POs defined by NBA)
SGPA	Semester Grade Point Average (The performance of a student in a semester is indicated by a number called SGPA) $SGPA = \frac{\sum [\text{Course Credits x Grade Points}] \text{ for all the Courses in that semester}}{\sum [\text{Course Credits }] \text{ for all the Courses in that Semester}}$
CGPA	Cumulative Grade Point Average (which is the sum total of the SGPA's of all semesters or that of an academic year) $CGPA = \frac{\sum [\text{Course Credits x Grade Points}] \text{ for all Courses excluding those with F grades until that semester}}{\sum [\text{Course Credits}] \text{for all Courses excluding those with F grades until that semester}}$

Letter Grade and corresponding Grade Points on a typical 10 - Point scale									
Level	**Outstanding**	**Excellent**	**Very Good**	**Good**	**Above Average**	**Average**	**Pass**	**Fail**	**Not Eligible**
Grade	O	A+	A	B+	B	C	P	F	NE
Grade Points	10	9	8	7	6	5	4	0	0
Score (Marks) Range %	90-100	80-89	70-79	60-69	55-59	50-54	40-49	0-39	-

RBT	**Revised Blooms Taxonomy Levels** (There are six levels of cognitive learning according to the revised version of Bloom's Taxonomy. Each level is conceptually different. The six levels are **remembering(L1), understanding(L2), applying(L3),analyzing(L4), evaluating(L5), and creating(L6).**



APPLIED SCIENCES COURSES

APPLIED MATHEMATICS FOR ENGINEERS-I
(FOR AIML, CSE & CS (DS))

Course Code	**24MAT11**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Solve the system of linear equations by applying the ideas of linear algebra.
CO2	Understand the properties of Linear Algebra for network, traffic and electrical circuits analysis.
CO3	Understand the relations between different coordinate systems and its applications in digital gadgets and computer codes.
CO4	Apply multivariable methods for some real problems and estimating the maximum/minimum values for a physical model.
CO5	Apply modular arithmetic knowledge to computer algorithms.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ELEMENTS OF LINEAR ALGEBRA**	**CO1**	**9 Hours**

Elementary transformations, Reduction of the given matrix to echelon form, Rank of a Matrix, Consistency of a system of linear equations and solution. Solution of a system of linear homogeneous equations (trivial and non-trivial solutions), Solution of a system of non-homogeneous equations by Gauss-Seidel method.

Text Book	Text Book 1: 2.7, 2.10, 28.5 Text Book 2: 7.4, 8.1, 8.4 Text Book 3: 1.2.5, 1.2.6, 1.6.1

MODULE-2	**APPLIED LINEAR ALGEBRA AND ITS PROPERTIES**	**CO2**	**9 Hours**

Eigen values and Eigen vectors of a square matrix, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector, Power of matrices using Diagonalization.

Applications	Traffic, Network flow, Electrical circuit problems
Text Book	Text Book 1: 2.13, 28.9, 2.16 Text Book 2: 7.9, 8.1, 8.4 Text Book 3: 1.4.2, 1.5.1, 1.6.1

MODULE-3	**DIFFERENTIAL CALCULUS**	**CO3**	**9 Hours**

Importance of cartesian and polar coordinate system: Angle between the radius vector and tangent, angle between two curves, Pedal equation for polar curves.

Curvature and radius of curvature: Cartesian, Parametric, Polar and Pedal forms.

Applications	Math.h header file in C-programming, Digital gadgets, Handling different geometries.
Text Book	Text Book 1: 4.6, 4.7, 4.8, 4.11

MODULE-4	**MULTIVARIABLE DERIVATIVES**	**CO4**	**9 Hours**

Existence of multivariable in real problems leading to partial derivatives understanding partial differentiation, Total differentiation, Homogeneous function Euler's Theorem, Taylors and Maclaurin's series for two variables, Extreme values of the function and Jacobians.

Applications	Strength of a beam with relative changes, Transformation from one coordinate system to another.
Text Book	Text Book 1: 5.2, 5.4, 5.5, 5.7, 5.9, 5.11

MODULE-5	**MODULAR ARITHMETIC**	**CO5**	**9 Hours**

Introduction to Congruences, Linear Congruences, The Remainder theorem, Solving Polynomials, Linear Diophantine equation, System of Linear Congruences, Euler's theorem, Wilson theorem and Fermat's little theorem. RSA algorithm.

Applications	Cryptography, Encoding and Decoding, RSA applications in public key encryption.
Text Book	Text Book 4

List of Experiments in Python

Sl. No.	Experiments	COs

1.	Finding the rank of a Matrix.	CO1
2.	Solution of system of linear equations using Gauss-Seidel method.	CO1
3.	Compute the Eigen values and Eigen vectors of a square matrix.	CO2
4.	Find the largest and smallest eigenvalue by Rayleigh power method.	CO2
5.	Finding the angle between the radius vector and tangent.	CO3
6.	Finding the radius of curvature in cartesian and polar forms.	CO3
7.	Finding the Partial Derivatives.	CO4
8.	Partial Derivatives by Jacobian Method.	CO4
9.	Finding GCD using Euclid's Algorithm	CO5
10.	Solving linear congruences $ax \equiv b(mod\ m)$	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.
4) M.K.Pathak, S.Ramasamy, Modular Arithmetics, Campus Books International, 2012 Edition, ISBN: 9788180303463.

Reference Books:

1) David C Lay, Linear Algebra and its applications, Addison-Wesley Publishers, Fourth Edition, 2012, ISBN: 9780321385178.
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1) https://youtu.be/l0E3QXclYR0?si=af23LlzOXE6udyqi
2) https://youtu.be/p8XcOigHZoo?si=ueuQaQh4iMb1fi2_
3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/HEAokut4F4I

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)

➢ For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
➢ Organizing Group wise discussions on related topics

Seminars

APPLIED MATHEMATICS FOR ENGINEERS-I
(FOR ECE, EEE)

Course Code	**24MAT11**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	Solve the system of linear equations by applying the ideas of linear algebra.
CO2	Understand the properties of Linear Algebra for network, traffic and electrical circuits analysis.
CO3	Understand the relations between different coordinate systems and its applications in digital gadgets and computer codes.
CO4	Apply multivariable methods for some real problems and estimating the maximum/minimum values for a physical model.
CO5	Apply the concept of vector calculus for solving engineering problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ELEMENTS OF LINEAR ALGEBRA**	**CO1**	**9 Hours**
Elementary transformations, Reduction of the given matrix to echelon form, Rank of a Matrix, Consistency of a system of linear equations and solution. Solution of a system of linear homogeneous equations (trivial and non-trivial solutions), Solution of a system of non-homogeneous equations by Gauss-Seidel method.			
Text Book	Text Book 1: 2.7, 2.10, 28.5 Text Book 2: 7.4, 8.1, 8.4 Text Book 3: 1.2.5, 1.2.6, 1.6.1		
MODULE-2	**APPLIED LINEAR ALGEBRA AND ITS PROPERTIES**	**CO2**	**9 Hours**
Eigen values and Eigen vectors of a square matrix, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector, Power of matrices using Diagonalization.			
Applications	Traffic, Network flow, Electrical circuit problems		
Text Book	Text Book 1: 2.13, 28.9, 2.16 Text Book 2: 7.9, 8.1, 8.4 Text Book 3: 1.4.2, 1.5.1, 1.6.1		
MODULE-3	**DIFFERENTIAL CALCULUS**	**CO3**	**9 Hours**
Importance of cartesian and polar coordinate system: Angle between the radius vector and tangent, angle between two curves, Pedal equation for polar curves. Curvature and radius of curvature: Cartesian, Parametric, Polar and Pedal forms.			
Applications	Math.h header file in C-programming, Digital gadgets, Handling different geometries.		
Text Book	Text Book 1: 4.6, 4.7, 4.8, 4.11		
MODULE-4	**MULTIVARIABLE DERIVATIVES**	**CO4**	**9 Hours**
Existence of multivariables in real problems leading to partial derivatives understanding partial differentiation, Total differentiation, Homogeneous function Euler's Theorem, Taylors and Maclaurin's series for two variables, Extreme values of the function and Jacobians.			
Applications	Strength of a beam with relative changes, Transformation from one coordinate system to another.		
Text Book	Text Book 1: 5.2, 5.4, 5.5, 5.7, 5.9, 5.11		
MODULE-5	**VECTOR CALCULUS**	**CO5**	**9 Hours**
Velocity and Acceleration, Gradient, Divergence, Curl, Laplacian-physical significance and problems. Solenoidal and Irrotational vector fields. Potential functions.			
Text Book	Text Book 1: 8.3, 8.5, 8.7, 8.18 Text Book 2: 9.7, 9.8, 9.9 Text Book 3: 3.2, 3.3		

List of Experiments in Python

Sl. No.	**Experiments**	**COs**
1.	Finding the rank of a Matrix.	CO1
2.	Solution of system of linear equations using Gauss-Seidel method.	CO1

3.	Compute the Eigen values and Eigen vectors of a square matrix.	CO2
4.	Find the largest and smallest eigenvalue by Rayleigh power method.	CO2
5.	Finding the angle between the radius vector and tangent.	CO3
6.	Finding the radius of curvature in cartesian and polar forms.	CO3
7.	Finding the Partial Derivatives.	CO4
8.	Partial Derivatives by Jacobian Method.	CO4
9.	Finding the Gradient of a function	CO5
10.	Calculating the curl of a vector field	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.

Reference Books:

1) David C Lay, Linear Algebra and its applications, Addison-Wesley Publishers, Fourth Edition, 2012, ISBN: 9780321385178.
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3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1) https://youtu.be/l0E3QXclYR0?si=af23LlzOXE6udyqi
2) https://youtu.be/p8XcOigHZoo?si=ueuQaQh4iMb1fi2_
3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/3TKfcgdQBfU?si=H9JTHtprff2xUlTp

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

APPLIED MATHEMATICS FOR ENGINEERS-I
(FOR ME)

Course Code	**24MAT11**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	Solve the system of linear equations by applying the ideas of linear algebra.
CO2	Understand the properties of Linear Algebra for network, traffic and electrical circuits analysis.
CO3	Understand the relations between different coordinate systems and its applications in digital gadgets and computer codes.
CO4	Apply multivariable method for some real problems and estimating the maximum/minimum values for a physical model.
CO5	Apply partial differential equation techniques to solve Engineering problems.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ELEMENTS OF LINEAR ALGEBRA**	**CO1**	**9 Hours**

Elementary transformations, Reduction of the given matrix to echelon form, Rank of a Matrix, Consistency of a system of linear equations and solution. Solution of a system of linear homogeneous equations (trivial and non-trivial solutions), Solution of a system of non-homogeneous equations by Gauss-Seidel method.

Text Book	Text Book 1: 2.7, 2.10, 28.5 Text Book 2: 7.4, 8.1, 8.4 Text Book 3: 1.2.5, 1.2.6, 1.6.1

MODULE-2	**APPLIED LINEAR ALGEBRA AND ITS PROPERTIES**	**CO2**	**9 Hours**

Eigen values and Eigen vectors of a square matrix, Rayleigh's power method to find the dominant Eigenvalue and Eigenvector, Power of matrices using Diagonalization.

Applications	Traffic, Network flow, Electrical circuit problems
Text Book	Text Book 1: 2.13, 28.9, 2.16 Text Book 2: 7.9, 8.1, 8.4 Text Book 3: 1.4.2, 1.5.1, 1.6.1

MODULE-3	**DIFFERENTIAL CALCULUS**	**CO3**	**9 Hours**

Importance of cartesian and polar coordinate system: Angle between the radius vector and tangent, angle between two curves, Pedal equation for polar curves.

Curvature and radius of curvature: Cartesian, Parametric, Polar and Pedal forms.

Applications	Math.h header file in C-programming, Digital gadgets, Handling different geometries.
Text Book	Text Book 1: 4.6, 4.7, 4.8, 4.11

MODULE-4	**MULTIVARIABLE DERIVATIVES**	**CO4**	**9 Hours**

Existence of multivariables in real problems leading to partial derivatives understanding partial differentiation, Total differentiation, Homogeneous function Euler's Theorem, Taylors and Maclaurin's series for two variables, Extreme values of the function and Jacobians.

Applications	Strength of a beam with relative changes, Transformation from one coordinate system to another.
Text Book	Text Book 1: 5.2, 5.4, 5.5, 5.7, 5.9, 5.11

MODULE-5	**PARTIAL DIFFERENTIAL EQUATIONS**	**CO5**	**9 Hours**

Formation of partial differential equation by eliminating arbitrary constants and functions. Solution of Lagrange's partial differential equation, Solution by separation of variables method.

Applications	Solutions of one-dimensional heat, wave and two-dimensional Laplace equation by separation of variables method.
Text Book	Text Book 1: 17.2, 17.5, 18.2, 18.4, 18.5, 18.7 Text Book 2: 12.2, 12.5, 12.11

List of Experiments in Python

Sl. No.	Experiments	COs
1.	Finding the rank of a Matrix.	CO1

2.	Solution of system of linear equations using Gauss-Seidel method.	CO1
3.	Compute the Eigen values and Eigen vectors of a square matrix.	CO2
4.	Find the largest and smallest eigenvalue by Rayleigh power method.	CO2
5.	Finding the angle between the radius vector and tangent.	CO3
6.	Finding the radius of curvature in cartesian and polar forms.	CO3
7.	Finding the Partial Derivatives.	CO4
8.	Partial Derivatives by Jacobian Method.	CO4
9.	Solution of Lagrange's partial differential equation	CO5
10.	Solution by separation of variables method	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.

Reference Books:

1) David C Lay, Linear Algebra and its applications, Addison-Wesley Publishers, Fourth Edition, 2012, ISBN: 9780321385178.
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

1) https://youtu.be/l0E3QXclYR0?si=af23LlzOXE6udyqi
2) https://youtu.be/p8XcOigHZoo?si=ueuQaQh4iMb1fi2_
3) https://youtu.be/JV0hjyI4Erg?si=X9xFpzvscqsyheYh
4) https://youtu.be/bTs7ncA_AtY
5) https://youtu.be/hcm-CgHFbwI

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

APPLIED MATHEMATICS FOR ENGINEERS-II
(FOR AI&ML, CSE, CDS)

Course Code	**24MAT21**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	Find an approximate curve for a real practical problem using least square method.
CO2	Apply to find the solution for LCR and Newton's law of cooling.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Analyse the continuous/discontinuous/periodic and its initial value problems.
CO5	Apply the concept of vector calculus for solving engineering problems.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**STATISTICAL ANALYSIS**	**CO1**	**9 Hours**

Fitting of the curves of linear, quadratic, exponential and geometric curves by least square method. Correlation and Regression Lines.

Text Book	Text Book 1: 24.5, 25.12, 25.13, 25.14

MODULE-2	**ORDINARY DIFFERENTIAL EQUATIONS**	**CO2**	**9 Hours**

First order and First degree: Exact, Reducible to exact. Second and Higher order linear ordinary differential equation: Inverse differential operator techniques for the functions-e^{ax}, $e^{ax}\,f(x)$, $\sin(ax+b)$, $\cos(ax+b)$ and $a\,x^n$. Solution of Legendre's linear differential equation.

Applications	Newton's law of cooling, LCR circuits, Solution of initial and boundary value problems.
Text Book	Text Book 1: 11.11, 11.12, 13.5 Text Book 2: 1.4

MODULE-3	**MULTIPLE INTEGRALS**	**CO3**	**9 Hours**

Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications	Find Area and Volume by double integration method.
Text Book	Text Book 1: 7.1, 7.2, 7.3.

MODULE-4	**LAPLACE AND INVERSE LAPLACE TRANSFORMS**	**CO4**	**9 Hours**

Definition of Laplace transform and its standard functions. Properties of Laplace transforms: Shifting properties, $t^n f(t)$, $\frac{f(t)}{t}$ forms. Periodic functions, unit-step function-Problems. Inverse Laplace Transform.

Applications	Solution of continuous/discontinuous functions, electrical circuits, bridges/beams and Solution of linear differential equations.
Text Book	Text Book 1: 21.2, 21.4, 21.5, 21.9, 21.10, 21.1221.15 Text Book 3: 5.2, 5.3.1, 5.3.2, 5.5.6

MODULE-5	**VECTOR CALCULUS**	**CO5**	**9 Hours**

Velocity and Acceleration, Gradient, Divergence, Curl, Laplacian-physical significance and problems. Solenoidal and Irrotational vector fields. Potential functions.

Text Book	Text Book 1: 8.3, 8.5, 8.7, 8.18 Text Book 2: 9.7, 9.8, 9.9 Text Book 3: 3.2, 3.3

List of Experiments in Python

Sl. No.	Experiments	COs
1.	Finding the mean of x and y	CO1
2.	Finding the Correlation coefficient between x and y	CO1
3.	Solution of first-order differential equation	CO2
4.	Solution of second order linear differential equation	CO2
5.	Evaluating the Double Integration	CO3
6.	Evaluating the Triple Integration	CO3
7.	Finding the Laplace transform of a function.	CO4

8.	Finding the Inverse Laplace transform of a function	CO4
9.	Finding the Gradient of a function	CO5
10.	Calculating the curl of a vector field	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

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2) https://youtu.be/hiNbVgSye-o
3) https://youtu.be/BJ_0FURo9RE
4) https://youtu.be/4Mr7aEHQr8E
5) https://youtu.be/3TKfcgdQBfU?si=H9JTHtprff2xUlTp

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

APPLIED MATHEMATICS FOR ENGINEERS-II
(FOR ECE, EEE)

Course Code	**24MAT21**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	Find an approximate curve for a real practical problem using least square method.
CO2	Apply to find the solution for LCR and Newton's law of cooling.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Analyse the continuous/discontinuous/periodic and its initial value problems.
CO5	Apply partial differential equation techniques to solve Engineering problems.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**STATISTICAL ANALYSIS**	**CO1**	**9 Hours**

Fitting of the curves of linear, quadratic, exponential and geometric curves by least square method. Correlation and Regression Lines.

Text Book	Text Book 1: 24.5, 25.12, 25.13, 25.14

MODULE-2	**ORDINARY DIFFERENTIAL EQUATIONS**	**CO2**	**9 Hours**

First order and First degree: Exact, Reducible to exact. Second and Higher order linear ordinary differential equation: Inverse differential operator techniques for the functions-e^{ax}, $e^{ax}\,f(x)$, $\mathrm{Sin}\,(ax+b)$, $\mathrm{Cos}\,(ax+b)$ and $a\,x^n$. Solution of Legendre's linear differential equation.

Applications	Newton's law of cooling, LCR circuits, Solution of initial and boundary value problems.
Text Book	Text Book 1: 11.11, 11.12, 13.5 Text Book 2: 1.4

MODULE-3	**MULTIPLE INTEGRALS**	**CO3**	**9 Hours**

Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications	Find Area and Volume by double integration method.
Text Book	Text Book 1: 7.1, 7.2, 7.3.

MODULE-4	**LAPLACE AND INVERSE LAPLACE TRANSFORMS**	**CO4**	**9 Hours**

Definition of Laplace transform and its standard functions. Properties of Laplace transforms: Shifting properties, $t^n f(t)$, $\frac{f(t)}{t}$ forms. Periodic functions, unit-step function-Problems. Inverse Laplace Transform.

Applications	Solution of continuous/discontinuous functions, electrical circuits, bridges/beams and Solution of linear differential equations.
Text Book	Text Book 1: 21.2, 21.4, 21.5, 21.9, 21.10, 21.1221.15 Text Book 3: 5.2, 5.3.1, 5.3.2, 5.5.6

MODULE-5	**PARTIAL DIFFERENTIAL EQUATIONS**	**CO5**	**9 Hours**

Formation of partial differential equation by eliminating arbitrary constants and functions**.** Solution of Lagrange's partial differential equation, Solution by separation of variables method.

Applications	Solutions of one-dimensional heat, wave and two-dimensional Laplace equation by separation of variables method.
Text Book	Text Book 1: 17.2, 17.5, 18.2, 18.4, 18.5, 18.7 Text Book 2: 12.2, 12.5, 12.11

List of Experiments in Python

Sl. No.	Experiments	COs
1.	Finding the mean of x and y	CO1
2.	Finding the Correlation coefficient between x and y	CO1
3.	Solution of first-order differential equation	CO2
4.	Solution of second order linear differential equation	CO2

5.	Evaluating the Double Integration	CO3
6.	Evaluating the Triple Integration	CO3
7.	Finding the Laplace transform of a function.	CO4
8.	Finding the Inverse Laplace transform of a function	CO4
9.	Solution of Lagrange's partial differential equation	CO5
10.	Solution by separation of variables method	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

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3) https://youtu.be/BJ_0FURo9RE
4) https://youtu.be/4Mr7aEHQr8E
5) https://youtu.be/hcm-CgHFbwI

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)

➢ For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes

➢ Organizing Group wise discussions on related topics

➢ Seminars

APPLIED MATHEMATICS FOR ENGINEERS-II
(FOR ME)

Course Code	**24MAT21**	**CIE Marks**	**50**
L:T:P:S	**2:1:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2+2+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Find an approximate curve for a real practical problem using least square method.
CO2	Apply to find the solution for LCR and Newton's law of cooling.
CO3	Apply the concept of change of order of integration and variables to evaluate multiple integrals and their usage in computing area and volume.
CO4	Analyse the continuous/discontinuous/periodic and its initial value problems.
CO5	Apply modular arithmetic knowledge to computer algorithms.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

MODULE-1	**STATISTICAL ANALYSIS**	**CO1**	**9 Hours**

Fitting of the curves of linear, quadratic, exponential and geometric curves by least square method. Correlation and Regression Lines.

Text Book	Text Book 1: 24.5, 25.12, 25.13, 25.14

MODULE-2	**ORDINARY DIFFERENTIAL EQUATIONS**	**CO2**	**9 Hours**

First order and First degree: Exact, Reducible to exact. Second and Higher order linear ordinary differential equation: Inverse differential operator techniques for the functions-e^{ax}, $e^{ax}\,f(x)$, $\sin(ax+b)$, $\cos(ax+b)$ and $a\,x^n$. Solution of Legendre's linear differential equation.

Applications	Newton's law of cooling, LCR circuits, Solution of initial and boundary value problems.
Text Book	Text Book 1: 11.11, 11.12, 13.5 Text Book 2: 1.4

MODULE-3	**MULTIPLE INTEGRALS**	**CO3**	**9 Hours**

Evaluation of double and triple integrals, evaluation of double integrals by change of order of integration, changing into polar coordinates.

Applications	Find Area and Volume by double integration method.
Text Book	Text Book 1: 7.1, 7.2, 7.3.

MODULE-4	**LAPLACE AND INVERSE LAPLACE TRANSFORMS**	**CO4**	**9 Hours**

Definition of Laplace transform and its standard functions. Properties of Laplace transforms: Shifting properties, $t^n f(t)$, $\frac{f(t)}{t}$ forms. Periodic functions, unit-step function-Problems. Inverse Laplace Transform.

Applications	Solution of continuous/discontinuous functions, electrical circuits, bridges/beams and Solution of linear differential equations.
Text Book	Text Book 1: 21.2, 21.4, 21.5, 21.9, 21.10, 21.1221.15 Text Book 3: 5.2, 5.3.1, 5.3.2, 5.5.6

MODULE-5	**MODULAR ARITHMETIC**	**CO5**	**9 Hours**

Introduction to Congruences, Linear Congruences, The Remainder theorem, Solving Polynomials, Linear Diophantine equation, System of Linear Congruences, Euler's theorem, Wilson theorem and Fermat's little theorem. RSA algorithm.

Applications	Cryptography, Encoding and Decoding, RSA applications in public key encryption.
Text Book	Text Book 4

List of Experiments in Python

Sl. No.	Experiments	COs
1.	Finding the mean of x and y	CO1
2.	Finding the Correlation coefficient between x and y	CO1
3.	Solution of first-order differential equation	CO2
4.	Solution of second order linear differential equation	CO2
5.	Evaluating the Double Integration	CO3

6.	Evaluating the Triple Integration	CO3
7.	Finding the Laplace transform of a function.	CO4
8.	Finding the Inverse Laplace transform of a function	CO4
9.	Finding GCD using Euclid's Algorithm	CO5
10.	Solving linear congruences $ax \equiv b(mod\ m)$	CO5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	5	20
L1	Remember	5	2.5	2.5
L2	Understand	5	2.5	2.5
L3	Apply	10	-	10
L4	Analyze	2.5	-	2.5
L5	Evaluate	2.5	-	2.5
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	5
L5	Evaluate	5
L6	Create	-

Suggested Learning Resources:

Text Books:

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2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.
3) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2016, ISBN: 9789332575288.
4) M.K.Pathak, S.Ramasamy, Modular Arithmetics, Campus Books International, 2012 Edition, ISBN: 9788180303463.

Reference Books:

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2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
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4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

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1) https://youtu.be/kAa5ReiZH6o
2) https://youtu.be/hiNbVgSye-o
3) https://youtu.be/BJ_0FURo9RE?si=XSfVyPQPSJxR1i39
4) https://youtu.be/4Mr7aEHQr8E
5) https://youtu.be/HEAokut4F4I

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
  - Organizing Group wise discussions on related topics
  - Seminars

APPLIED CHEMISTRY FOR ENGINEERS
(For AIML, CS, CS(DS))

Course Code	**24CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basics of chemical sensors and methods for e-waste management and metal recovery

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	-	-	1	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	1	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1 CO2 CO5**	**9 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.

Derivation of Nernst equation and Numerical. Concentration cell and numericals.

Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li -ion battery

Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)

Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells

Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Laboratory Component:

Potentiometric estimation of Iron using std. potassium dichromate solution.

Self-study / Applications	EMF measurement -Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=190
Text Book	2,3,4,11&12

MODULE-2	**Corrosion Science Engineering**	**CO2 CO4 CO5**	**9 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion- Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.

Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.

Electro plating: Introduction. Chromium plating and its applications.

Electro less plating: Introduction, double sided PCB making using copper electro less plating.

Laboratory Component:

1.Determination of percentage of iron in rust by external indicator method

Self-study	Collect the literature on Eco friendly metal finishing techniques. Calculate CPR practically.
Text Book	1,2,7,11&12

MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1 CO3 CO5**	**9 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes(CNTs) by chemical vapor deposition. Applications of gold nano particles in cancer treatment.

Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.

Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Laboratory Component:

Synthesis of Cuo/ ZnO nano material

Estimation of mixture of acids using standard NaOH by conductometry sensor.

Self-study	Spectrophotometry (Virtual lab https://vlab.amrita.edu/index.php?sub=2&brch=190) Determination of unknown concentration of an analyte by using the Beer-Lambert Law (Virtual lab: https://mas-iiith.vlabs.ac.in/exp/unknown-concentration-analyte/
Text Book	6,9 & 10

MODULE-4	**Advanced Methods for Air and Water Treatment**	**CO1 CO2 CO3**	**9 Hours**

Air pollution Management: Introduction to Primary and secondary air pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electro static precipitation technique for the removal of particulate matter and smoke in mining industries.

Water treatment: Determination of chemical oxygen demand of Industry waste water sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Laboratory Component:

Determination of total hardness of a sample of water by using standard EDTA Solution

Determination of chemical oxygen demand (COD) of the given industrial waste water sample.

Determination of total alkalinity of given water sample

Self-study /Applications	Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193 Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193
Text Book	1,2,3,11,12 &13

MODULE-5	**Chemical Sensors and E-Waste Management:**	**CO3 CO4 CO5**	**9 Hours**

Chemical Sensors: Definition and significance. Classification of Chemical Sensors based on transduction principle and analyte type. Basic Components of Chemical Sensors.
Electrochemical Sensors: Introduction and types**.** Construction and working of pH sensor.
Optical Sensors: Introduction and types. Construction and working of Flame photometer.
Applications of chemical sensors in Environmental monitoring (DO sensor). Medical diagnostics (Glucose sensor). Industrial processes (sensors for process control and safety)
E-Waste Management:
Introduction, sources of e-waste, composition, characteristics, and need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste.
Metal Recovery from E-Waste: Physical, chemical (Pyro and hydro metallurgy), biological and integrated methods. Extraction of gold from E-waste. Li - ion battery recycling.

Laboratory Component:

Estimation of amount of copper in E -waste by optical sensor (Colorimetry)
Estimation of mixture of acids using standard NaOH by conductometry sensor
Determination of pKa value of a weak acid using pH sensor
Determination of Viscosity coefficient of an organic liquid.

Self-study component	1.Soil Analysis-Determination of Specific conductivity of Soil (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193) 2.Soil Analysis-Determination of pH of Soil (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193)
Text Books	14,15&16

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test(s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	10	2	10
L3	Apply	5	2	5
L4	Analyze	5	1	5
L5	Evaluate			
L6	Create			

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Text Books / Reference Books

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
6. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
7. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
8. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
9. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell, 2012
10. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition,

Cengage Learning, 2020
11. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
12. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
13. Environmental Chemistry" by A.K. De
14. Electronic Waste Management: RSC Green Chemistry, Ronald E. Hester, Roy M. Harrison
15. Handbook of Chemical and Biological Sensors, R.F. Taylor, J.S. Schultz
16. Sensors and Transducers, D. Patranabis

Journal references

1. Design of materials for solid oxide fuel cells, perm selective membranes, and catalysts for biofuel transformation into syngas and hydrogen based on fundamental studies of their real structure, transport properties, and surface reactivity, Current Opinion in Green and Sustainable Chemistry 2022, 33:100558.
2. Graphene and graphene oxide as new class of materials for corrosion control and protection: Present status and future scenario, Progress in Organic Coatings, Volume 147, October 2020, 105741.
3. Review on dye-sensitized solar cells (DSSCs): Advanced techniques and research trends, Renewable and Sustainable Energy Reviews, Volume 68, Part 1, February 2017, Pages 234-246
4. Photocatalytic degradation of organic pollutants using TiO2-based photocatalysts: A review, Journal of Cleaner Production 268 (2020) 121725.
5. Production, structural design, functional control, and broad applications of carbon nanofiber-based nanomaterials: A comprehensive review, Chemical Engineering Journal, Volume 402, 15 December 2020, 126189.

Web links and Video Lectures (e-Resources):

https://youtu.be/2zr1-GKKet0 - Demonstration of galvanic cell
https://youtu.be/G5McJw4KkG8 - Li-ion battery working
https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
https://youtu.be/g1TfQ9rypHI - Construction and working of dye sensitized solar cell
https://youtu.be/f6WYxkhum-s - Galvanizing of Steel
https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
https://youtu.be/Ukc_kc5OAhw - PCB making
https://youtu.be/JtdCLPOcz5Y - CuO synthesis
https://youtu.be/xAMhX3Drq14 - OLED working
https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis
https://youtu.be/F7YKvhjNWsk - Sewage treatment plant
https://youtu.be/eH-LMwOU2fg - Dissolved oxygen sensor
https://youtu.be/ldlniZfA2X4 - Gold extraction from e waste

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Video Demonstrations
Practical experiments in lab
Contents related activities (Activity-based discussions)
Flowcharts and Handout preparation by students
Group Discussion
Seminars

APPLIED CHEMISTRY FOR ENGINEERS
(For ECE&EEE)

Course Code	**24CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basic principles of electronic materials and Chemical sensors.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	-	-	1	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1 CO2 CO5**	**9 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.

Derivation of Nernst equation and Numerical. Concentration cell and numericals.

Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li -ion battery

Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)

Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells

Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Laboratory Component:

1. Potentiometric estimation of Iron using std. potassium dichromate solution.

Self-study / Applications	1. EMF measurement (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=190)
Text Book	2,3,4,11&12

MODULE-2	**Corrosion Science Engineering**	**CO2 CO4 CO5**	**9 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion-Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.

Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.
Electro plating: Introduction. Chromium plating and its applications.
Electro less plating: Introduction, double sided PCB making using copper electro less plating.

Laboratory Component:
1.Determination of percentage of iron in rust by external indicator method

Self-study	1. Collect the literature on Eco friendly metal finishing techniques. 2. Calculate CPR practically.		
Text Book	1,2,7,11&12		
MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1 CO3 CO5**	**9 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes(CNTs) by chemical vapor deposition. Applications of gold nano particles in cancer treatment.
Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.
Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Laboratory Component:
1. Synthesis of Cuo/ ZnO nano material
2. Estimation of mixture of acids using standard NaOH by conductometry sensor.

Self-study	1. Spectrophotometry (Virtual lab https://vlab.amrita.edu/index.php?sub=2&brch=190) 2. Determination of unknown concentration of an analyte by using the Beer-Lambert Law (Virtual lab: https://mas-iiith.vlabs.ac.in/exp/unknown-concentration-analyte/)		
Text Book	6,9 & 10		
MODULE-4	Advanced Methods for Air and Water Treatment	**CO1 CO2 CO3**	**9 Hours**

Air pollution Management: Introduction to Primary and secondary air pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electro static precipitation technique for the removal of particulate matter and smoke in mining industries.
Water treatment: Determination of chemical oxygen demand of Industry waste water sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Laboratory Component:
1. Determination of total hardness of a sample of water by using standard EDTA solution
2. Determination of chemical oxygen demand (COD) of the given industrial waste water sample.
3. Determination of total alkalinity of given water sample

Self-study /Applications	1. Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193 2. Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193		
Text Book	1,2,3,11,12 &13		
MODULE-5	**Chemistry of Electronic Materials and Chemical Sensors.**	**CO3 CO4 CO5**	**9Hours**

Chemistry of Electronic Materials

Silicon as semiconductor and its applications. Production of solar grade silicon by Union carbide process and Zone refining. Synthesis of electronic grade silicon by Czochralski process (CZ).

Polymers for Electrical and Electronic Applications:

Conducting polymers: Synthesis and conducting mechanism of poly acetylene, Poly aniline and applications

Insulating Polymers: Synthesis and applications of PVC and Teflon

Chemical Sensors: Definition and significance. Classification of Chemical Sensors based on transduction principle and analyte type. Basic Components of Chemical Sensors.

Electrochemical Sensors: Introduction and types**.** Construction and working of pH sensor.

Optical Sensors: Introduction and types. Construction and working of Flame photometer.

Applications of chemical sensors in Environmental monitoring (DO sensor). Medical diagnostics (Glucose sensor). Industrial processes (sensors for process control and safety)

Laboratory Component:

1. Estimation of amount of copper in E -waste by optical sensor (Colorimetry)
2. Estimation of mixture of acids using standard NaOH by conductometry sensor
3. Determination of pKa value of a weak acid using pH sensor
4. Determination of Viscosity coefficient of an organic liquid.

Self-study component	1. Soil Analysis-Determination of Specific conductivity of Soil (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193) 2. Soil Analysis-Determination of pH of Soil (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193)
Text Books	14,15&16

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	10	2	10
L3	Apply	5	2	5
L4	Analyze	5	1	5
L5	Evaluate			
L6	Create			

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Text Books / Reference Books

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
6. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
7. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
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9. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
10. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh Edition, Cengage Learning, 2020

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12. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
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14. Electronic Waste Management: RSC Green Chemistry, Ronald E. Hester, Roy M. Harrison
15. Handbook of Chemical and Biological Sensors, R.F. Taylor, J.S. Schultz
16. Sensors and Transducers, D. Patranabis

Journal references

1. Design of materials for solid oxide fuel cells, perm selective membranes, and catalysts for biofuel transformation into syngas and hydrogen based on fundamental studies of their real structure, transport properties, and surface reactivity, Current Opinion in Green and Sustainable Chemistry 2022, 33:100558.
2. Graphene and graphene oxide as new class of materials for corrosion control and protection: Present status and future scenario, Progress in Organic Coatings, Volume 147, October 2020, 105741.
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5. Production, structural design, functional control, and broad applications of carbon nanofiber-based nanomaterials: A comprehensive review, Chemical Engineering Journal, Volume 402, 15 December 2020, 126189.

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- https://youtu.be/G5McJw4KkG8 - Li-ion battery working
- https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
- https://youtu.be/g1TfQ9rypHI - Construction and working of dye sensitized solar cell
- https://youtu.be/f6WYxkhum-s - Galvanizing of Steel
- https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
- https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
- https://youtu.be/Ukc_kc5OAhw - PCB making
- https://youtu.be/JtdCLPOcz5Y - CuO synthesis
- https://youtu.be/xAMhX3Drq14 - OLED working
- https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis
- https://youtu.be/F7YKvhjNWsk - Sewage treatment plant
- https://youtu.be/eH-LMwOU2fg - Dissolved oxygen sensor
- https://youtu.be/ldlniZfA2X4 - Gold extraction from e waste

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstrations
- Practical experiments in lab
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

APPLIED CHEMISTRY FOR ENGINEERS
(For ME)

Course Code	**24CHE12/22**	**CIE Marks**	**50**
L: T : P :S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to

CO1	**A**nalyze the functioning of energy storage systems, corrosion mechanisms, and sensor technologies using fundamental electrochemical principles.
CO2	Implement chemical techniques to control pollution and promote sustainability by understanding the environmental impact of industrial processes.
CO3	Apply knowledge of advanced materials in energy storage, display systems, and environmental monitoring.
CO4	Develop problem-solving skills through numerical problems, design challenges, and applications in electrochemistry, corrosion science, and nanotechnology.
CO5	Understand the basic principles and applications of various engineering materials and fuels.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	2	2	1	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	-	-	1	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	1	-	-	-	-	-

MODULE-1	**Energy Conversion and Storage**	**CO1 CO2 CO5**	**9 Hours**

Fundamentals of Electrochemistry: Gibb's free energy, Single electrode potential, Galvanic cell, EMF, Reference electrode.
Derivation of Nernst equation and Numerical. Concentration cell and numericals.
Batteries: Introduction, classification, characteristics. Construction, working and applications of Zn- air and Li - ion battery
Fuel cell -Definition and classification. Construction, working and applications of solid oxide fuel cell (SOFC)
Photo Voltaic Cells – Introduction. Construction and working of silicon solar cell and Dye-sensitized solar cell, Advantages and disadvantages of PV cells
Super Capacitors: Introduction and classification. Construction, working and applications of electro chemical double layer capacitors.

Laboratory Component:

1. Potentiometric estimation of Iron using std. potassium dichromate solution.

Self-study / Applications	EMF measurement (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=190
Text Book	2,3,4,11&12

MODULE-2	**Corrosion Science Engineering**	**CO2 CO4 CO5**	**9 Hours**

Corrosion Science: Electrochemical theory of corrosion. Types of corrosion - differential metal, differential aeration corrosion (pitting and waterline) and stress corrosion Caustic embrittlement. Factors influencing rate of corrosion- Nature of the metal, Relative anodic and cathodic areas and Nature of the corrosion product, selection and design of materials. Corrosion penetration rate (CPR) - Introduction and numerical problem.
Corrosion control techniques: – protective coatings – metal coatings (Anodic and Cathodic metal coatings taking Galvanization and Tinning as example). Inorganic coatings - Anodizing of aluminium. Cathodic protection by sacrificial anodic method and Impressed voltage method.

Metal Finishing - Introduction and technological importance.
Electro plating: Introduction. Chromium plating and its applications.
Electro less plating: Introduction, double sided PCB making using copper electro less plating.

Laboratory Component:
1.Determination of percentage of iron in rust by external indicator method

Self-study	1. Collect the literature on Eco friendly metal finishing techniques. 2. Calculate CPR practically.		
Text Book	1,2,7,11&12		
MODULE-3	**Nano Materials, Display Systems and Analytical techniques**	**CO1 CO3 CO5**	**9 Hours**

Nanomaterials: Introduction, Size dependent properties. Classification based on dimensions (0D, 1D, 2D and 3D. Bottom up and top down approach of nano material synthesis, Synthesis and applications of copper oxide nanoparticles by co-precipitation method, carbon nano tubes(CNTs) by chemical vapor deposition. Applications of gold nano particles in cancer treatment.
Display systems: Liquid crystals - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). LED display system working and applications. OLED display system working and applications. QLED display system working and applications.
Analytical Techniques: Introduction. Principle, instrumentation and applications of UV-Visible spectrophotometry and conductometry.

Laboratory Component:
1. Synthesis of Cuo/ ZnO nano material
2. Estimation of mixture of acids using standard NaOH by conductometry sensor.

Self-study	1. Spectrophotometry (Virtual lab https://vlab.amrita.edu/index.php?sub=2&brch=190) 2. Determination of unknown concentration of an analyte by using the Beer-Lambert Law (Virtual lab: https://mas-iiith.vlabs.ac.in/exp/unknown-concentration-analyte/)		
Text Book	6,9 & 10		
MODULE-4	Chemistry of Pollution: Advanced Methods for Air and Water Treatment	**CO1 CO2 CO3**	**9 Hours**

Air pollution Management: Introduction to Primary and secondary air pollutants, Selective catalytic reduction of NOx, Chemical capturing of carbon dioxide, Electro static precipitation technique for the removal of particulate matter and smoke in mining industries.
Water treatment: Determination of chemical oxygen demand of Industry waste water sample, problems on it. Sewage treatment - primary and secondary methods. Softening of water by ion exchange method. Desalination of sea water by electro-dialysis. Construction and working of domestic water purifier. Role of reverse osmosis process in water purification. Photo catalytic dye degradation in water by TiO_2 nano particles.

Laboratory Component:
1. Determination of total hardness of a sample of water by using standard EDTA Solution
2. Determination of chemical oxygen demand (COD) of the given industrial waste water sample.
3. Determination of total alkalinity of given water sample

Self-study /Applications	1. Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193 2. Water Analysis-Determination of Physical parameters Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193		
Text Book	1,2,3,11,12 &13		
MODULE-5	**Materials for Mechanical Engineering Applications and Chemistry of Fuels**	**CO3 CO4 CO5**	**9Hours**

Materials for Mechanical Engineering Applications

Alloys: Introduction, classification, composition, properties and applications of Stainless Steel, Brass and Alnico.

Ceramics: Introduction, classification based on chemical composition, properties and applications of perovskites($CaTiO_3$).

Polymers: Introduction, methods of polymerization (condensation and free radical),

Introduction, Synthesis, properties and industrial applications of **polyvinylchloride** (PVC) and **Teflon.**

Chemistry of Fuels

Introduction to chemical fuels and classification.

Properties of fuels: Calorific value (GCV and NCV), Octane and Cetane number. Determination of calorific value of fuel using Bomb calorimeter- Numerical problems. knocking in IC engine and its mechanism. Anti-knocking agents. Unleaded petrol. Bio diesel - synthesis, properties and applications. Power alcohol- synthesis, properties and applications

Laboratory Component:

1. Estimation of amount of copper in E -waste by optical sensor
2. Estimation of mixture of acids using standard NaOH by conductometry sensor
3. Determination of pKa value of a weak acid using pH sensor
4. Determination of Viscosity coefficient of an organic liquid

Self-Study /Applications	1. Alloy Analysis (Brass) (Virtual lab: https://vlab.amrita.edu/index.php?sub=2&brch=193)
Text Book	1,2,5,11 &12

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	10	2	10
L3	Apply	5	2	5
L4	Analyze	5	1	5
L5	Evaluate			
L6	Create			

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1. Wiley Engineering Chemistry, Wiley India Pvt. Ltd. New Delhi, 2013- 2nd Edition. 20.11.2022
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. A Text Book of Engineering Chemistry, Shashi Chawla, Danpat Rai prakashan.
4. Essentials of Physical Chemistry, Bahl&Tuli, S.Chand Publishing
5. Text Book of Polymer Science, F.W. Billmeyer, John Wiley & Sons, 4th Edition, 1999.
6. Nanotechnology A Chemical Approach to Nanomaterials, G.A. Ozin & A.C. Arsenault, RSC Publishing, 2005.
7. Corrosion Engineering, M. G. Fontana, N. D. Greene, McGraw Hill Publications, New York, 3rd Edition, 1996.
8. Linden's Handbook of Batteries, Kirby W. Beard, Fifth Edition, McGraw Hill, 2019.
9. OLED Display Fundamentals and Applications, Takatoshi Tsujimura, Wiley–Blackwell , 2012
10. Principles of Instrumental Analysis, Douglas A. Skoog, F. James Holler, Stanley R. Crouch Seventh

Edition, Cengage Learning, 2020
11. Chemistry for Engineering Students, B. S. Jai Prakash, R. Venugopal, Sivakumaraiah & Pushpa Iyengar., Subash Publications, 5th Edition, 2014
12. "Engineering Chemistry", O. G. Palanna, Tata McGraw Hill Education Pvt. Ltd. New Delhi, Fourth Reprint, 2015.
13. Environmental Chemistry" by A.K. De
14. Electronic Waste Management: RSC Green Chemistry, Ronald E. Hester, Roy M. Harrison
15. Handbook of Chemical and Biological Sensors, R.F. Taylor, J.S. Schultz
16. Sensors and Transducers, D. Patranabis

Journal references

1. Design of materials for solid oxide fuel cells, permselective membranes, and catalysts for biofuel transformation into syngas and hydrogen based on fundamental studies of their real structure, transport properties, and surface reactivity, Current Opinion in Green and Sustainable Chemistry 2022, 33:100558.
2. Graphene and graphene oxide as new class of materials for corrosion control and protection: Present status and future scenario, Progress in Organic Coatings, Volume 147, October 2020, 105741.
3. Review on dye-sensitized solar cells (DSSCs): Advanced techniques and research trends, Renewable and Sustainable Energy Reviews, Volume 68, Part 1, February 2017, Pages 234-246
4. Photocatalytic degradation of organic pollutants using TiO2-based photocatalysts: A review, Journal of Cleaner Production 268 (2020) 121725.
5. Production, structural design, functional control, and broad applications of carbon nanofiber-based nanomaterials: A comprehensive review, Chemical Engineering Journal, Volume 402, 15 December 2020, 126189.

Web links and Video Lectures (e-Resources):

- https://youtu.be/2zr1-GKKet0 - Demonstration of galvanic cell
- https://youtu.be/G5McJw4KkG8 - Li-ion battery working
- https://youtu.be/PilpTDYtyIc - Construction and working of SOFC fuel cell
- https://youtu.be/g1TfQ9rypHI - Construction and working of dye sensitized solar cell
- https://youtu.be/f6WYxkhum-s - Galvanizing of Steel
- https://www.youtube.com/watch?v=0yl35W0o9S0&t=118s - Anodizing of Al
- https://www.youtube.com/watch?v=iLgiTAz86Hw - Cr plating
- https://youtu.be/Ukc_kc5OAhw - PCB making
- https://youtu.be/JtdCLPOcz5Y - CuO synthesis
- https://youtu.be/xAMhX3Drq14 - OLED working
- https://youtu.be/aVdWqbpbv_Y - Working of reverse osmosis
- https://youtu.be/F7YKvhjNWsk - Sewage treatment plant
- https://youtu.be/eH-LMwOU2fg - Dissolved oxygen sensor
- https://youtu.be/ldlniZfA2X4 - Gold extraction from e waste

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstrations
- Practical experiments in lab
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

APPLIED PHYSICS FOR ENGINEERS
(FOR AIML, CSE &CS(DS))

Course Code	**24PHY12/22**	**CIE Marks**	**50**
L:T:P:S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and quantum computing.
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and quantum computing.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic material behavior and the functioning of sensors and quantum gates.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Laboratory Component:

1. Stefan' Law of Radiation
2. Determination of Planck's Constant

Self-study / Applications	Application of Heisenberg's principle –Finite potential well, Application of Schrödinger Equation (free particle), Quantum tunnelling
Text Book	1 &2

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point telecommunication network, Problems.

Laboratory Component:

1. Laser Diffraction: To determine the wavelength of Laser using grating
2. Particle Size Determination – Using LASER
3. Numerical Aperture: To determine the numerical aperture of Optical Fiber

Self-study	Application of Lasers & Optical fiber endoscopy		
Text Book	3&4		
MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1,CO2, CO3,CO4 CO5**	**9 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Laboratory Component:

1. Fermi Energy: To determine the Fermi energy of copper.
2. Resistivity: Four Probe method
3. Hall Effect: To measure Hall Coefficient of materials.

Self-study /Applications	Maglev,Squids		
Text Book	5&6		
MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1,CO2, CO3,CO4 CO5**	**9 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT

Physics of Animation:

Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Laboratory Component:

1. Photodiode Characteristics

Self-study / Applications	Wearable Sensors		
Text Book	7,8,9&10		
MODULE-5	**QUANTUM COMPUTING**	**CO1,CO2, CO3 ,O4 CO5**	**9 Hours**

Introduction to Quantum Computing, Moore's law and its end , bits, Qbits, representation of qubit by Bloch sphere, quantum superposition, quantum entanglement, classical and quantum information comparison, difference between classical & quantum computing,

Matrix Operations: Pauli Matrices,Unitary Matrix,Row and Column Matrices,Transpose of Matrix, Orthogonality, Orthonormality

Quantum gates:Single Qubit Gates-NOT Gate,Pauli X,Y, and Z gates,Hadamard Gate,Phase Gate,T Gate

Multiple Qubit Gates- Controlled Gate, CNOT Gate (4 different input states), Controlled Z Gate,Toffoli Gate

Laboratory Component 1. Qiskit tool (Demonstration)	
Self Study /Applications	IBM Quantum, Superconducting Qubits
Text Book	11,12&13

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	10	2	10
L4	Analyze	5	2	10
L5	Evaluate	-	1	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1)Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand Publishing, 18th ed. 2016
2)Concepts of Modern Physics, Arthur Beiser, 7th Edition, 2017, Tata McGraw Hill
3)Engineering Physics, D K Bhattacharya, poonam Tandon, Oxford university Press, 2015
4)Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
5)A Textbook of Solid State Physics, S.O. Pillai, 6th Edition, 2010, New Age International
6)Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
7)Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
8)INTRODUCTION TO SENSORS AND TRANSDUCERS, Mr. M.Sivasubramanian, Notion Press, ISBN: 9798887339948
9)Sensors. Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN: 3540422595).
10)Physics for Animators,Michele Bousquet with Alejandro Garcia,CRC Press,Taylor and Francis,2016
11)Text Book Fundamentals of Quantum Computing by Venkateswaran Kasirajan, Springer, 2021, ISBN978-3-030-63688-3 ISBN 978-3-030-63689-0 (eBook) https://doi.org/10.1007/978- 3-030-63689-0
12)Quantum Computing -A beginners's Introduction,Parag K Lala,Indian Edition,McGraw Hill reprint 2020
13)Quantum Computing Fundamentals 5th Edition by Easttom, Pearson India, ISBN9789356062597

Web links and Video Lectures (e-Resources):

- **https://www.compadre.org/quantum/**
- **https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf**
- **https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf**
- **https://www.youtube.com/watch?v=_40dpUzzfhA**
- **https://www.youtube.com/watch?v=QuR969uMICM&t=1s**
- **https://www.youtube.com/watch?v=vruYFOlM1-Q**
- **https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9yGeM3**
- **https://www.youtube.com/watch?v=D8uMVrplSFA**
- **Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube**

Virtual Labs

- **https://www.vlab.co.in/broad-area-physical-sciences**

- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

APPLIED PHYSICS FOR ENGINEERS (FOR ECE&EEE)

Course Code	**24PHY12/22**	**CIE Marks**	**50**
L: T:P:S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and dielectric and magnetic materials
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and dielectric and magnetic materials.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic and magnetic material behavior and the functioning of sensors.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Laboratory Component:

1. Stefan' Law of Radiation
2. Determination of Planck's Constant

Self-study / Applications	Application of Heisenberg's principle –Finite potential well, Application of Schrödinger Equation (free particle), Quantum tunneling
Text Book	1 &2

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point telecommunication network, Problems.

Laboratory Component:

1. Laser Diffraction: To determine the wavelength of Laser using grating
2. Particle Size Determination – Using LASER
3. Numerical Aperture: To determine the numerical aperture of Optical Fiber

Self-study	Application of Lasers & Optical fiber endoscopy		
Text Book	3 & 4		
MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1 CO2 CO3 CO4 CO5**	**9 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Laboratory Component:

1. Fermi Energy: To determine the Fermi energy of copper.
2. Resistivity: Four Probe method
3. Hall Effect: To measure Hall Coefficient of materials.

Self-study /Applications	Maglev, Squids		
Text Book	5&6		
MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT
Physics of Animation:
Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Laboratory Component:

1. Photodiode Characteristics

Self-study / Applications	Wearable Sensors		
Text Book	7,8,9&10		
MODULE-5	**DIELECTRIC AND MAGNETIC MATERIALS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Dielectrics, types, polarization, types and temperature dependence of polarization, Polarizability, Internal field (Expression for One dimensional solid), Clausius-Mossotti equation (Derivation), Dielectric loss,

Expression for dielectric loss (derivation)Dielectric relaxation, frequency dependence of εr, Ferroelectrics – properties & applications -Piezoelectrics – properties and applications.

Introduction to magnetic materials: Paramagnetic, Diamagnetic and Ferromagnetic Materials-Properties, Ferromagnetic Domain theory, B-H curve, Soft and hard magnetic materials, applications, Problems on dielectrics.

Laboratory Component

1.Dielectric constant: To determine the dielectric constant of given dielectric by charging and discharging method

Self Study /Applications	Magnetic Memory devices, Piezoelectric sensors and actuators
Text Book	11&12

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	10	2	10
L4	Analyze	5	2	10
L5	Evaluate	-	1	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1)Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, 18th ed. 2016 S Chand Publishing,
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4)Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
5)A Textbook of Solid State Physics, S.O. Pillai, 6th Edition, 2010, New Age International
6)Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
7)Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
8)INTRODUCTION TO SENSORS AND TRANSDUCERS, Mr. M.Sivasubramanian, Notion Press, ISBN: 9798887339948
9)Sensors. Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN: 3540422595).
10)Physics for Animators,Michele Bousquet with Alejandro Garcia, 2016,CRC Press,Taylor and Francis,
11) ENGINEERING PHYSICS Paperback – January 2018 by S.P.Basavaraju,Subhas Stores
12) Applied Physics for Engineers Paperback – January 2014 by Dr. P.K. Diwan,Wiley

Web links and Video Lectures (e-Resources):

- https://www.compadre.org/quantum/
- https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf
- https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf
- https://www.youtube.com/watch?v=_40dpUzzfhA
- https://www.youtube.com/watch?v=QuR969uMICM&t=1s

- https://www.youtube.com/watch?v=vruYFOlM1-Q
- https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9yGeM3
- https://www.youtube.com/watch?v=D8uMVrplSFA
- Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube

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- https://bop-iitk.vlabs.ac.in/
- https://vlab.amrita.edu/index.php?sub=1&brch=189

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

APPLIED PHYSICS FOR ENGINEERS (FOR ME)

Course Code	**24PHY12/22**	**CIE Marks**	**50**
L:T:P:S	**3:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**4+2**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principles of quantum mechanics, lasers, electronic materials, sensors, physics in animation and Instrumentation physics.
CO2	Apply mathematical techniques to solve physics-related problems within the context of quantum mechanics, laser technology, electronic material physics, and Instrumentation physics.
CO3	Analyze various physical phenomena through the principles of wave mechanics, laser operation, electronic material behavior, material characterization and the functioning of sensors.
CO4	Understand how physical principles are used in engineering technology.
CO5	Develop problem-solving skills by tackling physics problems and apply theoretical knowledge to practical situations and engineering challenges.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-

MODULE-1	**QUANTUM MECHANICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Wave-Particle dualism, de-Broglie hypothesis, phase velocity, group velocity, relationship between phase velocity and group velocity, expression for de-Broglie wavelength from the concept of group velocity, Heisenberg's uncertainty principle, physical significance and application (broadening of spectral lines), Wave function Properties, Physical significance, derivation of Time independent Schrödinger wave equation, eigen value and eigen function, Application of Schrödinger Equation (one dimensional potential well) Numerical problems.

Laboratory Component:

1. Stefan' Law of Radiation
2. Determination of Planck's Constant

Self-study / Applications	Application of Heisenberg's principle –Finite potential well, Applicationof Schrödinger Equation (free particle), Quantum tunnelling
Text Book	1 &2

MODULE-2	**LASERS & FIBER OPTICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Introduction, Interaction of radiation with matter, expression for energy density at thermal equilibrium in terms of Einstein's coefficient, conditions and requisites of Laser, characteristics of laser, Quantum Dot Laser and their applications, Problems.

Principle and propagation of light in optical fibers, Numerical aperture and Acceptance Angle, Types of Optical fibers, Attenuation, Expression for attenuation co-efficient (derivation), application- point to point telecommunication network, Problems

Laboratory Component:

1. Laser Diffraction: To determine the wavelength of Laser using grating
2. Particle Size Determination – Using LASER
3. Numerical Aperture: To determine the numerical aperture of Optical Fiber

Self-study	Application of Lasers & Optical fiber endoscopy		
Text Book	3&4		
MODULE-3	**CONDUCTORS, SEMICONDUCTORS &SUPERCONDUCTORS**	**CO1 CO2 CO3 CO4 CO5**	**9 Hours**

Review of CFET (Qualitative), Quantum free electron theory, Fermi factor, variation of Fermi factor with Energy at T = 0K, T> 0K, Density of states (qualitative), Problems based on fermi factor.

Introduction of semiconductor physics, conductivity in an intrinsic semiconductor , mention of electron concentration in intrinsic semiconductor(Ne) and mention of Nh , expression for intrinsic carrier concentration ni from Law of mass action, expression for position of Fermi level in Intrinsic semiconductors , graphical discussion of variation of fermi level with temperature and concentration in intrinsic and extrinsic semiconductors, Hall Effect and expression for Hall coefficient in n and p type semiconductors(derivation) Application of Hall effect, Problems.

Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Current, Types of Super Conductors, BCS theory(qualitative), Applications in Quantum Computing.

Laboratory Component:

4. Fermi Energy: To determine the Fermi energy of copper.
5. Resistivity: Four Probe method
6. Hall Effect: To measure Hall Coefficient of materials.

Self-study /Applications	Maglev,Squids		
Text Book	5&6		
MODULE-4	**SENSORS AND PHYSICS OF ANIMATION**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Sensors: Difference between sensor, transmitter and transducer, working principle of sensors, sensor characteristics, Sensor classification, Sensor types and its applications, Biomedical sensors and Sensors in IOT

Physics of Animation:

Taxonomy of physics-based animation methods, Frames, Frames per second, Size and Scale, Weight and strength, Motion and Timing in animations, Force and acceleration, The Odd rule, Odd rule scenarios, Motion Graphs, Examples of Character animation: Jumping, Parts of Jump, Jump Magnification, Stop Time, Walking: Strides and Steps, Walk Timing. Numerical Problems

Laboratory Component:1. Photodiode Characteristics

Self-study / Applications	Wearable Sensors		
Text Book	7,8,9&10		
MODULE-5	**INSTRUMENTATION PHYSICS**	**CO1 CO2 CO3, CO4 CO5**	**9 Hours**

Instrumentation Physics

Introduction to materials – Nanomaterials- Synthesis, properties and applications, Composites-Types. Properties and applications Introduction to characterization techniques, XRD- Bragg's Law, X-ray Diffractometer, Particle size determination using XRD, XPS – Principle, instrumentation and application, AFM - Principle, instrumentation and application, SEM – Principle, instrumentation, Application and advantages. Problems on XRD

LABORATORY Component1.Particle Size Determination – Using LASER

Self-Study /Applications	TEM, FTIR
Text Book	11,12&13

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	10	2	10
L4	Analyze	5	2	10
L5	Evaluate	-	1	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1)Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, S Chand Publishing, 18th ed. 2016
2)Concepts of Modern Physics, Arthur Beiser, 7th Edition, 2017, Tata McGraw Hill
3)Engineering Physics, D K Bhattacharya, poonam Tandon, Oxford university Press, 2015
4)Engineering Physics, B. K. Pandey and S. Chaturvedi,1st edition, 2012, Cengage Publication
5)A Textbook of Solid State Physics, S.O. Pillai, 6th Edition, 2010, New Age International
6)Solid State Physics, C Kittel, 8th Edition, 2019, Wiley India
7)Measurement, Testing and Sensor Technology: Fundamentals and Application to Materials and Technical Systems 1st ed. 2018 Edition, by Horst Czichos, Springer
8)INTRODUCTION TO SENSORS AND TRANSDUCERS, Mr. M.Sivasubramanian, Notion Press, ISBN: 9798887339948
9)Sensors. Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN: 3540422595).
10)Physics for Animators,Michele Bousquet with Alejandro Garcia,CRC Press,Taylor and Francis,2016
11) Electron Microscopy and Analysis, ,Peter J. Goodhew, John Humphreys, Richard Beanland, 3rd Edition 2000, 272,Taylor and Francis.
ISBN 0-748-40968-8.
12)https://www.youtube.com/watch?v=nSuHuaNT8kE-Material Charecterization Part 1
13). https://www.youtube.com/watch?v=TnT7vXpsn6E-Material Charecterization Part2

Web links and Video Lectures (e-Resources):

- **https://www.compadre.org/quantum/**
- **https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture2.pdf**
- **https://www.iitk.ac.in/stc/Publications/DGoswami/marked_Chapter_07.pdf**
- **https://www.youtube.com/watch?v=_40dpUzzfhA**
- **https://www.youtube.com/watch?v=QuR969uMICM&t=1s**
- **https://www.youtube.com/watch?v=vruYFOlM1-Q**
- **https://www.youtube.com/watch?v=5j37DOD8q4U&list=PLTkE7n2CwG_PH09_q0Q7ttjqE2F9yGeM3**
- **https://www.youtube.com/watch?v=D8uMVrplSFA**
- **Quantum computing and networking w/ alkali atom qubit arrays | Qiskit Seminar Series w/ Mark Saffman - YouTube**

Virtual Labs

- **https://www.vlab.co.in/broad-area-physical-sciences**
- **https://bop-iitk.vlabs.ac.in/**
- **https://vlab.amrita.edu/index.php?sub=1&brch=189**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video Demonstration of working of QD Laser
- Video demonstration of latest trends in Quantum Computing
- Contents related activities (Activity-based discussions)
  - Flowcharts and Handout preparation by students
  - Group Discussion
  - Seminars

ENGINEERING SCIENCE COURSES (ESC)

DATA STRUCTURES USING C			
Course Code	**24CSE24**	**CIE Marks**	**50**
L:T:P:S	**2:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**02**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the essentials of programming constructs
CO2	Use the concepts of Arrays and Functions to develop programs using C language
CO3	Apply the concepts of Structures, Unions and Pointers to solve the given problem
CO4	Investigate the insertion and deletion operations of Stack data structure
CO5	Analyze the primitive operations of Queue data structure
CO6	Evaluate Sorting and Searching operations for a given set of data elements

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	-	2	2	-	-	-	-	-	-	-	-
CO5	3	3	1	2	-	-	-	-	-	-	-	-
CO6	3	3	2	2	-	-	-	-	-	-	-	3

MODULE-1	**Programming Essentials**	**CO1**	**6 Hours**

Structure of a Program, Data Types, Operators and Expressions, Managing Input and Output operations, Decision Making, Branching and Looping Statements.

Text Book	Text Book 1: Chapter 1 to Chapter 7

MODULE-2	**Arrays and Functions**	**CO2**	**6 Hours**

One-Dimensional Arrays, Two-Dimensional Arrays, Declaration, Initialization.
Built-in and User-defined functions, Calling a Function, Category of Functions, Call by value and Call by reference, Recursion.

Text Book	Text Book 1: Chapter 8, 13, 14, Text Book 2: Chapter 1

MODULE-3	**Structures, Unions and Pointers**	**CO3**	**6 Hours**

Definition, Initialization, Arrays of Structures, Structures within Structures and Unions.
Understanding Pointers, Declaration, Initialization, Pointer Arithmetic. Pointers to Pointers

Text Book	Text Book 1: Chapter 9, 17

MODULE-4	**Stacks and Queues**	**CO4, CO5**	**6 Hours**

Overview of Data Structures, Representation of a Stack, Primitive Operations on a Stack, Representations of Arithmetic Expressions, Evaluation of Postfix Expression.
Introduction to Queue, Representation of a Queue, Primitive Operations on a Queue.

Text Book	Text Book 2: Chapter 5,6

MODULE-5	**Searching and Sorting**	**CO6**	**6 Hours**

Searching, Linear Search, Binary Search, Recursive Binary Search
Sorting, Internal Sorting, External Sorting, Bubble sort, Insertion Sort, Selection sort.

Text Book	Text Book 2: Chapter 9

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	10	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	15
L4	Analyze	15
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Let Us C: Authentic guide to C Programming language – 19th Edition Paperback – Yashavant Kanetkar, 15 December 2022, ISBN: 9789389845693.
2. Data Structures Through C – 4th Edition, Yashavant Kanetkar, BPB Publications, March 2022, ISBN 978-93-5551-189-8.

Reference Books:

1. Data Structures And Algorithms Made Easy: Paperback, Narasimha Karumanchi, July 2023, ISBN: 9788193245286.

Web links and Video Lectures (e-Resources):

- https://youtu.be/wKoGImLA2KA?si=iN19IRhSTntmV2Mp
- **https://youtu.be/AT14lCXuMKI?si=z_vvUCUlsvBec5au**
- **https://youtu.be/si-KFFOW2gw?si=zkDv_FzVPZgczeYm**
- **https://youtu.be/Db9ZYbJONHc?si=CDozOf3s0JMTs5kJ**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Tricky Programs:** Tricky programs that can improve student's logical knowledge to solve complex problems with different methods. They can be individual or team-based.
  https://www.includehelp.com/c-programming-puzzles-c-sundae-examples-solutions.aspx
  Programming Puzzles: To become proficient in coding, students need to write clear, concise and correct programs. Students are given a set of programs on each module to enhance their programming skills. Primary task is to discover what each program prints.
  https://efrei.poupa.net/Programmation%20en%20C/Cours/The_C_Puzzle_Book.pdf
- **Peer Teaching**: The students can be asked to teach and discuss specific topic or concept to their peers. This not only reinforces their own understanding but also encourages active engagement and collaboration.
- **Reflection and Discussion**: The students can be asked to present their learning of any topic with others. This will encourage students to reflect on their experiences and discuss what they learned. This promotes critical thinking and deeper understanding.

DATA STRUCTURES USING C LAB

Course Code	**24CSL24**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Implement the essential programming constructs to solve a problem
CO2	Analyze applications of Arrays, Structures and Pointers to develop C programs
CO3	Implement insertion and deletion operations on stacks and queues
CO4	Apply searching and sorting techniques on a set of given elements

Mapping of Course Outcomes to Program Outcomes and Program-Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	3	-	-	-	3	3	-	3
CO2	3	3	3	-	3	-	-	-	3	3	-	3
CO3	3	3	3	-	3	-	-	-	3	3	-	3
CO4	3	3	3	-	3	-	-	-	3	3	-	3

Prog. No.	List of Experiments	Hours	COs
	PART-A		
1	Write a C program to find the roots of a quadratic equation.	**2**	**CO1**
2	Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.	**2**	**CO1**
3	Write a program to implement simple calculator using switch case statement.	**2**	**CO1**
4	Write a C program to find both the largest and smallest number in a list of integers.	**2**	**CO2**
5	Write a C program that uses functions to perform the following: i) Addition of Two Matrices ii) Multiplication of Two Matrices	**2**	**CO2**
6	Write a program to swap two numbers using pointers.	**2**	**CO2**
7	Create a structure named Book to store book details like title, author, and price. Write a C program to input details for three books, find the most expensive and the lowest priced books, and display their information.	**2**	**CO2**
8	Develop a program for Stack that performs following primitive operations: push, pop, peek and display.	**2**	**CO3**
	PART-B		
9	Write a program to evaluate a postfix expression using a Stack.	**2**	**CO3**
10	Develop a program for Queue that performs following primitive operations: Enqueue, Dequeue and Display.	**2**	**CO3**
11	a) Write a Program to perform linear search. b) Write a program to perform binary search.	**2**	**CO4**
12	a) Write a Program to sort the numbers using Selection Sort. b) Write a Program to sort the numbers using Bubble Sort.	**2**	**CO4**

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. https://cse02-iiith.vlabs.ac.in/List%20of%20experiments.html
2. **https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Weekly Evaluation	Test
		30	20
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	10	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. C Programming - Learn to Code, Sisir Kumar Jena, 2021, CRC Press, Taylor & Francis Group, ISBN: 978-1-032-03625-0.

COMPUTER AIDED ENGINEERING DRAWING			
Course Code	**24CAD15/25**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**5**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Draw the objects with definite shape and dimensions
CO2	Recognize and draw the shape and size of objects through different views
CO3	Develop the lateral surfaces of the object
CO4	Create the drawing views using CAD software
CO5	Generate orientation of 3D objects in Isomeric projections.
CO6	Identify the interdisciplinary engineering components or systems through its graphical representation

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	3	-	-	-	-	-	-	3
CO2	3	3	-	-	3	-	-	-	-	-	-	3
CO3	3	3	-	-	3	-	-	-	-	-	-	3
CO4	3	3	-	-	3	-	-	-	-	-	-	3
CO5	3	3	-	-	3	-	-	-	-	-	-	3
CO6	3	3	-	-	3	-	-	-	-	-	-	3

MODULE-1	**PROJECTIONS OF POINTS, STRAIGHT LINES AND PLANE SURFACES**	**CO1**	**8 Hours**

Introduction:
Significance of Engineering drawing, BIS Conventions, Lettering, Dimensioning, geometrical constructions and freehand practicing. Introduction to software, commands used for engineering drawing

Projections of Points: Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.

Projections of Straight Lines: True and apparent lengths, True and apparent inclinations to reference planes (First quadrant only).

Projections of plane surfaces– Introduction, triangle, square, rectangle, pentagon, hexagon and circle (First quadrant and change of position method only)

Self-study	List the different types of plane surfaces for their dimensions and orientation.
Text Book	Text Book 1: 5.1-5.6,6.1-6.4,7.1-1.13

MODULE-2	**PROJECTIONS OF SOLIDS**	**CO2**	**8 Hours**

Introduction, Projections of prisms, pyramids, cylinders and cones in different positions.

Self-study	Study the orientation of different types of solids for their shapes and dimensions.
Text Book	Text Book 1: 8.1-8.5

MODULE-3	**ORTHOGRAPHIC PROJECTIONS**	**CO3, CO4**	**8 Hours**

Conversion of pictorial views into orthographic projections of simple machine parts.

Case Study	Explore the different types of machine components to identify visible and invisible lines.
Text Book	Text Book 2: 2

MODULE-4	**ISOMETRIC PROJECTIONS**	**CO5**	**8 Hours**

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of cubes, right regular prisms, pyramids, cylinders, cones, spheres, hemispheres and combination of solids (Isometric projection of two simple solids).

Self-study	Study the different Mechanical components for the visible and invisible edges.
Text Book	Text Book 1: 11.1-11.7

MODULE-5	**DEVELOPMENT OF LATERAL SURFACES AND MULTI-DISCIPLINARY APPLICATIONS AND PRACTICE**	**CO6**	**8 Hours**

Development of lateral surfaces: Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones with base on HP only.

Multi-disciplinary applications and practice: Drawing Simple Mechanisms: Bicycles, Tricycles, Gear trains, Ratchets, two-wheeler cart & Four-wheeler carts to dimensions
Electrical Wiring and Lighting diagrams: Like Automatic fire alarm, call bell system, UPS system, Basic power distribution system using suitable software.
Basic Building Drawings: Simple Electronic Circuit Drawings, practice on layers' concept.

Applications	List the sheet metal drawing components used in automobile and aerospace application
Text Book	Text Book 1: 10.1-10.3

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	Lab Internal
		25	5	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	2	10
L4	Analyze	5	2	10
L5	Evaluate	5	1	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Engineering Drawing, Trymbaka Murthy, I.K International Publishing House Pvt Ltd, Bangalore,2013. ISBN-13-9380578606
2. Machine Drawing, K. R. Gopala Krishna, Subhas Stores, Bangalore,2005. ASIN : B074Y8HWKF

Reference Books:

1. French, Thomas E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company (2005). ISBN-13-9780071004251
2. A Textbook of Engineering Graphics by K. Venugopal & Prabhu Raj, New Age International, 2009. ISBN-13-9788122424577
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production- Luzadder Warren J., Duff John M.,Eastern Economy Edition, 2005- Prentice-Hall of India Pvt. Ltd., New Delhi. ISBN-13-9780134808499
4. Bhattacharya S. K., Electrical Engineering Drawing, New Age International publishers, second edition 1998, reprint 2005.
5. Chris Schroder, Printed Circuit Board Design using AutoCAD, Newnes, 1997.

Web links and Video Lectures (e-Resources):

Publications of Bureau of Indian Standards:

1. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
2. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
3. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

- **https://nptel.ac.in/courses/112/103/112103019/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit Manufacturing industries

ENGINEERING SCIENCE COURSES I&II (ESC I&II)

BASIC ELECTRONICS			
Course Code	**24ESC131/231**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply the principle of semiconductor device for real time applications
CO2	Analyze the different concepts of number systems for digital circuits
CO3	Construct combinational and sequential circuits using the basic logic gates
CO4	Understand the principles and usage of Embedded systems
CO5	Analyze the modulation techniques and relate with evolution of cellular communication systems
CO6	Engage in independent learning as a member of a team, submit a report and use ICT for effective presentation of the study on assigned topics related to electronic systems.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	1	2	1	-	1	2	2	-	2

MODULE-1	**SEMICONDUCTOR DIODE AND TRANSISTOR**	**CO1, CO6**	**8 Hours**

Semiconductor Diodes and Applications: P-N Junction diode – its principle, characteristics and parameters Applications: Half-Wave Rectifier, Full Wave Rectifier (Two Diode, Bridge Rectifier), Zener diode as Voltage regulator.

Bipolar Junction Transistor: BJT Operation, BJT Voltages and Currents, BJT as a switch, Common Emitter Characteristics, Numerical examples as applicable.

Self-study	Study the movement of electrons and holes in different regions of the BJT.
Text Book	Textbook 1: 1.6, 1.7, 2.2, 3.1, 3.2, 9.5, 4.1, 4.2, 4.4, 4.6

MODULE-2	**FUNDAMENTALS OF TRANSISTORS AND OSCILLATORS IN ELECTRONICS**	**CO1, CO6**	**8 Hours**

MOSFET: Introduction to MOSFET theory, Operation and characteristics of Enhancement MOSFET for n-channel, MOSFET as a switch. Comparison between BJT and MOSFET.

BJT as an Amplifier: Biasing DC load line, Need for biasing, Single stage CE amplifier using Voltage divider bias.

Oscillator: Barkhausen criterion, Conceptual discussion of Crystal controlled oscillator.

Self-study	MOSFET as a Switch
Text Book	Textbook 1: 9.5, 5.1, 5.4, 6.4, 16.1, 16.9

MODULE-3	**FUNDAMENTALS OF NUMBER SYSTEMS AND DIGITAL ELECTRONICS**	**CO2, CO3, CO6**	**8 Hours**

Number Systems: Introduction, Number Systems (Decimal, Binary, Hexadecimal, Octal), Conversion from one number system to other, Complement of Binary Numbers (1's and 2's), Binary subtraction using 1's and 2's complement.

Digital Electronics: Logic gates, NAND and NOR as universal gates, Boolean Algebra Theorems, De Morgan's theorem, Algebraic Simplification.

Applications	Implement logic circuits using basic gates (AND, OR, NOT) and universal gates (NAND, NOR) to build the core components of the electronic voting system.
Text Book	Textbook 2: 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.7

MODULE-4	**CORE COMPONENTS OF DIGITAL AND EMBEDDED SYSTEMS**	**CO3, CO4, CO6**	**8 Hours**

Building blocks of a Digital system: Combinational circuits (Half Adder, Full Adder), Sequential circuits (SR Latch using NAND gates, Flip-Flops [SR, JK, D, T]).
Embedded Systems: Definition of an Embedded System, Embedded systems vs General Purpose Systems, Application of Embedded Systems, Purpose of Embedded systems, Characteristics of Embedded systems.

Applications	Design circuit boards integrating microcontrollers, sensors, actuators, and communication modules.
Text Book	Textbook 2: 4.3, 5.5, 6.2, 7.2 Reference book 1: 1.1, 1.2, 1.5, 1.6, 3.1

MODULE-5	INTRODUCTION TO COMMUNICATION SYSTEMS AND CELLULAR TECHNOLOGIES	CO5, CO6	8 Hours

Communication Systems: Introduction to communication systems, need for modulation, Principles of amplitude modulation, Introduction to angle modulation, FM and PM waveforms, Amplitude shift keying, Frequency shift keying, Phase shift keying.1G, 2G cellular telephone systems – GSM, 3G and 4G, Simplified block diagram of a digital radio system.

Case Study	Evolution of cellular networks from analog (1G) to digital (2G) and subsequent advancements in speed and data capabilities (3G and 4G).
Text Book	Textbook 3: 1.3, 1.4, 4.1, 4.2, 7.5, 9.3, 9.4, 9.5 ,Textbook 3: 19.3, 20.2, 20.4, 20.9.2, 9.1

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution			
		Test (s)	Assignment	MCQ's	Mini Project
		25	5	10	10
L1	Remember	10	-	5	-
L2	Understand	10	-	5	-
L3	Apply	5	5	-	-
L4	Analyze	-	-	-	5
L5	Evaluate	-	-	-	-
L6	Create	-	-	-	5

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources: Text Books:

1) Electronic Devices and Circuits, David. A. Bell, 5th edition, 2008, Oxford University Press, ISBN: 978-0195693409.
2) Digital Logic and Computer Design, M. Morris Mano, 5th edition, 2002, PHI, ISBN: 978-0131989269.
3) Electronic communication systems, Wayne Tomasi, 5th edition, 2001, Pearson.education, ISBN: 978-0130494924.

Reference Books:

1) Introduction to Embedded systems, Shibu K.V., 1st Edition, McGraw Hill Education, 2009, ISBN**:** 978-0070145894
2) Principles of Electronics, V. K. Mehta, 12th edition, 2020, S. Chand Publishing, ISBN: 978-9352838277

Web links and Video Lectures (e-Resources):

- https://www.rfpage.com/evolution-of-wireless-technologies-1g-to-5g-in-mobile- communication/
- **MOSFET :https://archive.nptel.ac.in/courses/108/106/108106105/**
- Basic Electronics: https://nptel.ac.in/courses/122106025
- **Embedded system : https://nptel.ac.in/courses/108102045**
- **https://www.youtube.com/watch?v=bGxhPG3H5BQ**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Hands-On Component Identification
- Group Projects
- Group activity to Diagnose fault finding in basic simple electronic circuits.

BASIC ELECTRICAL ENGINEERING			
Course Code	**24ESC132/232**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the principle of operation, components, layout, environmental and social issues of various power plants.
CO2	Recognize the energy properties of electric elements and the techniques to measure voltage and current.
CO3	Analyze the active and passive elements and performance parameters of ac circuits.
CO4	Choose the proper type and specification of measuring procedure and instruments for different industrial, commercial, and domestic applications.
CO5	Evaluate the basic operation and performance of electrical machines and can select appropriate machine for different purposes.
CO6	Use the concepts of tariff and different safety measures of electrical appliances.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	1	-	-	-	-	-	-	-	-
CO3	3	1	-	1	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	1	-	-	-	-	-	-	-	-
CO6	2	1	-	1	-	-	-	-	-	-	-	-

MODULE-1	**POWER PLANTS AND DC CIRCUITS**	**CO1, CO2**	**8 Hours**

Power Generation:
Renewable and Non-Renewable energy resources - Hydel, Nuclear, Solar & wind power generation (Block Diagram approach) - Electrical power system structure-Single line diagram.

DC Circuits:
Ohm's Law and its limitations- KCL & KVL-series, parallel, series-parallel circuits-Simple Numerical

Text Book	Text Book 1: Chapter 1,2 & 3, Chapter 15 Text Book 5 : Chapter 17, 1 & 2
Self-Study	A case study of the power sector in India

MODULE-2	**AC CIRCUITS**	**CO3**	**8 Hours**

A.C. Fundamentals:
Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor (only definitions)-Voltage and current relationship with phasor diagrams in R, L, and C Circuits- Series R-L, R-C, R-L-C circuits, concept of impedance and admittance, Concept of active, reactive, apparent, complex power and power factor

Three Phase Circuits:
Three phase AC quantity, advantages, and limitations-star and delta connection-relationship between line and phase quantities.

Text Book	Text Book 1:Chapter 7,8 & 9
Self-Study	AC Electrical Circuit Analysis- Watching NPTEL video lecture series and Identification of phase, Neutral and Earth wires for connection

MODULE-3	**ELECTRICAL MEASUREMENTS AND WIRING**	**CO4**	**8 Hours**

Measurement and Instrumentation:
Functional elements of measuring instruments – Types of measuring instruments – Standards, Errors, and calibration-Construction and working Principle of Permanent magnet moving coil and moving iron instruments-Attraction type, Single phase wattmeter and Single phase energy meter and digital meters.

Domestic Wiring:
Requirements, Types of wiring: Two way and three-way control of lamp.

Text Book	Text Book 1: Chapter 13 ;Text Book 4 : Chapter 15; Text Book 3 : Chapter 1,2
Self-study	Study of electrical safety measures and protective devices and Identification of phase, Neutral and Earth wires for connection

MODULE-4	ELECTRICAL MACHINES	CO5	8 Hours

DC Generator:
Principle of operation-constructional details, types-induced EMF expression.
DC Motor:
Principle of operation, back emf and its significance- Torque equation, types of motors, Applications of DC machines.
Transformers:
Principle of operation, construction of single-phase transformers, Types, EMF equation and losses in transformer, Definition of regulation and efficiency.

Text Book	Text Book 1: Chapter 10,11 & 12 ;Text Book 2: Chapter 9 & 10
Self-study	Watching NPTEL video lecture on Electrical Machines and Magnetic circuits

MODULE-5	TARIFF CALCULATION AND ELECTRICAL SAFETY	CO6	8 Hours

Energy conservation and load calculation:
Energy conservation and its necessity-Power rating and load calculations of domestic appliances -tariff and its types.
Equipment Safety measures:
Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits, Personal safety measures -Electric Shock, Earthing and its types, Safety Precautions to avoid shock.
An over view of electric vehicles - block diagram approach.

Text Book	Text Book 1:782-796
Self-study	Case study on Electrical safety measures

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	5	3
L2	Understand	10	5	2
L3	Apply	5	5	5
L4	Analyze	5	-	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:
TEXT BOOKS:

1) Basic Electrical Engineering by D C Kulshreshtha, Tata McGraw Hill, 2nd Edition 2019, ISBN-13: 978-9353167219
2) Principles of Electrical Engineering and Electronics, V.K. Mehta, S Chand Publishing, 2019, ISBN: ISBN : 9788121942980
3) Electrical and electronic measurements and instrumentation by A K Sawhney, Dhanpat Rai & Co. (P) Limited,2015, ISBn-10: 8177001000, ISBN-13: 978-8177001006
4) Basic Electrical and Electronics Engineering, D P Kothari, I J Nagrath, Second Edition, McGraw Hill Publishers, 2020, ISBN-10: 9389811244,ISBN-13: 978-9389811247

Reference books:

1) Basic Electrical and Electronics Engineering, S.K. Bhattacharya, Pearson Education, 2017, ISBN: 9789332586505
2) A textbook of Electrical Technology by B.L. Theraja, S Chand Publication, 2014, ISBN: 8121924413

Web links and Video Lectures (e-Resources):

1. AC and DC circuits: https://www.youtube.com/watch?v=ERIToctYUcQ
2. Basic concepts and examples: https://youtu.be/3TR_DS_7z2w
3. Ohm's Law, KVL, KCL : https://youtu.be/FjaJEo7knF4
4. Electrical measurements and instrumentation: https://www.youtube.com/watch?v=xLjk5DrScEU&list=PLt5syl71JKf3yk9h0mWg6vCNn1Jmb72JJ
5. Electrical machines: https://www.youtube.com/watch?v=KUSBS11qpX0&list=PLohtAIfLLw8cdi1iOLyLNX1f839KSXDnl

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on different topics
- Problem solving approach
- Collaborative learning
- Seminars
- Experiential learning approach through lab sessions (Hardware/Software)

BASIC MECHANICAL ENGINEERING

Course Code	**24ESC133/233**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Apply the concepts of conventional and non-conventional energy systems to design and develop alternate source of energy production
CO2	Understand the working of advanced vehicle technologies
CO3	Analyse the different types of IC engines and refrigeration systems and solve problems related to them
CO4	Apply the concepts of advanced technology and visualize various ways to create the development of products with the aid of modern tools.
CO5	Analyze the advanced manufacturing systems.
CO6	Understand the characteristics of smart materials and their uses in manufacturing.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	-	-	-	-	-

MODULE-1	**ENERGY RESOURCES**	**CO1**	**8 Hours**

Introduction- Various Energy demands in India. Solar Energy- Types of Solar Energy Utilization, Solar Energy application- Solar Water heater, Space heating of buildings, Solar cooking, Solar in Agriculture.
Wind Power: Utilization of Wind power and hydel power for electric power generation, Installed capacity of hydel and Wind power in India. Electrical Power generation from Bio-fuels.
Steam Formation and Application: Formation of steam and thermodynamic properties of steam. Simple problems using steam tables. Application of steam in power generation industry, processing industries

Case Study	Bio-diesel a future Technology- Growth in Global Market, advantages, disadvantages, Jatropha biodiesel in India, Process involved in Modern Biodiesel production
Text Book	Text Book 1: Ch. 1, 2

MODULE-2	**I C ENGINES**	**CO2, CO3**	**8 Hours**

Parts of IC Engines, Working of Four stroke petrol and four stroke diesel engine, Working of Two-stroke Engine. Microprocessor based Engine Management system, Battery Ignition system, Anti-lock braking system, Parking Assist systems, Automatic Suspension control, Electric vehicles- EV batteries and drive Motors, Hybrid vehicles and its types,

Self Study	Self study about different vehicles and their safety systems.
Text Book	Text Book 1: Ch.3

MODULE-3	**IC ENGINE PARAMETERS AND REFRIGERATION**	**CO3**	**8 Hours**

Introduction- IC Engine Terminologies, Definition and Calculation on IP, BP, FP, SFC and various Efficiencies for IC Engine- Problems.
HVAC & R- Modern Refrigerants, Vapour Compression Refrigeration cycle, Domestic Refrigerator. Basic Air cycle, Summer and Winter Air conditioning systems, Split AC unit.

Self-study	Study the different types of Refrigertors and AC, also its features.
Text Book	Text Book 1: Ch. 3

MODULE-4	**INTRODUCTION TO ADVANCED MANUFACTURING SYSTEMS**	**CO4, CO5**	**8Hours**

Computer Numerical Control (CNC) : Introduction, components of CNC, Open loop and closed loop systems, advantage of CNC, CNC Machining centre's and Turning centers. Applications of CNC, Advantages and disadvantages of CNC.
Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid prototyping, Advantages and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

Applications	Industrial applications in the field of advanced manufacturing systems
Text Book	Text Book 2-Ch.-5, 3-Ch-1,2

MODULE-5	SMART MATERIALS	CO6	8Hours

Introduction to Smart Materials, Principles of Piezoelectricty, Perovskyte Piezoceramic Materials, Single Crystals vs Polycrystalline Systems, Piezoelectric Polymers, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rheological Fluids

Self Study	Study the different types of smart materials and its applicability
Text Book	Ref. 1, Ch-1,2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

TEXT BOOKS:

1) Elements of Mechanical Engineering, Kestoor Praveen, M R Ramesh, Suggi Publishers
2) R S Khurmi and J K Gupta, A Text book Machine Design, EURASIA PUBLISHING HOUSE (PVT.) LTD.,

Reference Books

1) Brian Culshaw, Smart Structures and Materials, Artech House2000
2) D.T Pham, S. S. Dony, "Rapid Manufacturing", Springer, 1st Edition,
3) Paul F Jacobs, "Rapid Prototyping & Manufacturing", Wohlers Associates, ASME Press,
4) S S Bhavikatti Elements of Civil Engineering and Mechanics,Fifth Edition,New Age International Pubhishers ISBN:978-81-224-3817-8
5) B.K. Kolhapure Elements of Civil Engineering and Engineering Mechanics, EBPB Publishers 8th edition ASIN : B073RRM9X1
6) 3. K. R. Gopalakrishna, Elements of Mechanical Engineering, Subhas Publications, Bangalore, 2017, ISBN- 13: 5551234091781

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=EVqBzOGQlkI
- https://www.youtube.com/watch?v=GF5C8dH4f5o
- https://www.youtube.com/watch?v=0MeAZFFqmek&list=PLdLe0dTcWW-u_dCcNGoAK8fx2PiS5gkVu

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Automobile industry visit
- IC engine Lab Visit

PROGRAMMING LANGUAGE COURSES I&II (PLC I&II)

PROBLEM SOLVING USING PYTHON

Course Code	**24PLC141/241**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**3+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts of Python and Apply the basic programming skills of Python Language in problem-solving.
CO2	Implement Python programs using different datatypes, Control statements loops and user-defined functions.
CO3	Analyze different string manipulation functions available in Python.
CO4	Analyze Exception handling functions available in Python.
CO5	Apply List, set, dictionary and Tuple concepts to design a Python program.
CO6	Create applications using Python programming language to solve real-world problems with files and OOPS concepts

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	-	-	3	-	-	-	-	-	-	-
CO3	3	3	3	-	3	-	-	-	-	-	-	-
CO4	3	3	3	-	3	-	-	-	-	-	-	-
CO5	3	3	3	-	3	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	1

MODULE-1	**BASICS OF PYTHON**	**CO1**	**8 Hours**

Algorithm and Flowchart, Elements of Python: Keywords, Identifiers, Variables, Data Types, Features. Operators and Expression: Assignment Statements, Numeric Expressions, Order of Evaluation, Operator Precedence, Type Conversions, Input Output Statement, Comments in Python.

Laboratory Components: (all programs must be done with Pseudo code and Flow chart)

1. Write a Python program that calculates the area of a circle based on the radius entered by the user.
2. Write a Python program that accepts an integer (n) and computes the value of n+nn+nnn.
3. Given two integer numbers, return their product only if the product is equal to or lower than 1000. Otherwise, return their sum.

Textbook	Textbook 1: 1.2

MODULE-2	**LOOPS ,CONTROL STATEMENTS AND FUNCTIONS**	**CO2**	**8 Hours**

Loops and Control Statements: If, elif, Nested if, for, nested for, while continue, Break, Pass.
Functions: Advantage of Functions in Python, creating a Function, Function Calling, return statement, Arguments in function, Pass by Object Reference, Built-in Function, Lambda Functions, Map, Filter, Reduce functions, Recursive functions.

Laboratory Components: (all programs must be done with Pseudo code and Flow chart)

1) Write a Python program to create the multiplication table (from 1 to 10) of a number.
2) Write a Python program to count the number of even and odd numbers in a series of numbers
   Sample numbers: numbers = (1, 2, 3, 4, 5, 6, 7, 8, 9)
3) Write a Python program to convert temperatures to and from Celsius and Fahrenheit.
   [Formula : c/5 = f-32/9 [where c = temperature in Celsius and f = temperature in Fahrenheit]

Self-study / Case Study / Applications	1.A game must be made from marbles of Five colors, yellow, blue, green, red and Violet where five marbles have to be kept one upon another. Write a python program using recursion, to find how many ways these marbles can be arranged. 2. Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules: Here is a high-level outline of how to move a tower from the starting pole to the goal pole, using an intermediate pole: Move a tower of height-1 to an intermediate pole, using the final pole. Move the remaining disk to the final pole. 3. Move the tower of height-1 from the intermediate pole to the final pole using original pole		
Textbook	Textbook 1: 1.3,1.5,1.6,1.7,2:2.4		
MODULE-3	**STRINGS AND EXCEPTION HANDLING**	**CO3, CO4**	**8 Hours**
Strings: Creating String in Python, Strings indexing and splitting, Reassigning Strings, Deleting the String, String Operators, Python String functions, slice operations. **Assertion and Exception Handling:** Assertion usage in Python, Exception handling, try, except, raise, finally.			
Laboratory Components: (all programs must be done with Pseudo code and Flow chart) 1) Write a Program to Accept a Hyphen Separated Sequence of Words as Input and Print the Words in a Hyphen-Separated Sequence after Sorting them Alphabetically 2) Given a string in python, count number of uppercase letters, lowercase letters and spaces in a string and toggle case the given string (convert lowercase to uppercase and vice versa). 3) Write a Python program that accepts a string and calculates the number of digits and letters. Sample Data: Python 3.6			
Self-study / Case Study / Applications	A musical album company has 'n' number of musical albums. The PRO of this company wishes to do the following operations based on some scenarios: Name of the album starts with 's' or 'S'. Name of the album which contains 'jay' as substring. Check whether the album name presents in the repository or not. Count number of vowels and consonants in the given album name.		
Textbook	Textbook 1:1.5,1.8,2:2.8		
MODULE-4	**LIST SET, DICTIONARY AND TUPLE**	**CO5**	**8 Hours**
List: Creating a List, List indexing and splitting, Python List Operations, List Built-in functions, **Tuple:** Creating a tuple, Indexing, Deleting Tuple, Tuple operations, Tuple inbuilt functions. **Set:** Creating a set, Python Set Operations, Python Built-in set methods. **Dictionary:** Creating the dictionary, Properties of Keys and Values, Accessing the dictionary values, and adding dictionary values, Iterating Dictionary, Built in Dictionary functions.			
Laboratory Components: (all programs must be done with Pseudo code and Flow chart) 1) Write a Python script to add a key to a dictionary. Sample Dictionary: {0: 10, 1: 20} Write a Python program to remove an item from a set if it is present in the set. 2) Write a Python program to find repeated items in a tuple			
Self-study / Case Study / Applications	In a class of 50 numbers of students, 6 students are selected for the state cricket academy. The sports faculty of this school must report to the state cricket academy about the selected students' physical fitness. Here is one of the physical measures of the selected students'; Height in cm is given for those 6 selected students [153,162,148,167,175,151]. By implementing functions, do the following operations. The state academy selector must check whether the given height is present in the selected students list or not. State academy selector must order the height of students in an incremental manner. State academy selector must identify the maximum height from the list.		

Textbook	Textbook 1: 1.10,1.11,1.12,2:2.5		
MODULE-5	**FILES AND OBJECT-ORIENTED PROGRAMMING**	**CO6**	**8 Hours**

Files: Text files, reading and writing files, format operator; command line arguments, modules, packages
Object Oriented Programming: – creating python classes – Initializing objects, Objects and classes - Abstraction – overview of inheritance and its type, polymorphism

Laboratory Components: (all programs must be done with Pseudo code and Flow chart)

1) Write a Python program to count the number of lines in a text file
2) Write a Python program to append text to a file and display the text
3) Write a Python program to generate 26 text files named A.txt, B.txt, and so on up to Z.txt

Self-study / Case Study / Applications	1.Shuffle Deck of Cards To shuffle the deck of cards, use the shuffle module. Import the required module Declare a class named Cards which will have variables suites and values, now instead of using self. Suites and self. Values are to be declared as global variables. Declare a class Deck that will have an empty list named mycardset, and the suites and values will be appended to mycardset list. Declare a class ShuffleCards along with a method named shuffle() that would check the number of cards and then shuffle them. To remove some cards, we will create a popCard() method in ShuffleCards class.
Textbook	Textbook 1:1.14 to 1.18,2:2.6,2.7,2.9

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	**Remember**	5	-	-
L2	**Understand**	5	-	-
L3	**Apply**	5	5	10
L4	**Analyze**	5	-	10
L5	**Evaluate**	5	-	-
L6	**Create**	5	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	--

Suggested Learning Resources:

Textbooks:

1) Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Publisher: O'Reilly Publishers, 3rd Edition,24 May 2024,ISBN:978-1098155438
2) Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2", Publisher: Network Theory Ltd., 2011, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

1) John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, Publisher: MIT Press, 2023.
2) Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Publisher: Pearson India Education Services Pvt. Ltd., 2022.

3) Timothy A. Budd, “Exploring Python, Mc-Graw Hill Education (India) Private Ltd., 2021.
4). Kenneth A. Lambert, “Fundamentals of Python: First Programs, CENGAGE Learning, 2022.
5). Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2023.
6). Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3, Pragmatic Programmers, LLC, 2022.

Web links and Video Lectures (e-Resources):

1) https://www.python.org/
2) https://www.codecademy.com/learn/learn-python-3
3) https://pynative.com/
4) https://www.programiz.com/python-programming
5) https://learnpython.com/
6) https://alison.com/course/a-python-course-for-complete-beginners
7) https://www.coursera.org/learn/python
8) https://www.edx.org/learn/computer-science/massachusetts-institute-of-technology-introduction-to-computer-science-and-programming-using-python

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1) Contents related activities (Activity-based discussions)
2) For active participation of students, instruct the students to prepare Flowcharts and Handouts
3) Organizing Group wise discussions on issues
4) Seminars

PROBLEM SOLVING USING C

Course Code	24PLC142/242	CIE Marks	50
L:T:P:S	2:0:1:0	SEE Marks	50
Hrs / Week	3+2	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes: At the end of the course, the student will be able to:

CO1	Illustrate basic concepts of C programming
CO2	Understand the use of control structures forgiven problems using C programming language.
CO3	Apply the concepts of looping, branching, and decision-making statements for a given problem
CO4	Develop the programs for array representation problems using C programming language
CO5	Demonstrate the ability to write C programs using pointers, structures, unions and arrays
CO6	Develop modular applications using C programming language

Mapping of Course Outcomes to Program Outcomes a

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	1	-	-	-	-	-	-	1
CO2	3	3	3	1	1	-	-	-	-	-	-	1
CO3	3	3	3	1	1	-	-	-	-	-	-	1
CO4	3	3	3	1	1	-	-	-	-	-	-	1
CO5	3	3	3	1	1	-	-	-	-	-	-	1
CO6	3	3	3	1	1	-	-	-	-	-	-	1

MODULE-1	Introduction and Basic I/O in C	CO1	08 hours

Basics: Program development in C, structured programming, using algorithm and flow chart.
Introduction: The C character set, Identifiers and keywords, Data types, Constants and variables, Expressions, Arithmetic operators, Unary, Relational, Logical, Assignment and conditional operators, Bitwise operators.
I/0 Functions: Formatted and unformatted Input/Output functions like printf(), Scanf(), Puts(), Gets() etc, The first C program

Laboratory Component:

- Write a C program to find sum and average of three numbers.
- Write a C program to find the sum of individual digits of a given positive integer.
- Write a C program to generate the first n terms of the Fibonacci sequence.

Text Book	Text Book 1: Chapter 1 & 2

MODULE-2	Control Structures & Looping	CO2 CO3	08 hours

Control Structures: If, If-else, Switch case statements, While, For, Do-while loops, Break and continue statements, Goto, Return, Type conversion and type modifiers, Designing structured programs in C,

Laboratory Component:

- Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
- Write a program to implement Arithmetic operations using switch case statement.

Text Book	Text Book 1: Chapter 3, 4, 5

MODULE-3	Arrays and Strings in C	CO4	08 hours

Arrays: Declaring and initializing arrays in C, Defining and processing 1D and 2D, arrays, Array applications, inserting and deleting elements of an array, Searching an element, Sorting of array.
Strings: Defining and initializing strings, Reading and writing a string, Processing of string, Character arithmetic, String manipulation functions and library functions of string,

Laboratory Component:

- Write a C program to perform the following:
  i) Addition of Two Matrices ii) To find transpose of a matrix iii) Multiplication of Two Matrices

Text Book	Text Book 1: Chapter 13, 14, 15, 16

MODULE-4	Pointers & User defined Data Types in C	CO5	08 hours

Pointers: Pointer declaration and initialization, Types of pointers- dangling, null, generic (void), Pointer expressions and arithmetic, Pointer operators, Operations on pointers,Passing pointer to a function, Pointer

and 1D array, Dynamic memory management functions (malloc, calloc, realloc and free), Passing arrays to functions,

UDDT: Declaration of a structure, Definition and initialization of structures, Accessing structures, Structures and pointers, Nested structures, Declaration of a union.

Laboratory Component:

- Write a C program to swap two values using pointers
- Write a program to create a new matrix representing squares of elements in original matrix using pointers.

Text Book	Text Book 1: Chapter 9

MODULE-5	**Functions in C**	**CO6**	**08 hours**

Functions: User defined functions, Storage classes: Function prototypes, Function definition, Function call including passing arguments by value and passing arguments by reference, Math library functions, Recursive functions, Scope rules (local ,global scope), Storage classes in C namely auto, Extern, Register, Static storage classes.

Laboratory Component:

- Write a program containing a function to find factorial of a number.
- Write a program containing a function in C to convert a decimal number to a binary number.
- Write a program to input a number and print the number in words using a function.

Text Book	Text Book 1: Chapter 8, 10

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	10
L4	Analyze	5	-	10
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Yashavant P. Kanetkar, "Let Us C", 16th Edition, 2019, BPB Publications, ISBN: 978- 93 8728-449-4.

Reference Books:

1. "Programming In C" By Ashok N. Kamthane, 3rd edition, Pearson, ISBN 9789332543553.
2. "Programming in ANSI C" by E. Balaguruswamy, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Web links and Video Lectures (e-Resources):

1. http://elearning.vtu.ac.in/econtent/courses/video/BS/14CPL16.html
2. https://nptel.ac.in/courses/106/105/106105171/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Peer Teaching**: The students can be asked to teach and discuss specific topic or concept to their peers. This not only reinforces their own understanding but also encourages active engagement and collaboration.
- **Reflection and Discussion**: The students can be asked to present their learning of any topic with others. This will encourage students to reflect on their experiences and discuss what they learned. This promotes critical thinking and deeper understanding.
- **Tricky Programs:** Tricky programs that can improve student's logical knowledge to solve complex problems with different methods. They can be individual or team-based.

BASIC WEB PROGRAMMING

Course Code	**24PLC143/243**	**CIE Marks**	**50**
L: T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**3+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the concepts of HTML tags and elements to design a static webpage.
CO2	Apply CSS to style the web pages and create responsive layouts.
CO3	Apply JavaScript in HTML document to manipulate web page elements using the Document Object Model (DOM).
CO4	Evaluate the strategies for working with arrays, strings, functions, and form handling in PHP.
CO5	Examine file and directory management techniques in PHP.
CO6	Analyze basic object-oriented programming concepts and error handling in PHP.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	1	1	-	-	-	-	-	-	-
CO3	3	3	3	1	1	-	-	-	-	-	-	-
CO4	3	3	3	1	1	-	-	-	-	-	-	-
CO5	3	3	3	1	1	-	-	-	-	-	-	-
CO6	3	3	3	1	1	-	-	-	-	-	-	-

MODULE-1	**Introduction to HTML and Web Basics**	**CO1**	**8 Hours**

Overview of web programming and HTML. Structure of HTML documents: headers, paragraphs, hyperlinks, images, lists, tables, and basic forms.

Laboratory Component:

1. Design a basic HTML web page with headings, paragraphs, images, and lists.
2. Build an HTML form with text fields, radio buttons, checkboxes, a dropdown menu, and a submit button.
3. Design an HTML table with multiple rows, columns, and merged cells (colspan and rowspan).

Text Book	Textbook 1: Chapters 1, 2

MODULE-2	**CSS and HTML5**	**CO2**	**8 Hours**

Explores basic CSS, including properties, syntax, and techniques for page layout, styling sections, and positioning elements. Introduces HTML5 fundamentals, including new elements, graphics with Canvas and SVG, and how CSS is used for styling in HTML5.

Laboratory Component:

1. Apply CSS to a web page to set properties such as color, font, and margins. Use CSS to style headings, paragraphs, and lists, and to create a layout.
2. Use CSS to design a web page with multiple sections. Implement techniques for floating elements, sizing, and positioning to create a responsive layout.
3. Use HTML5 elements like <canvas> and <svg> to add graphics to a web page. Apply CSS to style these elements and integrate them into the overall page design.

Text Book	Textbook 1: Chapters 3, 5 Textbook 2: Chapters 6, 7

MODULE-3	**JavaScript and DOM**	**CO3**	**8 Hours**

Basic JavaScript: Syntax, program logic, arrays, strings, and functions. Introduction to the Document Object Model (DOM): Global DOM objects, DOM element objects, and the DOM tree.

Laboratory Component:

1. Write basic JavaScript code demonstrating syntax, program logic, and operations with arrays and strings.
2. Develop simple JavaScript functions to perform tasks and manipulate data.
3. Use JavaScript to interact with the DOM, modify DOM elements, and dynamically update a web page.

Text Book	Textbook 1: Chapter 7

MODULE-4	**PHP Basics**	**CO4**	**8 Hours**

Introduction to PHP: Syntax, arrays, strings, and functions. Basic Form Handling in PHP: Building and processing forms, handling form data.

Laboratory Component:

1. Write PHP scripts to handle basic form data submission and processing.
2. Work with PHP arrays, strings, and functions.
3. Build an HTML form and use PHP to process the data submitted through the form.

Text Book	Textbook 2: Chapter 11

MODULE-5	PHP Advanced Basics	CO5 CO6	8 Hours

File and Directory handling in PHP. Introduction to Object-Oriented Programming (OOP) in PHP: Classes, objects, and simple OOP concepts. Simple error handling and debugging in PHP.

Laboratory Component:

1. Use PHP's file and directory functions to manage files.
2. Develop a simple PHP application using basic OOP concepts.
3. Implement basic error handling in a PHP script.

Text Book	Textbook 2: Chapter 12

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	10
L4	Analyze	5	-	10
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Jeffrey C. Jackson, Web Technologies: A Computer Science Perspective, Prentice Hall, 2007. ISBN: 978-0136152000.
2. Deitel, Harvey M., Deitel, Paul J., and Nieto, Temi, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011. ISBN: 978-0132151009.

Reference Books:

1. Marty Stepp, Jessica Miller, and Victoria Kirst, Web Programming, Step by Step Publication, 2nd Edition, 2009. ISBN: 978-0977279732.
2. Robin Nixon, Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites, O'Reilly Media, 3rd Edition, 2014. ISBN: 978-1491918661.
3. Douglas E. Comer, The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works, 4th Edition, Prentice Hall, 2007. ISBN: 978-0132435674.
4. Kogent Learning Solutions Inc., Web Technologies: HTML, JavaScript, PHP, Java, JSP, ASP.NET, XML, and Ajax Black Book, Dreamtech Press, Recent Edition. ISBN: 978-8177228778.

Web links and Video Lectures (e-Resources):

1. **https://www.w3schools.com/**
2. https://www.freecodecamp.org/
3. **https://www.coursera.org/browse/computer-science/web-development**
4. **https://www.khanacademy.org/computing/computer-programming/html-css**
5. **https://www.youtube.com/user/TechGuyWeb**
6. **https://www.php.net/manual/en/**
7. **https://www.w3.org/XML/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- **Build a Personal Portfolio Website:** Create a personal portfolio website using HTML, CSS, and PHP. Include multiple pages showcasing your skills, projects, and experiences, with dynamic content and interactive features like contact forms.
- **Collaborate on Simple PHP-Based Projects:** Work on collaborative projects such as a basic chat application or a mini blog. These projects should involve user interactions, data handling, and fundamental PHP functionalities.
- **Analyze and Patch Basic Security Vulnerabilities:** Identify common security issues in PHP applications, such as vulnerabilities in user input handling. Analyze sample PHP code for these issues and apply basic security measures to improve the application's security.
- **Integrate Simple APIs into PHP Applications:** Enhance PHP applications by integrating simple APIs, such as those for weather data or search functionalities. This involves fetching data from external sources and using it within your PHP application.
- **Participate in Basic Hackathons:** Engage in hackathons that focus on developing simple web applications using HTML, CSS, and PHP. These events offer opportunities to apply your skills in real-world scenarios, work on practical projects, and collaborate with others.

EMERGING TECHNOLOGY COURSES I&II (ETC I &II)

ROBOTICS AND AUTOMATION			
Course Code	**24ETC151/251**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts of Robot anatomy
CO2	Analyze various control systems involved in robotic configuration
CO3	Implement the process of robot cell design and programming deployment
CO4	Understand industrial automation and assembly configuration
CO5	Demonstrate robotic utilization in various domains
CO6	Apply the current robotic technology adaptive to the industry

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	2	-	-	-	-	-	-	1
CO2	3	1	2	-	2	-	-	-	-	-	-	1
CO3	3	1	2	-	2	-	-	-	-	-	-	1
CO4	3	1	2	-	2	-	-	-	-	-	-	1
CO5	3	1	2	-	2	-	-	-	-	-	-	1
CO6	3	1	2	-	2	-	-	-	-	-	-	1

MODULE-1	**FUNDAMENTALS OF ROBOTICS**	**CO1**	**8 Hours**
Robot anatomy and configuration, basic terminology- accuracy, repeatability, resolution, degree of freedom. Introduction to robot control systems			
Self-study / Case Study / Applications	Industry specific case studies explaining the various configurations of robot		
Text Book	Text Book 1: 2.1		
MODULE-2	**DRIVE SYSTEMS AND GRIPPERS IN ROBOTICS**	**CO2**	**8 Hours**
Mechanisms and transmission, end effectors, Grippers-different methods, and their applications. Drive system- hydraulic, pneumatic, and electric systems.			
Self-study / Case Study / Applications	Mini project preparation involving drive systems and transmission mechanisms		
Text Book	Text Book 1: 3.4,3.7,3.8,5.1,5.2,5.3,5.4		
MODULE-3	**SENSORS, ROBOTIC CELL DESIGN AND PROGRAMMING**	**CO3**	**8 Hours**
Transducers and sensors in robots –tactile sensors, proximity and range sensors, robotic vision sensors, miscellaneous sensors, and areas of applicability. Robotic cell layout, work cell design and control, error detection and recovery, robot path control methods, robotic programming types, and languages, methods of robot programming			
Self-study / Case Study / Applications	mini project preparation by using various robotic sensors, Case study of detection of error and recovery		
Text Book	Text Book 1: 6.1,6.2,6.3,6.4,6.5,6.6,7.1,7.2,7.3,11.1,11.3,11.4,11.5,11.6		
MODULE-4	**AUTOMATION AND ASSEMBLY CONFIGURATIONS**	**CO4, CO6**	**8 Hours**
Part presentation method, assembly operations, assembly cell design, designing for robot assembly, inspection automation, and coding, operationsof preparatory codes (G codes) and miscellaneous codes (M codes) part programming deployment and demonstration.			

Self-study / Case Study / Applications	Case studies on robot assembly cells in the automotive industry and simulation of CNC milling programs using G-code with the open-source software Tutor
Text Book	Text Book 1: 8.1,8.2,8.4,8.7,9.1, 15.1,15.2,15.3,15.5,15.7,15.8

MODULE-5	**ROBOT APPLICATIONS**	**CO5, CO6**	**8 Hours**

Implementation of robots in industries– Machine loading/unloading Processing operation, Assembly and Inspection, applications of robots in medical, space, underwater, humanoid robots, and micro robots. Social issuesand the future of robotics. Demonstration on: Pick and Place robots, line following robots, and 3-axis CNC.

Self-study / Case Study / Applications	Demonstration of 3-axis CNC machine (Visit to Advanced Manufacturing lab.), Demonstration of Pick and Place robots (Visit to Fanuc Robotics lab)
Text Book	Text Book 1: 14.1,14.2,18.1,18.2,18.3,18.4,20.1,20.2,20.3,20.4

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**				
		Test (s)	**Assignment**	**Quiz**	**Alternative Assessment**	
		25	**10**	**5**	**10**	
L1	**Remember**	7.5	-	-		
L2	**Understand**	7.5	-	-		
L3	**Apply**	10	5	5	5	
L4	**Analyze**	-	5	-	5	
L5	**Evaluate**	-	-	-		
L6	**Create**	-	-	-		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**15**
L2	**Understand**	**15**
L3	**Apply**	**20**
L4	**Analyze**	**-**
L5	**Evaluate**	**-**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Groover. M.P. Industrial Robotics, technology, programming, and application Mc-Graw Hill 2012.
2. S. K. Saha, “Introduction to Robotics”, Tata McGraw-Hill Publishing Company Ltd. (2008).
3. “Computer Numerically Controlled Machining handbook”, James Madison, Industrial Press Inc., 1996, ISBN-978-0831130640

Reference Books:

1. Fu, King Sun, Rafael C. Gonzalez, and CS George Lee. Robotics. IEEE Computer Society Press, 1993.
2. Klafter, Richard David, Thomas A. Chmielewski, and Michael Negin. "Integrated Approachto Robotic Engineering." (1993).
3. Asada, Haruhiko, and J-JE lotine. Robot analysis and control. John Wiley & Sons, 1991.
4. Craig, John J. "Introduction to Robotics." (2005).

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=pwwVOpXrazs&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN**
- **https://www.youtube.com/watch?v=gizihSJ63o4&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=2**
- **https://www.youtube.com/watch?v=BnzUXag1qx8&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=3**
- **https://www.youtube.com/watch?v=7mm4ig8Lyc8&list=PL4g1oAdmuCfqmYvURLzVFkMMUI7839biN&index=5**

- **https://www.youtube.com/watch?v=RBD9LfLfkxA&list=PLQ3sZ7NCnFlEej8AWH_BfO9W7xlirvK6l&index=43**
- **https://www.youtube.com/watch?v=E2nnohpDw5k&list=PLQ3sZ7NCnFlEej8AWH_BfO9W7xlirvK6l&index=44**
- **https://www.youtube.com/watch?v=LGmvg0m1mJk&list=PLQ3sZ7NCnFlEej8AWH_BfO9W7xlirvK6l&index=45**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any Robot implemented manufacturing/assembly industry
- Demonstration of Robot operations
- Demonstration of working of Robot
- Demonstration of Robot programming applied to a typical robot task
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues Seminars

INTRODUCTION TO ELECTRIC VEHICLES

Course Code	**24ETC152/252**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the historical perspective and basic terminology of Electric Vehicles (EV).
CO2	Classify the different performance parameters of EV
CO3	Use the different energy storage elements for various types of EV.
CO4	Illustrate the performance of energy storage systems in electric vehicles.
CO5	Select appropriate Fuel Cell Technology for EVs
CO6	Demonstrate the overall building blocks of EV system

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	2	1	-	-	-	-	1
CO2	3	2	-	-	-	2	1	-	-	-	-	1
CO3	3	2	-	-	-	2	1	-	-	-	-	1
CO4	3	2	-	-	-	2	1	-	-	-	-	1
CO5	3	2	-	-	-	2	1	-	-	-	-	1
CO6	3	2	-	-	-	2	1	-	-	-	-	1

MODULE-1	**ENGINEERING PHILOSOPHY OF EV DEVELOPMENT**	**CO1**	**8 Hours**

Introduction need of electric drive, Historical development Recent development, Development trends Engineering philosophy of EV concept, key EV technologies

Applications	Investigate the Challenges of Electric Vehicles and its Applications.
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**BASIC TERMS OF ELECTRICAL AND EV PARAMETERS**	**CO2**	**8 Hours**

Electrical terms- current AC and DC voltage, Power, conductors, insulators, resisters, relays, capacitors, solenoids, AC & DC motors & generators EV parameters, Weight and size parameters, Force parameters, Energy parameters, Performance parameters,

Case Study	Case study on EV Parameters and its Performance Parameters.
Text Book	Text Book 1: 2.1, 2.2, 2.4 to 2.15

MODULE-3	**BASICS OF A BATTERY-OPERATED ELECTRIC VEHICLE (BOEV)**	**CO3, CO4**	**8 Hours**

Advantages and disadvantages, Major components of BOEV, Comparison with IC engine vehicles, Flywheel energy storage, Major parts, controller, Inverter/converter, Regenerative Braking, Driving.An EV-Starting Driving and Braking, Basic Diagnosis & Precautions, Self-diagnostics.

Self-study	Self-study on the types of Electric vehicles in Indian Market
Text Book	Text Book 2: 3.2, 3.3, 3.5, 3.7, 3.10

MODULE-4	**ENERGY STORAGE TECHNOLOGY**	**CO5**	**8 Hours**

Battery basics different types of batteries (lead-acid battery, Lithium/ Alkaline, Lithium ion Nickel Metal hydride), High discharge capacitors, Battery rating, Battery parameters, Battery discharging & charging characteristics, Battery chargers, Battery indicating methods and devices

Case Study	Case study on different EV battery manufacturers
Text Book	Text Book 1: 6.2, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7

MODULE-5	**FUEL CELLS**	**CO6**	**8 Hours**

Fuel cell characteristics, fuel cell types-alkaline fuel cell, proton exchange membrane, direct methanol fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, hydrogen storage systems, reformers, fuel cell EV

Applications	Survey on Fuel Cells, design, applications and case studies of the same.

Text Book	Text Book 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	3
L2	Understand	10	5	5
L3	Apply	5	5	2
L4	Analyze	5	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) MehrdadEhsani, Yimin Gao, sebastien E. Gay and Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, Boca Raton: CRC Press, 2018. ISBN-13: 918-3236390415

2) Iqbal Husain, Electric and Hybrid Vehicles: Design Fundamentals, Boca Raton: CRC Press,2011, ISBN-13: 978-1636390475

3) Tariq Muneer and Irene Illescas García, "The automobile, In Electric Vehicles: Prospects and Challenges", Elsevier, 2017

Reference Books:

1) AuliceScibioh M. and Viswanathan B., Fuel Cells Principles and Applications, India: University Press, 2009

2) James Larminie and John Loury, Electric Vehicle Technology-Explained, New York: John Wiley & Sons Ltd., 2012.

3). James Larminie and John Loury, Electric Vehicle Technology-Explained, New York: John Wiley & Sons Ltd., 2012.

Web links and Video Lectures (e-Resources):

- **https://youtu.be/3E1SXG7VkQk**
- https://youtu.be/A3fHQsIkYeU
- https://youtu.be/iihYXx79QiE
- https://youtu.be/A565YNXItLg
- **https://youtu.be/NnI7oJFvru8**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Electric Vehicles
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars/Self-study reports on Electric Vehicles

FUNDAMENTALS OF INTERNET OF THINGS (IoT)			
Course Code	**24ETC153/253**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.
CO2	Classify various sensing devices and actuator types.
CO3	Demonstrate the processing in IoT.
CO4	Explain Associated IoT Technologies
CO5	Understand the architecture of IoT Applications.
CO6	Analyze future trends in IoT.

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	2	2	-	2	-	-	-	1
CO2	1	1	1	1	2	2	-	2	-	-	-	1
CO3	1	1	1	1	2	2	-	2	-	-	-	1
CO4	1	1	1	1	2	2	-	2	-	-	-	1
CO5	1	1	1	1	2	2	-	2	-	-	-	1
CO6	1	1	1	1	2	2	-	2	-	-	-	1

MODULE-1	**BASICS OF NETWORKING**	**CO1**	**8 Hours**
Introduction, Network Types, Layered network models Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.			
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16		
MODULE-2	**IOT SENSING AND ACTUATION**	**CO2**	**8 Hours**
Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.			
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15		
MODULE-3	**IOT PROCESSING TOPOLOGIES AND TYPES**	**CO3, CO4**	**8 Hours**
Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**ASSOCIATED IOT TECHNOLOGIES**	**CO5**	**8 Hours**
Cloud Computing: Introduction, Virtualization, Cloud Models, Service- Level Agreement in Cloud Computing, Cloud Implementation, Sensor- Cloud: Sensors-as-a-Service. IOT CASE STUDIES: Agricultural IoT – Introduction and Case Studies			
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**IOT CASE STUDIES AND FUTURE TRENDS**	**CO6**	**8 Hours**
Vehicular IoT – Introduction. Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction			
Text Book	Text Book 2: 12.1 to 12.10		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	Quiz
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	5	5
L3	Apply	5	5	-
L4	Analyze	5	5	-
L5	Evaluate	5	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.
2. Satish Jain ,"Internet of Things and its Applications", BPB Publications (1 January 2020).
3. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on- Approach)",1st Edition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- https://onlinecourses.nptel.ac.in/noc22_cs52/preview
- **https://www.coursera.org/specializations/iot**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to Industry
- Demo of IOT and Industry 4.0 concepts
- IOT related Project Based Learning

DRONE TECHNOLOGY			
Course Code	**24ETC154/254**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand drone concepts and terminology
CO2	Understand the regulations that are defined for usage of drones
CO3	Describe the steps for drone design
CO4	Understand the technical characteristics of drones
CO5	Describe the process for drone fabrication
CO6	Discuss the algorithm for drone programming

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**INTRODUCTION**	**CO1**	**8 Hours**
Overview and background. Definitions, history of UAV, classifications of UAV, Scale lift generation method, contemporary applications			
Self-study / Case Study / Applications	Case Studies: Analyze real-world deployments of UAVs in different industries, their effectiveness, challenges faced, and outcomes. Applications: Explore how UAVs are transforming specific sectors, such as agriculture (precision farming), construction (site surveying), or environmental monitoring.		
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16		
MODULE-2	**IMPACT OF DRONES**	**CO2**	**8 Hours**
Military/ Government/Civil/Societal impact and future outlook, Operational considerations. Liability / legal issues, Insurance and ethical implications, Human factors			
Self-study / Case Study / Applications	Case Studies: Analyze specific incidents or deployments of UAVs in military, government, or civilian contexts to understand their impact, challenges faced, and lessons learned. Applications: Study how UAVs are applied in disaster response, agricultural innovation, or urban planning, considering their effectiveness, economic impact, and societal implications. By exploring these facts, one can grasp the multifaceted nature of UAV technology, its implications across sectors, and the evolving landscape of regulations, ethics, and operational challenges.		
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15		
MODULE-3	**DRONE DESIGN, FABRICATION AND PROGRAMMING**	**CO3**	**8 Hours**
Introduction to Drone Technology, Drone design and fabrication, Drone programming, Drone flying and operation			
Self-study / Case Study / Applications	Online courses, tutorials, and forums offer self-study opportunities. Hands-on projects build skills in design, programming, and operation		
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**DRONE MAINTENANCE, SAFETY AND APPLICATIONS**	**CO4**	**8 Hours**
Drone accessories, Drone maintenance, Safety and Regulations, Drone commercial applications			

Self-study / Case Study / Applications	Self-Study: • Online Courses: Platforms like Udemy, Coursera, and edX offer courses on drone technology, regulations, and applications. • Books and Publications: Explore texts covering drone design, programming, and commercial uses. • Forums and Communities: Engage with drone enthusiasts and professionals to exchange knowledge and tips. Case Study: • Amazon Prime Air: Study Amazon's drone delivery service and its technological challenges. • DJI's Agricultural Solutions: Examine DJI's drones used in precision agriculture for crop monitoring and spraying. • Emergency Response: Analyze drones' roles in disaster relief efforts and search-and-rescue operations.		
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7		
MODULE-5	**DRONE TECHNOLOGY AND ENTREPRENEURSHIP**	**CO5 CO6**	**8 Hours**
Case studies in the drone industry to show the potential for boosting entrepreneurial spirit, Drone technology and entrepreneurship, Drone Technology as a tool for social inclusion, Future of drones			
Self-study / Case Study / Applications	Self -study: Explore online resources, case studies, and industry reports on drone technology, entrepreneurship, and social impact. Applications: Experiment with drone technology through DIY projects, or join drone-related courses and communities to gain practical insights and network with industry professionals.		
Text Book	Text Book 2: 12.1 to 12.10		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Reference Books/Text Books:

1) Theory, Design, and Applications of Unmanned Aerial Vehicles- by A. R. Jha, 2016
2) Handbook of Unmanned Aerial Vehicles- Editors: Valavanis, K., Vachtsevanos, George J., 2014

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/user/flitetest
- https://www.youtube.com/c/readysetdrone
- https://www.youtube.com/watch?v=qBx-uCaAltM
- https://www.youtube.com/watch?v=TO7qa8oCACI&list=PLgiealSjeVyx3t4N9GroE29SbVwhYrOtL
- https://www.youtube.com/watch?v=9c769xiEXn0&list=PLFW6lRTa1g83B1HdU2mece6QLeBrtspL7
- https://www.youtube.com/watch?v=49RMSb4ht-I
- https://www.youtube.com/watch?v=j9nTBG8oa8M
- https://www.youtube.com/watch?v=t0CR4rPt2Fg
- https://www.youtube.com/watch?v=0w4BjJkkf5A

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Provide drone kits and guide students through the assembly process. Discuss the purpose of each part (e.g., motors, flight controller, propellers) and how they contribute to drone operation. Students can also learn basic maintenance tasks like battery care and propeller replacement.
- Use drone flight simulators or virtual reality (VR) platforms where students can practice flying drones in a controlled environment. Introduce basic manoeuvres (e.g., take off, landing, hovering) and progress to more advanced techniques (e.g., turns, altitude control).
- Assign students to plan and execute a mapping mission using drones equipped with cameras. They can learn to capture aerial images, process them using software (e.g., Pix4D, Drone Deploy), and create 2D/3D maps or models of a designated area (e.g., school campus, local park). Discuss the applications of drone mapping in agriculture, urban planning, and environmental monitoring.
- Set up an indoor or outdoor obstacle course using various objects (e.g., hoops, cones, obstacles). Students can take turns navigating the course with drones, practicing precision flying and manoeuvring around obstacles.
- Task students with capturing aerial photos or videos of specific subjects or events (e.g., school events, natural landscapes). Teach principles of composition, lighting, and storytelling through visuals. Students can edit and present their work, discussing the creative and technical decisions made during the process.
- Pose engineering challenges such as designing a payload delivery mechanism, improving drone stability in adverse weather conditions, or modifying drones for specific purposes (e.g., search and rescue, environmental monitoring). Encourage students to brainstorm ideas, prototype designs, and test their solutions.

FUNDAMENTALS OF CYBER SECURITY			
Course Code	**24ETC155/255**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the fundamental concepts and laws of cybercrime
CO2	Familiarize cybercrime terminologies and perspectives
CO3	Understand Cyber Offenses and Botnets
CO4	Understand the various tools and methods used in cybercrimes
CO5	Identify common characteristics of phishing attempts
CO6	Familiarize with the concepts of Computer Forensics

Mapping of Course Outcomes to Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	2	-	-	-	1
CO2	2	2	-	-	-	-	-	2	-	-	-	1
CO3	2	2	-	-	-	-	-	2	-	-	-	1
CO4	2	2	-	-	-	-	-	2	-	-	-	1
CO5	2	2	-	-	-	-	-	2	-	-	-	1
CO6	2	2	-	-	-	-	-	2	-	-	-	1

MODULE-1	**INTRODUCTION TO CYBER CRIME**	**CO1, CO2**	**8 Hours**
Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws., Global Perspectives			
Text Book	Text Book 2: 1.1 to 1.4,2.1 to 2.3		
MODULE-2	**CYBER OFFENSES:**	**CO3**	**8 Hours**
Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafe & cybercrimes. Botnets: The fuel for cybercrime, Attack Vector.			
Text Book	Text Book 1: 1.1 to 1.5,2.1 to 2.4		
MODULE-3	**TOOLS AND METHODS USED IN CYBERCRIME**	**CO4**	**8 Hours**
Introduction, Proxy Servers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS attacks, Attacks on Wireless networks.			
Self-study / Case Study	Case Study on different types of cyber crimes		
Text Book	Text Book1: 4.1 ,4.2,4.4 to 4.11		
MODULE-4	**PHISHING AND IDENTITY THEFT**	**CO5**	**8 Hours**
Introduction, methods of phishing, phishing, phishing techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft.			
Case Study	Case Study on different types of phishing scams		
Text Book	Text Book 1: 5.1 to 5.3		
MODULE-5	**UNDERSTANDING COMPUTER FORENSICS**	**CO6**	**8 Hours**
Introduction, Historical Background of Cyber forensics, Digital Forensics 8 CO6 88 5 Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics			
Text Book	Text Book 1: 6.1 to 6.5		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	10	5	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books:

1. Nina Godbole, Sunit Belapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Publications, copyright 2011, reprint 2015
2. Jennifer L. Bayuk, Jason Healey, Paul Rohmeyer, "Cyber Security Policy Guidebook" Wiley Publications.

Reference book:

1. James Graham, Richard Howard, Ryan Olsan, "Cyber Security Essentials" CRC Press.

Web links and Video Lectures (e-Resources):

1. https://www.mastersindatascience.org/resources/cybersecurity-resource-guide/
2. https://www.aicte-india.org/CyberSecurity
3. https://cybersecurityventures.com/industry-news/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of Phishing and Identity Theft
- Demonstration of Tools and Methods used in Cyber Crime
- Demonstration of Cyber Crimes
- Contents related activities (Activity-based discussions)
  - ➢ For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - ➢ Organizing Group wise discussions on issues
  - ➢ Seminars

NANO TECHNOLOGY			
Course Code	**24ETC156/256**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Demonstrate the synthesis of nanoparticles by various techniques
CO2	Explain working of basic instruments used in characterization of nanoparticles
CO3	Classify the nanomaterials based on the dimensions
CO4	Discuss the usage of nanotechnology in energy storage and conversion
CO5	Assess the suitability of nanomaterials for various device applications
CO6	Discuss the application of nanotechnology to all engineering domains

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-
CO6	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**INTRODUCTION TO NANOMATERIALS**	**24ETC156/256.1**	**8 Hours**

Nanotechnology, Frontier of future-an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems, Surface to Volume Ratio, Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of Nanomaterials-Sol-gel, Precipitation, Solution Combustion synthesis, Hydrothermal, SILAR, Chemical Bath Deposition. Top-Down approach- Ball milling technique, Sputtering, Laser Ablation

Self-study / Case Study / Applications	Case study on different Top-down, Bottom-up approaches for Nano synthesis
Text Book	Text Book 1: 2.1

MODULE-2	**CHARACTERIZATION OF NANOMATERIALS**	**24ETC156/256.2**	**8 Hours**

Basic principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope, Atomic Force Microscope –different imaging modes, comparison of SEM and TEM, AFM and STM, AFM and SEM.

Basic principles of working of X-ray diffraction, derivation of Debye-Scherrer equation, numericals on Debye Scherrer equation, Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement)

Self-study / Case Study / Applications	Case study of various nanomaterial characterisation Techniques
Text Book	Text Book 1: 3.4,3.7,3.8,5.1,5.2,5.3,5.4

MODULE-3	**CARBON BASED MATERIALS**	**24ETC156/256.3**	**8 Hours**

Introduction, Synthesis, Properties (electrical, Electronic and Mechanical), and Applications of Graphene, SWCNT, MWCNT, Fullerenes and other Carbon Materials: Carbon nanocomposites, nanofibres, nanodiscs, nanodiamonds.

Self-study / Case Study / Applications	Case study of Carbon based nanomaterial Synthesis
Text Book	Text Book 1: 6.1,6.2,6.3,6.4,6.5,6.6,7.1,7.2,7.3,11.1,11.3,11.4,11.5,11.6

MODULE-4	**NANOTECHNOLOGY IN ENERGY STORAGE AND CONVERSION**	**24ETC156/256.4**	**8 Hours**

Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells.

Batteries: Nanotechnology in Lithium ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms, limitations of graphite anodes, Advances in Cathodic materials, Anodic materials, Separators

Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes

Self-study / Case Study / Applications	Case studies of Nanotechnology in Energy storage and conversion		
Text Book	Text Book 1: 8.1,8.2,8.4,8.7,9.1, 15.1,15.2,15.3,15.5,15.7,15.8		
MODULE-5	**APPLICATIONS OF NANOTECHNOLOGY**	**24ETC156/256.5, 24ETC156/256.6**	**8 Hours**
Nanotech Applications and Recent Breakthroughs: Introduction, Significant Impact of Nanotechnology and Nanomaterial, Medicine and Healthcare Applications, Biological and Biochemical Applications (Nano biotechnology), Electronic Applications (Nano electronics), Computing Applications (Nano computers), Chemical Applications (Nano chemistry), Optical Applications (Nano photonics), Agriculture and Food Applications, Recent Major Breakthroughs in Nanotechnology.			
Self-study / Case Study / Applications	Case study of Applications of Nanotechnology		
Text Book	Text Book 1: 14.1,14.2,18.1,18.2,18.3,18.4,20.1,20.2,20.3,20.4		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution				
		Test (s)	Assignment	Quiz	Alternative Assessment	
		25	10	5	10	
L1	Remember	7.5	-	-		
L2	Understand	7.5	-	-		
L3	Apply	10	5	5	5	
L4	Analyze	-	5	-	5	
L5	Evaluate	-	-	-		
L6	Create	-	-	-		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	15
L2	Understand	15
L3	Apply	20
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Nano Materials – A.K. Bandyopadhyay/ New Age Publishers, 2009
2. Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science, 2007
3. Nano Essentials- T. Pradeep/TMH, 2007,Peter J. F. Harris, Carbon nanotube science: synthesis, properties, and applications,Cambridge University Press, 2011

Reference Books:

1. Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2. Understanding Nanotechnology, Scientific American, 2002
3. Nanotechnology, M. Ratner and D. Ratner, Prentice Hall, 2003
4. Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press, 2002

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=PNElByWIGNc
- https://www.youtube.com/watch?v=qUEbxTkPIWI
- https://www.youtube.com/watch?v=lFYs3XDu4fQ
- https://www.youtube.com/watch?v=Lpju0DTY8_g
- https://www.youtube.com/watch?v=G6MIQlIIozg&list=PLLy_2iUCG87BMH9aXArALEv_eH_f63kQu
- https://www.youtube.com/watch?v=-gdILnzYZEg

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any Nano Technology implemented manufacturing/assembly industry
- Demonstration of Nano material synthesis operations
- Demonstration of working of Nano material synthesis machines
- Demonstration of Nano material synthesis applied to a typical case study
- Video demonstration of latest trends in nanotechnology
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Seminars

RENEWABLE ENERGY SOURCES			
Course Code	**24ETC157/257**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the importance and the need of different renewable energy sources
CO2	Analyze economic aspects of various renewable energy sources in national and Global level
CO3	Analyze the working and construction of solar cells
CO4	Identify and differentiate between various types of wind turbines
CO5	Understand the operational principles of biogas plants
CO6	Evaluate the advantages of tidal & Geo-thermal energy, such as its predictability and low environmental impact, and identify limitations

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	2	-	-	-	-	-
CO2	3	2	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	-	-	-	2	-	-	-	-	-
CO4	3	2	-	-	-	-	2	-	-	-	-	-
CO5	3	2	-	-	-	-	2	-	-	-	-	-
CO6	3	2	-	-	-	-	2	-	-	-	-	-

MODULE-1	**INTRODUCTION TO RENEWABLE ENERGY SOURCES**	**CO1 CO2**	**8 Hours**
Renewable energy sources, non-renewable energy sources- Necessity and causes of energy Scarcity-Types-Advantages-Limitations-National and Global Scenarios-Economics of Renewable Energy Sources-Strategy of future energy requirements.			
Self-study	Industrial applications of Renewable energy sources and non-renewable energy sources		
Text Book	Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5		
MODULE-2	**SOLAR ENERGY**	**CO3**	**8 Hours**
Historical perspective of solar cell-photovoltaic Effect-Model and equivalent circuit of solar Cell-Parameters of solar Cell-Module-array- materials-series-parallel Connection-I-V and P-V Characteristics-Solar Collectors-thermal energy storage systems -applications of solar PV- Street lighting-water pumping.			
case-study	Case studies on Solar energy applications		
Text Book	Text Book 1: 2.1, 2.2, 2.3, 2.4, 2.5, 3.1, 3.2, 3.3, 3.4, 3.5		
MODULE-3	**WIND ENERGY**	**CO4**	**8 Hours**
Wind power-factors influencing wind and nature of wind-principle of wind energy conversion- types of wind-fundamentals of power generation In wind Turbine, classification of wind turbine-working of wind turbine-Advantages and disadvantages of wind mills-Applications of wind energy.			
Self-study	Industrial applications of Wind energy		
Text Book	Text Book 1: 6.1, 6.2, 6.3, 6.4, 6.5		
MODULE-4	**BIOMASS**	**CO5**	**8 Hours**
Biomass as Renewable energy sources-biomass resources- types of biomass fuel-biomass transformation techniques: Hydrolysis, enzyme & acid hydrolysis, Anaerobic digestion-working of biogas plant- energy Forming –Pyrolysis-Applications.			
Self-study	Industrial applications on Biomass energy		
Text Book	Text Book 1: 7.1, 7.2, 7.3, 7.4, 7.5		
MODULE-5	**TIDAL AND GEOTHERMAL ENERGY SYSTEMS**	**CO6**	**8 Hours**
Tidal energy electrical conversion systems- Energy from tides, basic principle of tidal power-single basin and double basin tidal power plants- advantages- limitation and scope of tidal energy.			

Geothermal electrical energy conversion systems-estimation and nature of geothermal energy-geothermal sources and resources-advantages- disadvantages and applications of geothermal energy.	
Self-study	Case studies on Tidal energy and geothermal energy in India
Text Book	Text Book 2:8 .1, 8.2, 8.3, 8.4,8.5, 8.6

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	4	-	-
L2	Understand	4	-	-
L3	Apply	6	3	5
L4	Analyze	8	7	5
L5	Evaluate	3	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Non-conventional Energy Sources, G D Rai -2017, Khanna Publishers, ISBN:978817409073, 9788174090737

2) Renewable energy-S C Bhatia, R.K Gupta-2019,Woodhead Publishing India inEnergy, ISBN- 139788193644607, 978-8193644607

Reference Books:

1) Solar Photovoltaics: Fundamentals, Technologies and Applications, Chetan Singh Solanki,3rd Edition, Kindle Edition, 2015, PHI Learning, ISBN-10 9788120351110, ISBN-13 978-8120351110
2) Renewable Energy Resources by John Twidell, Julie Alexander, 4th Edition, Routledge,2021,ISBN 9781032269252
3) Wind Power Technology, Joshua Earnest, Sthuthi' Rachel, 2019,PHI learning, ISBN-10 938802849X, ISBN-13 978-9388028493

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=FDng0LU2zpI
- https://www.youtube.com/watch?v=f0p0Fria5TY
- https://www.youtube.com/watch?v=Ps6Rn-i9t1Y
- https://www.youtube.com/watch?v=1-2TyKqP84o
- https://www.youtube.com/watch?v=LJul3ZYSb9M

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Renewable energy sources, non-renewable energy sources
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

HUMANITIES
AND
ABILITY ENHANCEMENT COURSES

COMMUNICATIVE ENGLISH			
Course Code	24ENG16	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**2**

Course outcomes: At the end of the course, the student will be able to:

CO1	Recognize the grammatical structures in English and identify errors in sentences.
CO2	Enhance English vocabulary and language proficiency for better communication skills.
CO3	Demonstrate conversational skills using situational vocabulary
CO4	Learn about techniques of information transfer through presentation

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	2
CO2	-	-	-	-	-	-	-	-	3	3	-	2
CO3	-	-	-	-	-	-	-	-	3	3	-	2
CO4	-	-	-	-	-	-	-	-	3	3	-	2

MODULE-1	**Error Detection I**	CO1	**3 Hours**

Common Errors in English - Articles & Prepositions
Common Errors in English - Noun Pronoun agreement
Activity: Self-introduction - talking about self, ambition, hobbies, likes, dislikes, skills and achievements

Know classmates/ Role play	Understand different ways of self-introduction; Learn about others and introduce them; Listen to others and list common errors
Reference Book	1,2,3

MODULE-2	**Error Detection II**	CO1 CO2	**3 Hours**

Common Errors in English - Verbs
Auxiliary Verbs
Subject Verb Agreement
Activity: Story telling

Story telling	Using appropriate tenses and cases as per Subject Verb Agreement
Reference Book	1,2,3

MODULE-3	**Question Tags & Forms**	CO1 CO2 CO3	**3 Hours**

Question forms with 5Ws and 1H
Question forms and tags with Auxiliary Verbs
Use of Do/ Don't and Does/ Doesn't/ Has/Have

Situational conversations / Role play	Understand art of questioning
Reference book	1,2,3

MODULE-4	**Articulation**	CO2 CO3	**3 Hours**

Idea generation techniques
Organising a speech - preparation, practice, delivery
Extempore Speech
Expressing opinions, agreeing & disagreeing
Conversational Etiquettes
Activity : Review of TEDx talk video presentation (assignment)

Review of TEDx talk presentation	Listening to understand		
Reference Book	1,2,3		
MODULE-5	**Presentation Skills**	CO2 CO3 CO4	**3 Hours**
Presentation Skills, Overcoming stage fear, Body language			
Interview and Presentation	To be able to speak on Cue Card topics, Compare and contrast ideas etc.,		
Reference Book	1,2,3		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Alternative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	10	10
L3	Apply	10	5
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Viva Voce)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

REFERENCE BOOKS:

1. Grammar Practice Activities by Penny Ur, Cambridge University Press
2. Intermediate English Grammar by Raymond Murphy, Cambridge University Press
3. A Final Course of Grammar & Composition – PC Wren & H. Martin by S Chand.

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Participate in role plays and presentations
- Watch TEDx videos and review
- Listen to POD Casts
- Participate in JAM sessions
- Use every opportunity in the class to communicate
- Actively participate in Group Discussions.

PROFESSIONAL WRITING SKILLS IN ENGLISH			
Course Code	24ENG26	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**2**

Course outcomes: At the end of the course, the student will be able to:

CO1	Recall strategies to improve vocabulary
CO2	Outline the different purposes and various styles of writing.
CO3	Analyse text and infer information using the sub skills of reading.
CO4	Acquire employment and workplace communication skills

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6		PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	-	-		-	-	3	3	-
CO2	-	-	-	-	-	-		-	-	3	3	-
CO3	-	-	-	-	-	-		-	-	3	3	-
CO4	-	-	-	-	-	-		-	-	3	3	-

MODULE-1	**Vocabulary**	CO1 CO3 CO4	**3 Hours**
Ways to enhance vocabulary, vocabulary in context, One-word substitution, Antonyms and Synonyms			
Practice Exercise	Homophones and Homonyms		
Reference Book	1,2,3,4		
MODULE-2	**Nature and Style of sensible writing:**	CO2 CO4	**3 Hours**
Organizing Principles of Paragraphs in Documents, Writing Introduction and Conclusion, Importance of Proper Punctuation, Errors due to Indianism in English Communication, Creating Coherence and Cohesion,			
Story writing	Thought flow, idea generation, sentence structure		
Reference Book	1,2,3,4		
MODULE-3	**Paragraph Writing**	CO2 CO4	**3 Hours**
Idea generation, Expansion of ideas, Expansion of proverbs, Paragraph writing, Report Writing **Activity:** Story writing			
Movie review	Comprehension and articulation		
Reference book	1,2,3,4		
MODULE-4	**Reading Comprehension**	CO3	**3 Hours**
Reading Comprehension, Strategies, Tips for effective reading, Sentence arrangements exercises, Practice of Sentence Corrections activities. Summarizing and paraphrasing			
Practice Exercise	RC passages		
Reference Book	1,2,3,4		
MODULE-5	**Communication Skills for Employment:**	CO2 CO4	**3 Hours**
Job Applications, Types of official/employment/business Letters, Email writing. Writing effective resume for employment,			
Resume writing	Understand different types of resume writing and connect resume writing to Job description		
Reference Book	1,2,3		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Alternative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	10	10
L3	Apply	10	5
L4	Analyze	5	10
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	20
L4	Analyze	10
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

REFERENCE BOOKS:

1. Basic Business Communication, Flately & Lesikar, Tata Mc Graw Hil, 10th Edition.
2. Business Communication, P.D Chaturvedi & Mukesh Chaturvedi, Pearson Education.
3. The Skill of Communicating, Bill Scott & Helen Wilkie, Jacob Books.
4. Communication Skills: A Workbook. – Sanjay Kumar, Pushpa Lata

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Story writing
- Paragraph writing
- Movie review writing
- Story building around key words
- Report writing for all the events of college

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

Course Code	**24CIP17/27**	**CIE Marks**	**50**
L: T:P:S	**2:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand the historical background, key influences, and foundational structure of the Indian Constitution.
CO2	Analyze the Fundamental Rights, Duties, and the Directive Principles of State Policy, including their implementation and significance.
CO3	Explain the structure, powers, and functions of the Union and State governments, including the roles of the Executive, Legislature, and Judiciary.
CO4	Comprehend the importance of professional ethics in Engineering, including social responsibility, sustainable development, and workplace ethics.
CO5	Understand Cyber Laws and the IT Act 2000 and analyze the land mark judgements.

Mapping of Course Outcomes to Program Outcomes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	3	-	-	-	-
CO2	3	-	-	-	-		3	3	-	-	-	-
CO3	3	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	3	-	-	-
CO5	-	-	-	-	-	-	-	3	-	3	-	-

MODULE-1	**INTRODUCTION TO CONSTITUTION OF INDIA**	**CO1**	**3 Hours**

Historical Background and Making of the Constitution, the preamble of the Indian Constitution, its significance, the role of the Constituent Assembly, Analyze the Fundamental Rights with certain case studies, Duties and the Directive Principles of State Policy, including their implementation and significance

Self-study / Case Study / Applications	Seminar on: • Is democracy the best form of government? • Duty of Union Government towards State Government. • Gender Equality & Law. • Present Status of Women in India.
Text Book	1

MODULE-2	**UNION EXECUTIVE & STATE EXECUTIVE**	**CO2**	**3 Hours**

Composition and function of Union & State Executive, Judicial activism as well as judicial review, Significant terms used in Parliament, powers and functions of Supreme Court, Public Interest Litigation (PIL) Power & Function of Subordinate Court and High Court. State Advocate General, State Controller and Auditor General, Comptroller & Auditor General of India.

Self-study / Case Study / Applications	Seminar on: • Why is the number of women's position in politics still low? • Position of President in Parliamentary system of Government. • Juvenile justice: a comparison across different countries. • "Women's Rights and Gender Equality in Indian Law".
Text Book	1

MODULE-3	**AMENDMENTS AND PROCEDURE, ELECTION COMMISSION & EMERGENCY PROVISIONS:**	**CO3**	**3 Hours**

Election laws, Electoral process and the Election Commission of India. Types and Significance of Amendments to the Constitution. Emergency Provisions, types of Emergencies and its consequences.

Self-study / Case Study / Applications	Seminar on: • Election Commission and its importance for vibrant Democracy. • Independence of Judiciary vis a vis Basic Structure Doctrine, Judicial Accountability.

	• Recent Developments in Respects to Judicial Appointments.		
Text Book	1		
MODULE-4	**ETHICS AND PROFESSIONALISM IN ENGINEERING.**	**CO4**	**3 Hours**
Introduction to Professional Ethics: Definition and importance of professional ethics. Codes of ethics for Engineers. Case studies on ethical dilemmas.Engineers' Responsibility to Society: Responsibility of Engineers, Impediments to responsibility. Clash of ethics. Ethics in Engineering Practice: Workplace ethics: honesty, integrity, and transparency. Conflicts of interest and whistle blowing. Case studies on workplace ethics			
Self-study / Case Study / Applications	Seminar on: • Engineers and Society. • The role of ethics in professional practice. • The importance of professional ethics in developing trust and respect in the workplace. • The Importance of Ethics in Engineering.		
Text Book	2,3 &4		
MODULE-5	**Cyber Law and Cyber Crimes**	**CO5**	**3 Hours**
Internet and Need for Cyber Laws, Types and Causes for Cyber Crimes, Cyber Crimes Landmark Judgements in India and the Information Technology Act 2000.			
Self-study / Case Study / Applications	Seminar on: • Major Types of Cyber Crimes and Their Legal Implications. • Challenges in Enforcing Cyber Laws Across Jurisdictions.		
Text Book	5		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Alternate assessment
		25	25
L1	Remember	10	-
L2	Understand	10	10
L3	Apply	5	10
L4	Analyze	-	5
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Text Books:

1.Durga Das Basu: "Introduction to the constitution"19th/20th Edn., or 2008, Lexis Nexis; Twentieth edition (2011)
2.Shubham Singles, Charles E.Haries :Constitution of India and Professional Ethics. Latest Edition- 2018, Cengage Learning India Private Limited (2019)
3.M. Govindarajan, Natarajan, V.S. Senthilkumar," Engineering Ethics", Prentice Hall India Learning Private Limited (2013)
4.Winston, M., & Edelbach, R. (2011). Society, Ethics, and Technology. Stamford, Connecticut: Cengage Learning.
5.Cyber Security and Cyber Laws Alfred Basta and et al Cengage Learning India 2018 Reference Books

Reference Books:

1.M.V. Pylee." An Introduction to Constitution of India". Vikas Publishing 2002.

2.Chandrachud, Y. V. Durga Das Basu Shorter Constitution of India 13th ed, Nagpur Wadhwa & Co. 2005.
3.Singh, M. P. Shukla V. N. Constitution of India, 10th ed. Lucknow: Eastern Book Co., 2001. 2. 4. Basu, D. D. Constitutional Law of India, 7th ed. Nagpur: Wadhwa, 1998.
5. Jain, M. P. Indian Constitutional Law, 5th ed. Nagpur: Wadhwa & Co., 2003
6.M. Govindarajan, Natarajan, V.S. Senthilkumar," Engineering Ethics", Prentice Hall India Learning Private Limited (2013)
7. Tavani, H. T. (2010). Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing. New York, NY: John Wiley & Sons.

Web links and Video Lectures (e-Resources):

- https://Iddashboard.legislstive.gov.in/sites/default/files/COI...pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Peer Presentation
- Usage of ICT tools.
- Flipped classroom.
- Seminars.

BALAKE KANNADA

Course Code	**24KBK17/27**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course Outcome: On completion of the course student will be able to:

CO1	Understand Kannada Language
CO2	Communicate in Kannada Language
CO3	Read simple Kannada words
CO4	Pronounce Kannada words

CO – PO Mapping:

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
CO1	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	3	-	3	-	-

MODULE-1	Balake Bhasheya Parichaya (Introduction to Balake Kannada)	CO1 CO2	**3 Hours**

1) Balake Bhasheyannu Kaliyuva Sulabha Vidhanagalu
2) Balake Bhasheya Prayojana
3) Sthaliya Bhasha Kalikeya Agatyate

Self-study / Case Study / Applications	Make a chart of English, Hindi, Kannada Language
Text Book	1&2

MODULE-2	Kannada Aksharamale haagu uchharane (Kannada Alphabet and Pronunciation)	CO1 CO2	**3Hours**

1) Kannada Akshara Male
2) Ottakkasharagalu
3) Kannada kagunita
4) Vergiya mattu Avergiya Vynjana
5) Nama pada, Servanama, Guna mattu Parimana Vachaka, Sankhyavachaka Padagala Parichaya

Self-study / Case Study / Applications	Any formal letter or Design advertisement board in Kannada
Text Book	1&2

MODULE-3	Sambhashaneyalli Kannada (Kannada in Conversation)	CO2 CO3	**3 Hours**

1) Sambhashanegagi Kannada Padagala parichaya
2) Sambhashaneyalli kannada padagala pramukyate Kannada words in conversation)
3) Namapadagala Sambandartaka Roopagalu, Sandehaspada Prashnegalu mattu Sambhadavachaka nama padagalu
4) Kale mattu samayada hagu kriyapadagala vivida prakaragalu
5) Hannugalu tarakarigalu hagu Tindi thinisugala hesarugalu

Self-study / Case Study / Applications	Write the Conversation between any two person Example: a) Doctor and Patient b) VTU student and VTU professor
Text Book	1&2

MODULE-4	Kannada Bhashe mattu Sahithya	CO2 CO4	**3 Hours**

1) Kannada Bhasheya mahatva
2) Kannada Sahitya Charitre
3) Adunika kannada Sahitya
4) Jnanapeeta Prashasti Vijeta 8 Sahitigalu

Self-study / Case Study / Applications	Give a pictorial representation of any topic of the Syllabus		
Text Book	1&2		
MODULE-5	Karnataka Rajya mattu Rajyada bagge Kuritada Mahitagalu (Karnataka State and General Information about the State)	CO2 CO4	**3Hours**

1) Karnataka Rajyada Udaya
2) Karnataka Rajyada Prekshaniya Stalagalu
3) Karnataka Rajyada Pramukha Jala nayana pradeshagalu
4) Pramukha Anekattugalu
5) Karnataka Rajyada 3 Bhougolika Pradeshagalu
6) Karnataka da Kelavu Janapriya Samskruthika Kalegalu

Self-study / Case Study / Applications	Write a case study on growth and development on Kannada in India.
Text Book	1&2

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	10	10
L2	Understand	10	10
L3	Apply	5	5
L4	Analyze	-	-
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

Text Books

1) Balake Kannada (Usage of Kannada) – Dr. L. Thimmesh
2) Vyavaharika Kannada – Prof. V Keshavamurthy

Reference Books :

1) Karnataka Samskruthi - M. Chidananda Murthy
2) Kannada Bhasha kai pidi - Sagamesha savadatti Mata
3) Mataduva Kannada – Kannada Sahitya Parishat Bangalore (2016)

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Make the groups of 4 students they should speak on any current topic in Kannada or present the talk show.

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

Course Code	**24KSK17/27**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

***Course outcomes:**
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಅಧ್ಯಯನದ ಕಲಿಕಾಂಶಗಳು :

24KSK17/27 1.	ವಿದ್ಯಾರ್ಥಿಗಳು ಕನ್ನಡ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಹಾಗೂ ಭಾಷಾ ರಚನೆ ನಿಯಮಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುವರು.
24KSK17/27 2.	ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿನ ದೋಷಗಳು, ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಅರಿತುಕೊಳ್ಳುವರು.
24KSK17/27 3.	ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗದ ಬಗ್ಗೆ ತಿಳುವಳಿಕೆ ಪಡೆಯುವರು.
24KSK17/27 4.	ಕನ್ನಡದಲ್ಲಿ ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನಗಳ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಹಲವಾರು ವಿಷಯಗಳನ್ನು ಪರಿಚಯ ಮಾಡಿಕೊಳ್ಳುವರು ಭಾಷಾಂತರ ಮತ್ತು ಪ್ರಬಂಧ ರಚನೆ ಬಗ್ಗೆ ಆಸಕ್ತಿ ವಹಿಸಿಕೊಳ್ಳುವರು.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
24KSK17/27 1.								**3**		**3**		
24KSK17/27 2.								**3**		**3**		
24KSK17/27 3.								**3**		**3**		
24KSK17/27 4.								**3**		**3**		

MODULE-1 ಭಾಗ – ೧	**ಕನ್ನಡ ನಾಡು ನುಡಿ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೆ ಸಂಬಂಧಿಸಿದ ಲೇಖನಗಳು,**	24KSK17/27 1. 24KSK17/27 2.	**3 Hours**

೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ, – ಹಂಪ ನಾಗರಾಜಯ್ಯ

೨. ಕರ್ನಾಟಕ ಏಕೀಕರಣ, – ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ

೩. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ್ ಮತ್ತು ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ

Self-study / Case Study / Applications	ಕನ್ನಡ ನಾಡು ನುಡಿ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಪ್ರಬಂಧ ರಚನೆ ಕರ್ನಾಟಕ ಏಕೀಕರಣದಲ್ಲಿ ಹೋರಾಡಿದ ವ್ಯಕ್ತಿಗಳ ಭಾವಚಿತ್ರದೊಂದಿಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹ
Text Book	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ. ವಿ.ತಾ.ವಿ. ಬೆಳಗಾವಿ

MODULE-2 ಭಾಗ – ೨	**ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕ ಪೂರ್ವ)**	24KSK17/27 1. 24KSK17/27 2.	**4Hours**

4. ವಚನಗಳು – ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರ ದಾಸಿಮಯ್ಯ,
5. ಕೀರ್ತನೆಗಳು – ಎಲ್ಲಾನು ಬಲ್ಲೆ ಎಂಬುವಿರಲ್ಲ – ಪುರಂದರದಾಸರು

   ಬಾಗಿಲನು ತೆರೆದು ಸೇವೆಯನು ಕೊಡು ಹರಿಯೆ – ಕನಕದಾಸರು
6. ತತ್ವಪದಗಳು – ಗುಡಿಯ ನೋಡಿರಣ್ಣ – ಸಂತ ಶಿಶುನಾಳ ಷರೀಫರು
7. ಜನಪದ ಗೀತೆ – ಬೀಸುವ ಪದ – ಬಡವರಿಗೆ ಸಾವ ಕೊಡಬೇಡ

Self-study / Case Study / Applications	ಪ್ರಸಿದ್ಧ ವಚನಕಾರರ ವಚನಗಳ ಸಂಗ್ರಹ ಸಮೂಹ ವಚನ ಗಾಯನ ಕೀರ್ತನೆ ಹಾಗೂ ತತ್ವಪದಗಳ ಸಂಗ್ರಹ, ಜನಪದ ಗೀತೆಗಳ ಸಮೂಹ ಗಾಯನ
Text Book	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ. ವಿ.ತಾ.ವಿ. ಬೆಳಗಾವಿ

MODULE-3 ಭಾಗ – ೩	**ಕಾವ್ಯಭಾಗ (ಆಧುನಿಕ)**	24KSK17/27 2. 24KSK17/27 3.	**7 Hours**
೮. ಮಂಕು ತಿಮ್ಮನ ಕಗ್ಗ – ಡಿ.ವಿ.ಜಿ. ೯. ಕುರುಡು ಕಾಂಚಾಣ – ದ.ರಾ. ಬೇಂದ್ರೆ ೧೦. ಹೊಸಬಾಳಿನ ಗೀತೆ – ಕುವೆಂಪು ೧೧. ಹೆಂಡತಿಯ ಕಾಗದ – ಕೆ.ಎಸ್. ನರಸಿಂಹಸ್ವಾಮಿ ೧೨. ಮಬ್ಬಿನಿಂದ ಮುಬ್ಬಿಗೆ – ಜಿ.ಎಸ್. ಶಿವರುದ್ರಪ್ಪ ೧೩. ಅಮರ ಈ ಮರ – ಚಂದ್ರಶೇಖರ ಕಂಬಾರ ೧೪. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು – ಸಿದ್ಧಲಿಂಗಯ್ಯ			
Self-study / Case Study / Applications	ಪ್ರಸಿದ್ಧ ಕನ್ನಡ ಕವಿಗಳ ಭಾವ ಚಿತ್ರದೊಂದಿಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹ		
Text Book	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ. ವಿ.ತಾ.ವಿ. ಬೆಳಗಾವಿ		
MODULE-4 ಭಾಗ – ೪	**ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿ ಪರಿಚಯ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ**	24KSK17/27 2. 24KSK17/27 4.	**3 Hours**
೧೫. ಸರ್ ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ. ಎನ್. ಮೂರ್ತಿರಾವ್ ಸುಧಾಮೂರ್ತಿ ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ ೧೬. ಯುಗಾದಿ – ವಸುದೇಂದ್ರ ೧೭. ಮೇಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ – ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ			
Self-study / Case Study / Applications	ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯನವರ ಭಾವಚಿತ್ರದೊಂದಿಗೆ ಕರ್ನಾಟಕದಲ್ಲಿ ಅವರು ಕೈಗೊಂಡ ಅಭಿವೃದ್ಧಿ ಕಾರ್ಯಗಳ ಮಾಹಿತಿ ಸಂಗ್ರಹ ಯುಗಾದಿ ಹಾಗೂ ಪ್ರಸಿದ್ಧ ಹಬ್ಬಗಳ ಬಗ್ಗೆ ಪ್ರಬಂಧ ರಚಿಸುವುದು		
Text Book	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ. ವಿ.ತಾ.ವಿ. ಬೆಳಗಾವಿ		
MODULE-5 ಭಾಗ – ೫	**ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ**	24KSK17/27 2. 24KSK17/27 4.	**4Hours**
೧೮. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ ೧೯. 'ಕ' ಮತ್ತು 'ಬಿ' ಬರಹ ತಂತ್ರಾಂಶಗಳು ೨೦. ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ, ೨೧. ತಾಂತ್ರಿಕ ಪದಕೋಶ			
Self-study / Case Study / Applications	ಕರಕುಶಲ ಕಲೆಗಳ ಮಾಹಿತಿ ಸಂಗ್ರಹಿಸುವುದು ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶದ ಪಟ್ಟಿ ಮಾಡುವುದು		
Text Book	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯ ಪುಸ್ತಕದ ಲೇಖಕರು : ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ, ಪ್ರಕಟಣೆ : ಪ್ರಸಾರಾಂಗ. ವಿ.ತಾ.ವಿ. ಬೆಳಗಾವಿ		

CIE Assessment Pattern (50 Marks – Theory) –
ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	10	10
L2	Understand	10	10
L3	Apply	5	5
L4	Analyze	-	-
L5	Evaluate	-	-
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)
ಸೆಮಿಸ್ಟರ್ ಎಂಡ್ ಪರೀಕ್ಷೆ

RBT Levels		Exam Marks Distribution (50)
L1	Remember	20
L2	Understand	20
L3	Apply	10
L4	Analyze	--
L5	Evaluate	--
L6	Create	--

Suggested Learning Resources:

ಪಠ್ಯ ಪುಸ್ತಕಗಳು (**Text Books)** ಸಂಪಾದಕರು

1) ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ – ಡಾ. ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ, ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ್
2) ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಪ್ರೋ. ಹಂಪ ನಾಗರಾಜಯ್ಯ
3) ಡಾ.ಸರ್.ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್
4) ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ – ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಪರಾಮರ್ಶನ ಗ್ರಂಥಗಳು (Reference Books)

1) ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ಸಮೀಕ್ಷೆ ಹೆಚ್. ತಿಪ್ಪೇರುದ್ರಸ್ವಾಮಿ
2) ಕರ್ನಾಟಕ ಏಕೀಕರಣಕ್ಕೆ ದುಡಿದ ಮಹನೀಯರುಗಳು – ಸುವರ್ಣ ಕರ್ನಾಟಕ ಮಾಲೆ ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ
3) ಕನ್ನಡ ಭಾಷಾ ಕೈಪಿಡಿ : ಸಂಗಮೇಶ ಸವದತ್ತಿ ಮಠ – ರೂಪ ರಶ್ಮಿ ಪ್ರಕಾಶನ, ಗುಲ್ಬರ್ಗ 1995
4) 'ಶತಮಾನದ ಪುರುಷ – ವಿಶ್ವೇಶ್ವರಯ್ಯ' – ಕೆ.ಎಂ. ವೆಂಕಟಕೃಷ್ಣ ರಾವ್, ಪ್ರಕಟಣೆ ಪ್ರಸಾರಾಂಗ ವಿತಾವಿ.
5) ಅಪೂರ್ವ ಪಶ್ಚಿಮ – ಶಿವರಾಮ ಕಾರಂತರು – 1953
6) ವಿಜ್ಞಾನ ಕಥಾ ಪ್ರಪಂಚ – ಸವಿತಾ ಶ್ರೀನಿವಾಸ್
7) ಪರಿಸರ ವಿಜ್ಞಾನ ಸಾಹಿತ್ಯ – ನಾಗೇಶ್ ಹೆಗ್ಗಡೆ
8) ಕಂಪ್ಯೂಟರ್ – ತಂತ್ರಜ್ಞಾನ, ಪದವಿವರಣ ಕೋಶ – ಟಿ.ಜಿ. ಶ್ರೀನಿಧಿ, ಕನ್ನಡ ಅಭಿವೃದ್ಧಿ ಪ್ರಾಧಿಕಾರ, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು – 560001.

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

ವಚನ ಗಾಯನ ಗೋಷ್ಠಿ ನಡೆಸುವುದು ತತ್ವಪದಗಳ ಸಮೂಹ ಗಾಯನ ನಡೆಸುವುದು

ಜನಪದ ಗೀತೆಗಳ ಸಮೂಹ ಗಾಯನ ಹಾಗೂ ವಿವಿಧ ಜಾನಪದ ಕಲೆಗಳ ಪ್ರದರ್ಶನ

ಕರ್ನಾಟಕದ ಏಕೀಕರಣ ಚಳುವಳಿಯಲ್ಲಿ ಹೋರಾಡಿದ ಮಹನೀಯರುಗಳ ವ್ಯಕ್ತಿ ಜೀವನ ಭಾವ ಚಿತ್ರದೊಂದಿಗೆ ಪ್ರದರ್ಶಿಸುವುದು

ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯವನ್ನು ನಾಟಕ ರೂಪದಲ್ಲಿ ಪ್ರದರ್ಶನ ಮಾಡುವುದು

ENGINEERING INNOVATIONS IN HEALTH CARE			
Course Code	**24EIH18/28**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**1**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

CO1	Understand healthcare systems and engineering innovations
CO2	Analyze medical devices and technologies
CO3	Evaluate the impact of digital health and telemedicine
CO4	Understand advanced therapeutic technologies and their applications
CO5	Develop ethical and innovative solutions for healthcare challenges

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	-	3	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-
CO3	3	-	2	-	3	-	-	-	-	-	-	-
CO4	3	-	3	-	3	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-

MODULE-1	**INTRODUCTION TO HEALTHCARE SYSTEMS**	**CO1**	**3 Hours**

Overview of Healthcare Systems and Challenges: Introduction to healthcare systems, Major challenges in healthcare, the role of engineering in addressing healthcare challenges

Historical Perspective and Evolution of Medical Technologies: Key historical milestones in medical technology, Evolution of healthcare innovations, Case studies of ground breaking healthcare innovations

SELF-STUDY	Case studies of successful innovations
Text Book	1

MODULE-2	**BIOMEDICAL ENGINEERING AND MEDICAL DEVICES**	**CO2**	**3 Hours**

Basics of Biomedical Engineering: Introduction to biomedical engineering, Key areas and applications, Career paths in biomedical engineering.

Medical Devices and Diagnostics: Types of medical devices (diagnostic, therapeutic, and monitoring), Innovations in medical imaging (MRI, CT, ultrasound), Advances in diagnostic tools (lab-on-a-chip, wearable sensors)

Self-study	Career opportunities in health care for engineers
Text Book	2

MODULE-3	**DIGITAL HEALTH AND TELEMEDICINE**	**CO3**	**3 Hours**

Digital Health Technologies: Introduction to digital health, Mobile health (m Health) apps, Health informatics and data analytics.

Telemedicine and Remote Monitoring: Overview of telemedicine, Benefits and challenges of telehealth, Innovations in remote patient monitoring.

Self-study	Case study on telemedicine and remote Monitoring
Text Book	3

MODULE-4	**ADVANCED THERAPEUTIC TECHNOLOGIES**	**CO4**	**3 Hours**

Biotechnology and Genetic Engineering: Basics of biotechnology, Genetic engineering and CRISPR technology, Applications in personalized medicine

Robotics and AI in Healthcare: Role of robotics in surgery and rehabilitation, Artificial intelligence in diagnostics and treatment planning, Future trends in AI and robotics in healthcare

Self-study	Applications of AI in health care.
Text Book	4

MODULE-5	INNOVATION, ETHICS, AND FUTURE DIRECTIONS	CO5	3 Hours

Innovation and Entrepreneurship in Healthcare: Pathways from innovation to market
Case studies of successful healthcare start-ups, Funding and support for healthcare innovations
Ethics, Privacy, and Future Trends: Ethical considerations in healthcare innovations, Privacy and security of health data, Future trends and emerging technologies in healthcare

Self-study	Presenting innovative ideas related to health care.
Text Book	**5&6**

CIE Assessment Pattern (50 Marks – Theory and Lab)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment
		25	25
L1	Remember	5	5
L2	Understand	10	10
L3	Apply	10	10
L4	Analyze		
L5	Evaluate		
L6	Create		

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	20
L4	Analyze	
L5	Evaluate	
L6	Create	

Suggested Learning Resources: **Text Books**

1. Engineering and Technology for Healthcare (IEEE Press) 1st Edition
2. Biomedical Engineering: Bridging Medicine and Technology By W. Mark Saltzman · 2009, Cambridge University Press.
3. Digital Health: Scaling Healthcare to the World by Homero Rivas and Katarzyna Wac , Springer International Publishing
4. Handbook of Research on Biomedical Engineering Education and Advanced Bioengineering Learning Interdisciplinary Concepts · Volume 2 By Ziad O. Abu-Faraj · 2012
5. The Innovator's Prescription: A Disruptive Solution for health care by Clayton M. Christensen, Jerome H. Grossman Jason Hwang · 2008, McGraw-Hill Education
6. Health Care Information Systems: A Practical Approach for Health Care Management By Karen A. Wager, Frances W. Lee, John P. Glaser · 2022, Wiley publications

Reference Books:

1) Bio design: The Process of Innovating Medical Technologies by Paul G. Yock, Stefanos Zenios, Josh Makower, Todd J. Brinton, Uday N. Kumar, and Lyn Denend
2) Medical Device Technologies: A Systems Based Overview Using Engineering Standards by Gail Baura
3) Healthcare Technology Management – A Systematic Approach by Francis Hegarty
4) Biomedical Engineering: Bridging Medicine and Technology by W. Mark Saltzman

Web links and Video Lectures (e-Resources):

- https://www.coursera.org/learn/wo-pmo-healthcareinnovation#outcomes
- https://www.futurelearn.com/courses/innovation-in-healthcare
- https://www.coursera.org/learn/guide-to-healthcare-innovation-principles-and-practice
- **Harvard University: Biodesign:** Image of Harvard University: Biodesign website
- **https://www.researchgate.net/publication/376324410_ENGINEERING_INNOVATIONS_IN_HEALTHCARE_A_REVIEW_OF_DEVELOPMENTS_IN_THE_USA**
- **https://eih.uw.edu/projects**
- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8508443/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
Case studies/Seminars/Presentation /patenting of innovative ideas

ENVIRONMENT AND DISASTER MANAGEMENT

Course Code	24EDM18/28	**CIE**	50
L:T:P:S	1:0:0:0	**SEE Marks**	50
Hrs / Week	1	**Total Marks**	100
Credits	01	**Exam Hours**	02

Course outcomes: At the end of the course, the student will be able to:

CO1	Analyze the structure and function of various ecosystems and the importance of biodiversity.
CO2	Evaluate advances in energy systems and disaster management.
CO3	Assess the sources, impacts, and preventive measures of environmental pollution, and effective waste management practices.
CO4	Investigate global environmental issues and groundwater problems, along with their associated policies and case studies.
CO5	Interpret key environmental legislation in India.

Mapping of Course Outcomes to Program Outcome.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	2	-	-	-	-	-
CO2	-	-	-	2	-	1	-	-	-	-	-	-
CO3	3		2	-	-	-	2	-	-	-	-	-
CO4	3	2	-	-	-	-	2	1	-	-	-	-
CO5	3	2	-	-	-	-	2	1	-	-	-	-

MODULE-1	Ecosystem and Biodiversity	CO1	3 Hours

Ecosystem

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake.

Biodiversity

Biodiversity-Introduction, types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-Wild life conflicts – endangered and endemic species of India – conservation of biodiversity.

Self-study	Conservation of biodiversity
Text Book	Text Book :1

MODULE-2	Advances in Energy Systems and Disaster Management	CO2	3 Hours

Advances in Energy Systems

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.

Disaster Management

Disaster Management, Earthquake, volcanoes, causes of volcanism, floods ,landslides, drought, Glacial Lake Outburst Floods (GLOF);sea level changes and its impact on coastal areas and coastal zone

Assignment	Various energy systems, merits, demerits, applications
Text Book	Text Book :2

MODULE-3	Environmental pollution and Waste Management	CO3	3 Hours

Environmental pollution

Environmental Pollution –Water, soil, air (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental (Case-studies)

Waste Management

Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; Industrial and Municipal Sludge.

Case Study	Environmental pollution
Text Book	Text Book :1

MODULE-4	Global Environmental Concerns	CO4	3 Hours

Global Environmental Concerns
Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

Presentation	Effect of pollution on climate change		
Text Book	Text book:2		
MODULE-5	Environmental acts	CO5	3 Hours

Environmental acts
The Indian Forest Act 1927; The Wildlife (Protection) Act 1972; The Water (Prevention and Control of Pollution) Act 1974; The Forests (Conservation) Act 1980; The Air (Prevention and Control of Pollution) Act 1981; The Environment (Protection) Act 1986; Noise Pollution (Regulation and Control) Rules 2000; Eco marks.

Case Study	Environmental acts
Text Book	Reference books:1,2,3

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	5	5
L2	Understand	10	10
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	-	
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	20
L3	Apply	10
L4	Analyze	10
L5	Evaluate	-
L6	Create	--

Suggested Learning Resources:

Text Books

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2.Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

Reference Books: -

1.Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web links and Video Lectures (e-Resources):

1.https://sdgs.un.org/goals
2. https://archive.nptel.ac.in/courses/109/105/109105190/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1.Visit to a local area to document environmental assets-river/ forest/ grassland/ hill/ mountain
2.Visit to a local polluted site – urban / rural / industrial / agricultural
3.Study of common plants, insects, and birds
4.Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

NEW HORIZON
COLLEGE OF ENGINEERING

Ring Road, Bellandur Post, Near Marathahalli
Bengaluru, India pin-560103

www.newhorizonindia.edu