DAYANANDA SAGAR UNIVERSITY

SCHOOL OF ENGINEERING

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(A State Private University under the Karnataka Act No. 20 of 2013)

Approved by UGC & AICTE, New Delhi, Accredited by NAAC with A+ grade

Department of Computer Science and Engineering (Cyber Security)

SCHEME FOR
BACHELOR OF TECHNOLOGY (B. Tech)

COMPUTER SCIENCE & ENGINEERING
(Cyber Security)

(1st to 4th Semester)

With effect from 2024-28

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SCHEME - B. TECH – 2024-25 ONWARDS I SEM - CHEMISTRY CYCLE

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					Duration in Hrs Exam	Examination (Maximum Marks)		
			L	T	P	J	C		CIE	SEE	TM
1	24EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	3	0	0	0	3	3	60	40	100
2	24EN1102	OBJECT ORIENTED PROGRAMMING	2	1	2	0	4	3	60	40	100
3	24EN1103	COGNITIVE AND TECHNICAL SKILLS – I	0	0	4	0	2	1	100	-	100
4	24EN1104	ENGINEERING CHEMISTRY	2	0	2	0	3	3	60	40	100
5	24EN1105	INTRODUCTION TO MECHANICAL ENGINEERING	2	0	2	0	3	3	60	40	100
6	24EN1106	INTRODUCTION TO ELECTRICAL ENGINEERING	2	0	0	0	2	3	60	40	100
7	24EN1107	ENGINEERING MECHANICS	2	0	0	0	2	3	60	40	100
8	24EN1108	TECHNICAL ENGLISH	2	0	0	0	2	1	100	-	100
9	24EN1109	ENVIRONMENTAL SCIENCE	1	0	0	0	0	1	50	-	50
10	24EN1110	KANNADA KALI / MANASU	1	0	0	0	0	1	50	-	50
			17	1	10	0	21		660	240	900

L – Lecture, T – Tutorial, P – Practical, J – Project, C – No. of Credits, CIE – Continuous Internal Evaluation,
SEE- Semester End Examinations, TM – Total Marks.

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SCHEME - B. TECH – 2024-25 ONWARDS I SEM - PHYSICS CYCLE

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					Duration in Hrs Exam	Examination (Maximum Marks)		
			L	T	P	J	C		CIE	SEE	TM
1	24EN1101	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS	3	0	0	0	3	3	60	40	100
2	24EN1102	OBJECT ORIENTED PROGRAMMING	2	1	2	0	4	3	60	40	100
3	24EN1103	COGNITIVE AND TECHNICAL SKILLS – I	0	0	4	0	2	1	100	-	100
4	24EN1111	ENGINEERING PHYSICS	3	0	2	0	4	3	60	40	100
5	24EN1112	INTRODUCTION TO ELECTRONICS ENGINEERING	3	0	0	0	3	3	60	40	100
6	24EN1113	ENGINEERING GRAPHICS AND DESIGN THINKING	2	0	2	0	3	2	60	40	100
7	24EN1114	BIOLOGY FOR ENGINEERS	2	0	0	0	2	1	100	-	100
8	24EN1115	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	1	0	0	0	0	1	50	-	50
			16	1	10	0	21		550	200	750

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SCHEME - B. TECH – 2024-25 ONWARDS II SEM - CHEMISTRY CYCLE

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					Duration in Hrs Exam	Examination (Maximum Marks)		
			L	T	P	J	C		CIE	SEE	TM
1	24EN1201	SINGLE AND MULTIVARIATE CALCULUS	3	0	0	0	3	3	60	40	100
2	24EN1202	C PROGRAMMING FOR PROBLEM SOLVING	2	1	2	0	4	3	60	40	100
3	24EN1203	COGNITIVE AND TECHNICAL SKILLS – II	0	0	4	0	2	1	100	-	100
4	24EN1104	ENGINEERING CHEMISTRY	2	0	2	0	3	3	60	40	100
5	24EN1105	INTRODUCTION TO MECHANICAL ENGINEERING	2	0	2	0	3	3	60	40	100
6	24EN1106	INTRODUCTION TO ELECTRICAL ENGINEERING	2	0	0	0	2	3	60	40	100
7	24EN1107	ENGINEERING MECHANICS	2	0	0	0	2	3	60	40	100
8	24EN1108	TECHNICAL ENGLISH	2	0	0	0	2	1	100	-	100
9	24EN1109	ENVIRONMENTAL SCIENCE	1	0	0	0	0	1	50	-	50
10	24EN1110	KANNADA KALI / MANASU	1	0	0	0	0	1	50	-	50
			17	1	10	0	21		660	240	900

L – Lecture, T – Tutorial, P – Practical, J – Project, C – No. of Credits, CIE – Continuous Internal Evaluation,
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SCHEME - B. TECH – 2024-25 ONWARDS II SEM - PHYSICS CYCLE

SL	COURSE CODE	COURSE TITLE	SCHEME OF TEACHING					Duration in Hrs Exam	Examination (Maximum Marks)		
			L	T	P	J	C		CIE	SEE	TM
1	24EN1201	SINGLE AND MULTIVARIATE CALCULUS	3	0	0	0	3	3	60	40	100
2	24EN1202	C PROGRAMMING FOR PROBLEM SOLVING	2	1	2	0	4	3	60	40	100
3	24EN1203	COGNITIVE AND TECHNICAL SKILLS – II	0	0	4	0	2	1	100	-	100
4	24EN1111	ENGINEERING PHYSICS	3	0	2	0	4	3	60	40	100
5	24EN1112	INTRODUCTION TO ELECTRONICS ENGINEERING	3	0	0	0	3	3	60	40	100
6	24EN1113	ENGINEERING GRAPHICS AND DESIGN THINKING	2	0	2	0	3	2	60	40	100
7	24EN1114	BIOLOGY FOR ENGINEERS	2	0	0	0	2	1	100	-	100
8	24EN1115	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	1	0	0	0	0	1	50	-	50
			16	1	10	0	21		550	200	750

L – Lecture, T – Tutorial, P – Practical, J – Project, C – No. of Credits, CIE – Continuous Internal Evaluation,
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III SEMESTER													
SN	**Course Type**	**Course Code**	**Course Name**	**Teaching Department**	**Teaching hours/Week**				**Examination**				**Credit**
					Lecture	**Tutorial**	**Practical**	**Project**	**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
					L	**T**	**P**	**J**					
1	BSC	24CY2301	Transforms and Numerical Techniques	MAT	3	0	0	0	03	60	40	100	**3**
2	IPCC	24CY2302	Data Structures	CSE(CY)	3	0	2	0	03	60	40	100	**4**
3	IPCC	24CY2303	Digital Logic Design	ECE	3	0	2	0	03	60	40	100	**4**
4	PCC	24CY2304	Discrete Mathematics and Graph Theory	CSE(CY)	3	0	0	0	03	60	40	100	**3**
5	PCC	24CY2305	Introduction to Computer Networks	CSE(CY)	3	0	2	0	03	60	40	100	**4**
6	PCC	24CY2306	Embedded System Design	CSE(CY)	3	0	0	0	03	60	40	100	**3**
7	SEC	24CY23XX	Skill Enhancement Course-1	CSE (CY)	1	0	2	0	01	100	--	100	**2**
8	TPC	24CYXXXX	Cognitive and Technical Skills-3	TPO	-	-	-	-	-	-	--		**-**
					19	**0**	**3**	**1**		**560**	**240**	**800**	**23**

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Skill Enhancement Course I	
Course Code	**Course Name**
24CY2307	Linux Programming
24CY2308	Web Technologies
24CY2309	DevOps**

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IV SEMESTER												
SN	**Course Type**	**Course Name**	**Teaching Department**	**Teaching hours/Week**				**Examination**				**Credit**
				Lecture	**Tutorial**	**Practical**	**Project**	**Duration in Hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
				L	**T**	**P**	**J**					
1	24CY2401	Probability & Statistics	MAT	3	0	0	0	03	60	40	100	**3**
2	24CY2401	Design and Analysis of Algorithms	CSE(CY)	3	1	0	0	03	60	40	100	**4**
3	24CY2401	Database Management System	CSE(CY)	3	0	2	0	03	60	40	100	**4**
4	24CY2401	Introduction to Cyber Security	CSE(CY)	3	0	2	0	03	60	40	100	**4**
5	24CY2401	AI Essentials for Cyber Security	CSE(CY)	3	0	0	2	03	60	40	100	**4**
6	24CY2401	Computer Organization and Architecture	CSE(CY)	3	0	0	0	03	60	40	100	**3**
7	24CY2401	Cognitive and Technical Skills-4	TPO	-	-	-	-	-	-	--		**-**
8	24CY2401	Liberal Studies	AEC	1	0	0	0	01	50	--	50	**1**
				19	**1**	**4**	**2**		**410**	**240**	**650**	**23**

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Liberal Studies	
Course Code	**Course Name**
24LS0001	Drama
24LS0002	Dance
24LS0003	Music
24LS0004	Photography
24LS0005	Introduction to Japanese language
24LS0006	Law for Engineers
24LS0007	Canvas Painting
24LS0008	Communication in Sanskrit
24LS0009	Vedic Mathematics
24LS0010	Critical Thinking
24LS0011	Introduction to Film Studies
24LS0012	Yoga & Meditation
24LS0013	Cyber Crimes, Policies & Laws
24LS0014	Holistic Medicine
24LS0015	3 D Modelling using Tinker cad
24LS0016	Introduction to German Language

LINEAR ALGEBRA & DIFFERENTIAL EQUATIONS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I				
Course Code	: 24EN1101	Credits	:	03
Hours / Week	: 03 Hours	Total Hours	:	39 Hours
L–T–P–J	: 3–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Apply the method of Gauss elimination to solve systems of linear equations and determine the row echelon form of a matrix
2. Analyze vector spaces, subspaces, and their properties to identify linear independence, span, and bases in the context of finite-dimensional vector spaces.
3. Evaluate and compute the dimensions of vector spaces by understanding the concepts of rank and nullity
4. Analyze the properties and characteristics of linear transformations and their corresponding matrices to gain a deeper understanding of their behavior and applications.
5. Utilize the concepts of eigenvalues and eigenvectors, employing diagonalization techniques to determine the diagonal form of a matrix and its implications in various contexts.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I	08 Hours
INTRODUCTION: System of Linear equations. (Text Book-1: Chapter 1: 1.1) Row reduction and echelon form. (Text Book-1: Chapter 1: 1.2) Rank of a matrix by row echelon form. (Text Book-1: Chapter 4: 4.6) Gauss elimination, Inverse of a matrix by Gauss Jordan (Text Book-5: Chapter 3: 3.7 and 3.11) LU decomposition (Text Book-1: Chapter 2: 2.5),	
UNIT – II	08 Hours
Vector spaces – Subspaces (Text Book-1: Chapter 4: 4.1) Linear independence – Span - Bases and Dimensions -Finite dimensional vector spaces (Text Book-1: Chapter 4: 4.3) Dimensions, finite dimensional vector spaces (Text Book-1: Chapter 4: 4.5)	
UNIT – III	09 Hours
Linear transformation - Matrices of linear transformations (Text Book-1: Chapter 1: 1.7 and 1.8) Vector space of linear transformations – Inner Product, Orthogonal Vectors - Projections (Text Book-1: Chapter 6: 6.1, 6.2 and 6.3) Gram- Schmidt Orthogonalization process (Text Book-1: Chapter 6: 6.4)	
UNIT – IV	07 Hours
Introduction to Eigenvalues and Eigenvectors (Text Book-1: Chapter 5: 5.1) Diagonalization of a Matrix (Text Book-1: Chapter 5: 5.3)	
UNIT – V	07 Hours
Linear second order ordinary differential equation with constant coefficients (Text Book-5: Chapter 2) Solutions of homogenous and non-homogenous equations (Text Book-5: Chapter 2: 2.2 to 2.7) Method of variation of parameters (Text Book-5: Chapter 2: 2.10) Solutions of Cauchy-Euler and Cauchy-Legendre differential equations (Text Book-5: Chapter 2: 2.5)	

Course Outcomes:

At the end of the course the student will be able to:

1. Solve systems of linear equations using Gauss elimination and determine the inverse of a matrix by applying the Gauss-Jordan method.
2. Solve problems involving row reduction and echelon form in linear algebra to demonstrate an understanding of the concepts and their applications in solving systems of linear equations and transforming matrices.
3. Analyze matrices and determine their rank by using row echelon form, examining the relationships between rows and columns, and identifying the motives or causes behind the rank.
4. Apply LU decomposition techniques to factorize a matrix into lower and upper triangular matrices, illustrating their understanding of the process and its applications.
5. Apply the concepts of vector spaces, subspaces, linear independence, span, bases, and dimensions to solve problems related to finite-dimensional vector spaces, applying acquired knowledge and techniques.

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1						1					
CO2	3	2	1		1				1					
CO3	3	2	1		1				1					
CO4	3	2	1						1					
CO5	3	2	1		1				1					

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low) TEXT BOOKS:

1. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.
2. Linear Algebra and its Applications by Gilbert Strang, 4th Edition, Thomson Brooks/Cole, Second Indian Reprint 2007.
3. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition, Pearson Education, 2011.
4. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
5. Advanced engineering mathematics, Erwin Kreyszig, Wiley, London, 1972.

REFERENCE BOOKS:

1. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).
2. Higher Engineering Mathematics by B S Grewal, 42nd Edition, Khanna Publishers.
3. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press (2016).
4. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003.
5. Practical Linear Algebra, Farin and Hansford, CRC Press (2013).

E-Resources:

1. https://nptel.ac.in/courses/111101115
2. https://nptel.ac.in/courses/111108066
3. Linear Algebra Basics | Coursera
4. https://nptel.ac.in/courses/111108081
5. https://nptel.ac.in/courses/111106100
6. Differential Equations for Engineers Course (HKUST) | Coursera

Activity Based Learning (Suggested Activities in Class)

1. Introduce the concept of matrix transformations, such as translation, rotation, scaling, and reflection. Provide visual examples and interactive tools that allow students to manipulate shapes and observe the effects of different transformation matrices.
2. Using real-life scenarios or word problems to make the activity of solving linear equations using matrix method.
3. Some real-world scenarios that can be modelled using ODEs, such as population growth, radioactive decay, or chemical reactions that can be discussed and solve using appropriate methods.

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OBJECT ORIENTED PROGRAMMING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I			
Course Code Code	: 24EN1102	Credits	: 04
Hours / Week:	05 Hours	Total Hours	: 26(L) + 13(T) + 26(P) Hours
L–T–P–J	: 2–1–2–0		

Course Learning Objectives:

This Course will enable students to:

1. Understand different programming paradigms, significance of object-oriented programming approach and their applications.
2. Make use of Python programming environment to develop programs using conditionals, iterations, functions, strings and files to store and retrieve data in system.
3. Gain skills to develop python programs using core data structures like Lists, Tuples, Sets and Dictionaries.
4. Describe the concepts of object-oriented concept using class, objects, methods. Polymorphism and different levels of inheritance.
5. Explain operator overloading, overriding, single and multiple exception handling capabilities in python.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I	05 Hours

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND PYTHON Programming paradigms, Object oriented programming features, applications, merits & demerits, Features of Python, variables, Data types, input operation, Reserved words, Indentation, Expressions, String operations, Type conversions. (Text Book-1: Chapter 2: 2.3,2.4,2.5,2.6 Chapter 3: 3.1,3.6,3.7,3.8,3.10,3.11,3.13,3.14,3.16)	
DECISION AND LOOP CONTROL STATEMENTS: Conditional branch statements, Iterative statements, Nested loops, break, continue, pass, the else statement used with loops. (Text Book-1: Chapter 4: 4.1-4.8)	
UNIT – II	5 Hours
FUNCTIONS AND MODULES: Need for functions, Function definition, Function call, Scope, Return statement, Lambda functions, Recursive functions, Modules. (Chapter 5: 5.1 to 5.11) PYTHON STRINGS: String operations, Immutable, string formatting operator, built-in string methods, string slices, membership operator, comparing strings, Iterating strings. (Chapter 6: 6.1 to 6.9)	
UNIT – III	6 Hours
DATA STRUCTURES IN PYTHON: Sequence, List, Tuple, sets, dictionaries (Chapter 8: 8.1, 8.2, 8.4 to 8.6) FILE HANDLING METHODS: File path, File types, File operations, File positions, Rename and delete files. (Chapter 7: 7.1 to 7.7)	
UNIT – IV	5 Hours
USER DEFINED CLASSES & OBJECTS: Classes, Objects, class method and self-Argument, constructor, destructor, class variables, public and private data members, private methods, Calling methods, static methods. (Chapter 9: 9.1 to 9.10, 9.15) INHERITANCE: Introduction, Polymorphism, overriding, types of inheritance (Text Book: Chapter 10: 10.1 to 10.6)	

UNIT – V	5 Hours
OPERATOR OVERLOADING: Introduction, Implementation of operator overloading, Reverse addition, overriding methods and functions. (Text Book: Chapter 11: 11.1 to 11 .7) ERROR AND EXCEPTION HANDLING: Errors, Handling exceptions, Multiple except blocks, Multiple exceptions, except block without exception, the else clause, raising exceptions, Built-in and user defined exceptions, finally block, clean-up action (Text Book: Chapter 12: 12.1 to 12.7, 12.10 to 12.12)	

Course Outcomes:

At the end of the course the student will be able to:

1. Write a python program using 4 conditionals, definite loop, indefinite loop with jump statements.
2. Write an application using lambda, recursive functions, strings and files to store and retrieve the data from the system.
3. Write python programs using Core data structures like Lists, Tuples, Sets and Dictionaries.
4. Implement the concepts of object-oriented concept using class, objects, methods. Polymorphism and different levels of inheritance.
5. Implement operator overloading, overriding, single and multiple exception handling program capability in python

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1		2					1				
CO2	3	2	1		2					1		2	1	
CO3	3	2	2		2					1		2	1	
CO4	3	2	2		2					1		2	1	
CO5	3	2	2		2					1		2	1	

3: Substantial (High) 2: Moderate (Medium 1: Poor (Low)

TEXT BOOKS:

1. Reema Thereja, “Python programming: Using problem solving approach”, 2nd Edition, Oxford university press, 2019.

REFERENCE BOOKS:

1. John V Guttag, “Introduction to Computation and Programming Using Python”, The MITpress, 3rd edition, 2021.
2. Tony Gaddis, “Starting out with python”, 4th edition, Pearson, 2019.
3. Allen Downey, Jeffrey Elkner and Chris Meyers, "How to think like a Computer Scientist, Learning with Python", Green Tea Press, 2014.
4. Richard L. Halterman, “Learning to Program with Python”, 2011.
5. Charles Dierbach, “Computer Science Using Python: A Computational Problem-Solving Focus”, John Wiley, 2012.

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through programming.

OBJECT ORIENTED PROGRAMMING LABORATORY

Total 26 Hours

List of Programming Experiments:

1. Python Program for Data Handling and Expression Evaluation.
2. Python Program for Quadratic Equation Roots and Number Analysis.
3. Python Program for Function Illustration and Module Creation.
4. Python Program for String Operations and Data Validation.
5. Python Program for File Handling and Script Copying.
6. Python Program for Data Structures and Built-in Methods.
7. Python Program for Object-Oriented Concepts and Inheritance.
8. Python Program for Operator Overloading and Special Methods.

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ENGINEERING CHEMISTRY [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II					
Course Code	:	24EN1104	Credits	:	03
Hours / Week	:	04 Hours	Total Hours	:	26 + 26 Hours
L–T–P–J	:	2–0–2–0			

Course Learning Objectives:

This Course will enable students to:

- Understand the principles of chemical fuel towards energy production.
- Apply the concept of energy conversion from solar to electric energy in photovoltaic cells.
- Understand the basic principles of electrochemistry to measure the potential of redox reactions. Illustrate the construction, working, and applications of batteries, and fuel cells as energy storage devices.
- Understand the electrochemical theory of corrosion of metals and its prevention by metal finishing techniques.
- Understand the synthesis, structure–property relationship, and the applications of commercial polymers.
- Understand the different techniques for the purification of sewage water. Analyse the impurities present in waste water systems.

Teaching-Learning Process (General Instructions)

These are some of the innovative pedagogical approaches to accelerate the attainment of the various course outcomes.

1. Lecture method: Chalk and talk method, and demonstrations may be adopted to achieve the course outcomes.
2. Interactive Teaching: Active learning that includes brainstorming, group work, formulating questions, notetaking, and annotating.
3. Show Videos to explain and illustrate the various concepts.
4. Encourage Collaborative learning in the class.
5. Problem Based Learning, may foster students' analytical skills, ability to evaluate, and process the information.
6. Inculcate the culture of research and encourage students to come up with their own creativity.

UNIT – I Chemical Energy Source	06 Hours
Fuels: Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value-definition, Gross and Net calorific values (SI units). Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Numerical problems on GCV&NCV. Petroleum cracking-fluidized catalytic cracking. Reformation of petrol. octane number, cetane number, anti-knocking agents, power alcohol, and Biodiesel. (Text Book-1: Module-3) Solar Energy: Thermal energy: Photovoltaic Cells-Introduction, definition, importance, working of PV cell. Solar grade silicon physical and chemical properties relevant to photo-voltaics, doping of silicon by diffusion technique. (Text Book-1: Module-3)	

UNIT – II Energy Science and Technology	06 Hours
Electrochemistry and Battery Technology: Single electrode potential - Definition, and sign conventions. Standard electrode potential- Definition. EMF of a cell-Definition, notation and conventions. Reference electrodes– Calomel electrode, Ag/AgCl electrode. Measurement of standard electrode potential. Battery technology: Basic concepts including characteristics of anode, cathode, electrolyte and separator. Battery characteristics. Classification of batteries– primary, secondary and reserve batteries. State of the art Batteries-Construction working and applications of Zn-air, Lead acid battery, Nickel-Metal hydride and Lithium ion batteries. (Text Book-2: Module-1) Fuel Cells: Introduction to fuel cells, types of fuel cells. Construction, working and application of Methanol-Oxygen fuel cell. (Text Book-2: Module-1)	

UNIT – III Corrosion Science and Surface Modification Techniques	06 Hours
Corrosion Science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Metal Coatings-Galvanization, Tinning and its disadvantages. Cathodic protection of Corrosion: Sacrificial anode method and current impression method. (Text Book-2: Module-2) Surface Modification Techniques: Definition, Technological importance of metal finishing. Significance of polarization, decomposition potential and over-voltage in electroplating processes. Electroless Plating. Distinction between electroplating and Electroless plating, advantages of electroless plating. Electroless plating of copper. (Text Book-2: Module-2)	

UNIT – IV Polymers	02 Hours
Polymers: Introduction to polymers, Glass transition temperature, structure and property relationship. Synthesis, properties and applications of Teflon. PMMA. Synthesis, properties and application of silicone rubber. (Text Book-1: Module-4)	
UNIT – V Water Technology & Instrumental Methods of Analysis:	06 Hours
Water Technology: Impurities in water. Hardness of Water: Types of Hardness and determination of total hardness of water by using disodium salt of ethylenediaminetetraacetic acid method. Alkalinity. Potable water treatment by Electro dialysis and Reverse Osmosis. Water analysis- Biochemical oxygen demand and Chemical oxygen demand. Determination of COD. Numerical problems on COD. Sewage treatment. (Text Book-2: Module-5) Instrumental Methods of Analysis: Instrumental methods of analysis, Principles of Potentiometry, Conductometry (Strong acid against strong base, weak acid against strong base, mixture of strong acid and a weak acid against strong base).	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Determination of calorific value of fuels and apply the concepts of energy conversion for photovoltaic cells.	L3
2	Apply the basic principles of electrochemistry for the construction of energy storage devices.	L3
3	Implement the electrochemical theory to analyze the concept of corrosion of metals and its prevention by surface modifications.	L3
4	Apply the concept of polymerization for the synthesis of polymers and study their structure-property relationship for commercial applications.	L3
5	Demonstrate the techniques in the purification of sewage water. Determine the hardness and oxygen demand of the provided waste water samples.	L2

Table: Mapping Levels of COs to POs												
COs	Program Outcomes (POs)											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	0	0	0	0	0	0	0	0	0
CO2	3	2	2	0	0	0	0	0	0	0	0	0
CO3	3	1	1	0	0	0	0	0	0	0	0	0
CO4	3	1	3	0	0	0	0	0	0	0	0	0
CO5	3	1	3	0	0	0	0	0	0	0	0	0

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

Text Books

1. Engineering Chemistry, Edited by Dr. Mahesh B and Dr. Roopashree B, Sunstar Publisher, Bengaluru, ISBN 978- 93-85155-70-3, 2022.
2. Engineering Chemistry - by Chandra Shekara B M and Basavaraju B C, Banbayalu (publications), Bengaluru, 2014, 294 pages.

Reference Books

1. Prasanta Rath, “Engineering Chemistry”, Cengage Learning India PVT, LTD, Delhi, 2015. 2. Shikha Agarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, 2015.
3. Wiley’s Engineering Chemistry (Wiley India), 2nd Edition, 2013, 1026 pages.

E-Resources

1. https://nptel.ac.in/
2. https://swayam.gov.in/
3. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry/Basics_of_Electrochemistry

Activity Based Learning (Suggested Activities in Class)

1. Analyze research problems by reading research articles, group discussion, and presentations.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

ENGINEERING CHEMISTRY- LABORATORY

Total: 26 Hrs

Volumetric Analysis and Preparations

1. Evaluation of quality of water in terms of total hardness by complexometric titration.
2. Determination of Chemical Oxygen Demand (COD) of the given industrial waste water sample.
3. Determination of alkalinity of the given water sample

Instrumental methods of Analysis

1. Potentiometric titration–Estimation of FAS using standard $K_2Cr_2O_7$ solution.
2. Conductometric estimation of a mixture of a weak and strong acid using standard sodium hydroxide solution
3. Determination of viscosity coefficient of a given liquid 4. Colorimetric estimation of copper in a given solution

5. Determination of pKa of given weak acid.

Reference Books

1. Dayananda Sagar University laboratory manual.
2. J. Bassett, R.C. Denny, G.H. Jeffery, Vogels, Text book of quantitative inorganic analysis, 4th Edition.

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INTRODUCTION TO MECHANICAL ENGINEERING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II				
Course Code	:	24EN1105	Credits	: 03
Hours / Week	:	04 Hours	Total Hours	: 26 + 26 Hours
L–T–P–J	:	2–0–2–0		

Course Learning Objectives:

This Course will enable students to:

- Acquire a basic understanding of renewable energy resources and basic concepts of hydraulic turbines.
- Acquire knowledge of various engineering materials and metal joining techniques.
- Acquire essential knowledge of modern manufacturing tools and techniques.
- Acquire knowledge on basics of refrigeration and air-conditioning.
- Explain about the cooling of electronic devices.
- Acquire knowledge of basic concepts of mechatronics and robotics.
- Explain about the electric and hybrid vehicles.

COURSE OUTCOMES:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Describe basic concepts of renewable energy resources and power generation	L2
CO2	Distinguish various engineering materials and metal joining techniques	L2
CO3	Demonstrate different modern manufacturing tools and techniques	L3
CO4	Make use of basic concepts of refrigeration and air-conditioning concepts	L3
CO5	Illustrate essential knowledge of basic concepts of mechatronics and robotics	L2
CO6	Comprehend the important concepts of electric and hybrid vehicles	L2

COURSE CONTENT:	
MODULE 1 Energy Sources and Power Generation	10 Hrs
Review of energy sources: Construction and working of Hydel power plant, Thermal power plant, Nuclear power plant, Solar power plant, Tidal power plant, Wind power plant. Principle and Operation of Hydraulic turbines, Pelton Wheel, Francis Turbine and Kaplan Turbine. Working of Centrifugal Pump& reciprocating pump. Thermodynamics: System, boundary, surroundings, types of systems, Zeroth law, First and second laws of thermodynamics, Efficiency, COP, Carnot theorem	
MODULE 2 Engineering Materials and Metal Joining Processes	10 Hrs
Metals-Ferrous: Tool steels and stainless steels. Non-ferrous /metals: aluminum alloys. Ceramics- Glass, optical fiber glass, cermets. Composites- Fiber reinforced composites, Metal matrix Composites.	
Smart materials- Piezoelectric materials, shape memory alloys, semiconductors, and super insulators. Metal Joining Processes: Fitting, Sheet metal, Soldering, brazing and Welding: Definitions. Classification and methods of soldering, brazing, and welding. Brief description of arc welding, Oxy- acetylene welding, Introduction to TIG welding and MIG welding.	
MODULE 3 Modern Manufacturing Tools and Techniques	12 Hrs
CNC: Introduction, components of CNC, advantages and applications of CNC, CNC Machining centres and Turning Centers Concepts of Smart Manufacturing and Industrial IoT. Additive Manufacturing: Introduction to reverse Engineering, Traditional manufacturing vs Additive Manufacturing, Computer aided design (CAD) and Computer aided manufacturing (CAM) and Additive Manufacturing (AM), Different AM processes, Rapid Prototyping, Rapid Tooling, 3D printing: Introduction, Classification of 3D printing process, Applications to various fields.	

MODULE 4 Thermal Systems and Management	10 Hrs
Heat in Electronic Devices: Modes of Heat Transfer, heat generation in electronics, temperature measurement, heat sink, Cooling of electronic devises: Active, Passive, and Hybrid Cooling . Refrigeration: Principle of refrigeration, Refrigeration effect, Ton of Refrigeration, COP, Refrigerants and their desirable properties. Principles and Operation of Vapor Compression and Vapor absorption refrigeration. Applications of Refrigerator. Air-Conditioning: Classification and Applications of Air Conditioners. Concept and operation of Centralized air conditioning system.	
MODULE 5 Advanced Technologies	10 Hrs
Mechatronics: Introduction, Concept of open-loop and closed-loop systems, Examples of Mechatronic systems and their working principle. Robotics: Introduction, Robot anatomy, Joints & links, common Robot configurations. Applications of Robotics in Material Handling, Processing, Assembly, and Inspection. Electric and Hybrid Vehicles: Introduction, Components of Electric and Hybrid Vehicles, Drives and Transmission. Advantages and disadvantages of EVs and Hybrid vehicles.	

List of Laboratory/Practical Experiments activities to be conduct
• Demonstration on Principle and Operation of any one Turbo machine • Demonstration on pumps • Visit any one Conventional or Renewable Energy Power Plant and prepare a comprehensive report. • One exercises each involving Fitting and Sheet metal. One exercises each involving welding and Soldering. • Study oxy-acetylene gas flame structure and its application to gas welding □ Demonstration on Principle and Operation of CNC machine. • Demonstration on Principle and Operation of 3D printing process. • Demonstration of anyone Heat transfer application device and prepare a comprehensive report. • Demonstration of anyone air conditioning system. • Demonstration of the machine consists of Gear Trains. • Demonstration of various elements of mechatronic system. □ Demonstration of any one model of Robot

TEXT BOOKS:

1. Basic and Applied Thermodynamics, P.K. Nag, Tata McGraw Hill 2nd Ed., 2002
2. Non-Conventional Energy Sources, G.D Rai, Khanna Publishers, 2003
3. Elements of Workshop Technology (Vol. 1 and 2), Hazra Choudhry and Nirzar Roy, Media Promoters and Publishers Pvt. Ltd., 2010
4. Thermal Management in Electronic Equipment, HCL Technologies, 2010
5. Robotics, Appu Kuttan KK K. International Pvt Ltd, volume 1

REFERENCES:

1. An Introduction to Mechanical Engineering, Jonathan Wickert and Kemper Lewis, Third Edition,2012
2. Turbo Machines, M. S. Govindegowda and A. M. Nagaraj, M. M. Publications 7th Ed, 2012
3. Manufacturing Technology- Foundry, Forming and Welding, P.N. Rao Tata McGraw Hill 3rd Ed.,2003.
4. Thermal Management of Microelectronic Equipment, L. T. Yeh and R. C. Chu, ASME Press, NewYork, 2002
5. Fundamentals of Robotics: Analysis and Control, Robert J. Schilling, Pearson Education (US).

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INTRODUCTION TO ELECTRICAL ENGINEERING [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II				
Course Code	: 24EN1106	Credits	:	02
Hours / Week	: 02 Hours	Total Hours	:	26 Hours
L–T–P-J	: 2–0–0-0			

Course Learning Objectives:

This course enables students to:

- Demonstrate a foundational understanding of electrical quantities, including current, voltage, power, and energy.
- Apply fundamental laws of electric circuits, such as Ohm's law and Kirchhoff's laws to evaluate electrical circuits.
- Explain fundamental concepts of electro-magnetic circuits.
- Demonstrate a foundational understanding of the working principles, construction, and characteristics of DC machines.
- Illustrate the construction, operation, and types of transformers, considering their significance in electrical systems.
- Explain the structure and components of electrical power system, highlighting their interconnections.
- Explain emerging trends of green energy technologies and smart metering.
- Explain the importance of earthing, protective devices, and proper wiring for ensuring electrical safety.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I	10 Hours
Fundamentals laws of Electrical circuit and elements: Electrical charge, potential; current; power and energy; AC and DC current (mathematical treatment); Ohm's law; KCL and KVL in resistive circuits; series and parallel combination of resistors; voltage and current division rule;	
V-I relationships for inductor and capacitor under AC voltage; impedance and admittance (series RC and RL); Overview of active power, reactive power and power factor; Introduction to 3 phase systems; Simulation using LTspice software to demonstrate voltage division, current division in resistive circuits. Simulation using LTspice software to show voltage and current waveform for RC and RL circuit. (TextBook-1: Chapter 1: 1.1 to 1.4, 1.6 to 1.8. Chapter 2: 2.1 to 2.3. Chapter 4: 4.1 to 4.4 Chapter 6: 6.1 to 6.4)	
UNIT – II	10 Hours
Electromagnetic circuits: Magnetic circuits: Basics of magnetic circuits (flux, mmf, permeability, reluctance, B and H); Relation between field theory and circuit theory; Faraday's and lenz's laws, Lorentz force; Self and Mutual inductance. DC machines: Principle of operation of DC generator; generated EMF equation; classification; characteristics and applications. (Introductory treatment only); Principle of operation of DC Motor; back EMF; speed and torque; classification; characteristics and applications. Losses and efficiency in DC machines. Transformers: Construction, working principle, induced emf equation; step-up and step down; losses and efficiency. (TextBook-2: Chapter 7: 7.1 to 7.12; Textbook 1: 10.1, 10.2, 10.4, 10.5, 10.8, 10.9, 10.11 and 10.12; Chapter 8: 8.1, 8.2 and 8.9)	
UNIT – III	06Hours
Powers system fundamentals: Power system structure; generations sources; green energy; smart meters; power tariff calculations; Electrical safety and standards (IS: 732-2019, IEC: 60446): Colour code of wires for single phase supply, earthing, fuse and MCB. (Textbook 1: Chapter 16: 16.1 to 16.5; Textbook 2: Chapter 24: 24.1 to 24.6)	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
CO1	Solve for voltage, current, power and energy in purely R, series RL and RC circuits under DC and AC voltages.	L3
CO2	Demonstrate understanding of principle of operation of DC machines and its applications.	L2
CO3	Demonstrate understanding of the working principle of transformers.	L2
CO4	Demonstrate understanding of the working principle of transformers, generation sources, the significance of renewable energy sources in electrical engineering, and safety practices.	L2
CO5	Demonstrate proficiency in using simulation software (e.g., LTspice) to simulate and solve electrical parameters.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2		1	3						1		1		
CO2	3	2									1		1		
CO3	3	2									1		1		
CO4	3					2	3	2			1		1	1	2
CO5	3	3	2	1	3				1	1	2	2	1	1	

TEXT BOOKS:

1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill, 2019.
2. B.L. Theraja and A.K. Therja, "A textbook of electrical technology, Vol. I (Basic electrical Engineering)", S. Chand Publishing, 23rd Rev Ed, 2006.

REFERENCE BOOKS:

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, "Introduction to Electrical Engineering", 2nd Edition, McGraw-Hill, 1992.
2. William H Hayt and Jack E Kimberly and Steven M Durbin, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill, 2013.

E-Resources:

1. https://nptel.ac.in/courses/108/108/108108076

Activity Based Learning (Suggested Activities in Class):

1. Real world problem solving using group discussion and hands-on activities. E.g., Interfacing different types of sensors using Arduino.
2. Simulation of different electrical circuits. E.g., RL and RC circuits.

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ENGINEERING MECHANICS
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	24EN1107	Credits	:	02
Hours / Week	:	02 Hours	Total Hours	:	26 Hours
L–T–P–J	:	2–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Illustrate Couples and equivalent force couple system
2. Understand the principles of resolution and composition of forces
3. Calculate moment of coplanar concurrent and coplanar non-concurrent forces
4. Draw free body diagrams of objects subjected to coplanar concurrent and non-concurrent force systems
5. Calculate center of gravity/centroid for various planar figures
6. Determine area moment of inertia for various planar geometrical objects and standard symmetrical sections
7. Explain Limiting friction and Laws of Friction
8. Solve numerical on wedge friction, ladder friction
9. Explain assumptions made in analysis of Trusses
10. Determine axial forces in members of Planar determinate Truss
11. Illustrate rectilinear, plane curvilinear and projectile motions

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I Introduction to Engineering Mechanics	06 Hours
INTRODUCTION: Introduction to Engineering Mechanics, Force Systems Basic concepts, Particle Equilibrium in 2-D; System of Forces, Co-planar Concurrent Forces, Resultant- Moment of Forces and its Application; Couples and Resultant of force System, Equilibrium of System of Forces,	
UNIT – II Centroid, Centre and gravity and Moment of inertia	05 Hours
Introduction, Centroid of simple figures from first principle, centroid of standar sections Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections	
UNIT – III Friction	05 Hours
Introduction, Free body diagrams, Equations of Equilibrium. Types of friction, Limiting friction, Cone of Friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, related problems.	
UNIT – IV Dynamics	05 Hours
Introduction, Rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates); Projectile motion, Basic terms, general principles in dynamics; Types of motion, motion and simple problems, Kinetics- Newton's laws of motion and related problems.	
UNIT – V Analysis of Trusses	05 Hours
Introduction, Classification of trusses, Equilibrium in two and three dimensions; Method of Joints; To determine if a member is in tension or compression; Simple Trusses; Zero force members.	
Course Outcomes: At the end of the course the student will be able to: 1. Compute Resultant and reactions by principles and resolution of forces in a plane. 2. Analyse the objects under the action of applied and frictional forces in a plane by equations of equilibrium. 3. Determine the Moment of Inertia of composite geometrical sections in a plane 4. Analyse determinate two-dimensional truss by the method of joints and method of section. 5. Analyze the motion of objects by equations of motion, equations of equilibrium, and Newton's laws of motion and calculate quantities in projectile motion by equations of motion.	

Table: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	0	0	1	1	0	0	0	0	1	3	2
CO2	2	2	2	2	0	0	1	0	0	0	0	0	2	2	0
CO3	3	3	2	2	0	0	1	0	1	0	0	0	3	2	0
CO4	3	3	2	2	0	0	1	0	0	0	0	0	3	3	0
CO5	3	2	2	2	0	0	1	0	0	0	0	0	2	2	0

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall publications.
2. A Nelson (2009), Engineering Mechanics: Statics and dynamics, Tata McGraw Hill publications.

REFERENCE BOOKS:

1. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill publications.
2. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
3. H.J. Sawant, S.P Nitsure (2018), Elements of Civil Engineering and Engineering Mechanics, Technical Publications.

E-Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105108/
2. https://onlinecourses.nptel.ac.in/noc22_ce46/preview
3. https://www.youtube.com/watch?v=LIZ-PQbGZkA

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

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TECHNICAL ENGLISH

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I / II

Course Code	:	24EN1108	Credits	:	02
Hours / Week	:	02 Hours	Total Hours	:	26 Hours
L–T–P-J	:	2-0- 0-0			

Objective:

Developing Communicative competence: Enhancing the Language competence in the technical discourse and augmenting the strategic competence in the social and professional environment.

Course Learning Objectives: This course will enable students to:

a. To enable students to improve their lexical and grammatical competence.
b. To enhance their verbal and nonverbal communication in a professional environment
c. To optimize oral and written communication.
d. To familiarize the students with employability and job search skills.
e. To enhance the students with soft skills
f. To inculcate critical thinking

Teaching-Learning Process (General Instructions)

These are some of the innovative pedagogical approaches to accelerate the attainment of the various course outcomes.

1. Lecture method: Anecdotes, case studies and Examples from real-life situations may be adopted along with the traditional method of chalk and talk to achieve the course outcome.
2. Interactive Teaching: Active learning may be adopted which includes brainstorming, Teamwork, focused listening, formulating questions, note-taking, and Role play.
3. Collaborative learning through Debates and Group Discussion
4. Activity-based learning to inculcate Critical thinking – conceptualizing, applying, analyzing, synthesizing, and/or evaluating information from observation, perception, and expression. Minimum three higher-order questions from the real-world context
5. Problem-Solving method through Activities and discussion / Minimum of three situations to inculcate Problem-Solving skills and encourage the students to come up with creative ways to solve the problem
6. Audio-visual methods through language Lab in the teaching of LSRW skills.
7. Short films/ Ted talks/ Videos/Animation films to explain the functioning of various concepts.
8. Flipped learning
9. Peer learning / Peer tutoring

Module – I	06 Hours
Grammar and Usage, Language and Communication. (Branches of Grammar and Vocabulary Word Formation and Types of Word Formation. Communication process diagram. Types of Communication: Managerial, Corporate, Technical and Other Organizational Communication. Barriers to Effective Communication. Listening: Types and their Importance. Difference between hearing and listening. Speaking: Different aspects of Effective Speaking. Oral presentation Pronunciation Guidelines-Common Errors of Pronunciation-Various Techniques for Neutralization of Mother Tongue Influence)	
Objective: • Revising and practicing grammar will help students to optimize their language Competence • Listening steps up language learning and improves pronunciation • Speaking improves one's ability to construct phrases naturally and spontaneously in everyday discussions, Clarity and comprehensiveness in speech. • Communicating effectively in the Professional environment, to interact with the colleagues and to involve in collaborate initiatives	
Module – II	06 Hours
Reading: Extensive and Intensive. Technical Paper Writing and Minutes of the Meeting. Objective: • Reading provides exposure to the chosen field and helps in the coherence of the thought process • Technical writing techniques enable the knowledge in the relevant domain and creates better content based on the need of the target group • Meeting minutes allows to access information such as facts, opinions, votes cast, conflicts, attendees, and other crucial elements at the workplace.	
Module – III	05 Hours
Memo and E-mail Etiquette. Referencing Skills for Academic Report Writing. Objective: • Familiarizing with email etiquettes and correspondence provides learners to form an excellent first impression, establishing trust and confidence. • Following the Academic conventions helps the students to optimize their reference skills and use references to acknowledge the input of other authors and scholars in their work and avoid plagiarism. • Writing technical reports develop competence in creating a legally bound account of efforts and choices and engineering technical report propose a solution to a problem in order to inspire action.	

Module – IV	04 Hours
Group Discussion: Definition, How GD Helps in Student Life & Corporate Life. Objective: GD helps individuals to achieve the skills of organizing and presenting the ideas and concepts in a cohesive manner and to overcome the inhibition of expression in communication	
Module – V	05 Hours
Drafting Curriculum Vitae, Resumes, and Cover- Letters. Job Applications. {Types of Resumes, Preparing Resume, CV and Cover- Letter. Filling Job Application. Difference between Curriculum Vitae, Interview techniques: Telephonic interviews, Group interviews, face-to-face interviews -Mannerism and etiquette}. Objective: Learning the specifics of creating a CV or Resume helps in the effective presentation of their achievements and skills, and a cover letter is a chance for them to exhibit a few aspects of their personality.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
CO1	.	
CO2		
CO3		
CO4		
CO5		

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1										2				
CO2										2				
CO3										2				
CO4										2				
CO5										2				

TEXT BOOKS:

1. Dhanavel, S.P. "English and Communication Skills for Students of Science and Engineering". Orient Blackswan Pvt. Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice". 3rd Edition, Oxford University Press, 2009.
3. Murphy R. "English Grammar in Use", Cambridge University Press,2012.
4. N. Krishnaswamy and T. Sri Raman. "Creative English for communication", Macmillan Publication, 2005.

REFERENCE BOOKS:

1. Day. R A. "Scientific English: A Guide for Scientists and Other Professional". 2nd Edition, Hyderabad: Universities Press, 2000.
2. Ashraf Rizvi M. "Effective Technical Communication". McGraw Hill Education, 2017.
3. Eastwood J. "Oxford Practice Grammar". Oxford University Press, 1999.
4. Swan M and Walter C. "Oxford English Grammar Course". Oxford University Press, 2011.
5. Dale, Carnegie. "The Quick and Easy Way to Effective Speaking". JAICO Publishing House, 2019.
6. Chauhan, Gajendra S and Smita, Kashiramka. "Technical Communication". India: Cengage Learning India Private Limited, 2018.
7. Bailey, Stephen. "Academic Writing: A Handbook for International Students". 5th Edition, Routledge, 2017.
8. Kumar, Shiv K and Nagarajan, Hemalatha. "Learn Correct English: Grammar, Composition and Usage". 1st edition, India: Pearson, 2005.
9. Board of Editors. Language and Life: A Skills Approach. Orient BlackSwan, 2018.
10. Sudharshana, NP and C Savitha. English for Engineers. Cambridge University Press, 2018.
11. Kumar, Sanjay and Pushp Lata. English Language and Communication Skills for Engineers. Oxford University Press, 2018.

12. Thomson, A.J. and Martinet, A.V. A Practical English Grammar, OUP, New Delhi: 1986
13. Anne Laws, ―Writing Skills‖, Orient Black Swan, Hyderabad, 2011
14. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

E-Resources:

1. https://gnindia.dronacharya.info/ME/Common-Subjects/Downloads/Technical-Communication/Books/Technical-Communication-Book-9.pdf. Web.
2. https://projects.iq.harvard.edu/files/hks-communications-program/files/ho_murphy_michael-pp-slides_9_30_14.pdf. Web.
3. https://www.youtube.com/watch?v=TR0JZiapxXM. Web.
4. file:///C:/Users/rochn/Downloads/ManualofEnglishGrammarandComposition_10012575.pdf. Web.
5. https://www.youtube.com/watch?v=f5Tao6KHV5w. Web.
6. https://www.sastra.edu/nptel/download/Prof%20GPRagini/pdf_New/Unit%202 6.pdf. Web.
7. https://www.hansrajcollege.ac.in/hCPanel/uploads/elearning/elearning_document/English_communication_chapter_13.pdf. Web.
8. https://www.youtube.com/watch?v=voyGGhlpBR8. Web.

Activity Based Learning (Suggested Activities in Class)

1. Observing and responding appropriately to the real-life situations.
2. Encouraging students to participate in Group discussions.
3. Articulating internal observations precisely and confidently through extempore.
4. Producing sentences easily without any grammatical errors in speaking, writing essays, and creative writing.
5. Conducting mock interviews, to refine their expressions, familiarize them with the interview techniques, and provide training for the spontaneous response to tricky questions.
6. Directing students for PowerPoint presentations and orienting them towards the higher order skills of expressing their ideas and concepts with cohesion.

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ENVIRONMENTAL SCIENCES [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II			
Course Code : 24EN1109		Credits : 01	
Hours / Week : 01 Hour		Total Hours : 13 Hours	
L–T–P–J : 1–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Understand the concepts of environment, pollution, energy resources Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
2. Learn water as a resource, rain water harvesting as a method of conversation of water.
3. Explain solid waste and its management.
4. Understand environmental Protection Act laws, environmental Impact Analysis and air monitoring

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods like power point presentations and group discussion may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three higher order thinking questions in the class.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT:	
UNIT 1: Environment and ecosystem	3 Hrs
Definition of environment; Scope and importance of environmental studies; Basic concepts Xenobiotic, natural & anthropogenic; why are we concerned? Eco-kinetic & Bio-kinetic Properties of a xenobiotic, Dose-Response Relationships;3 T's, Chronic and acute effects.	
UNIT 2: Pollution and management	4 Hrs
Air Pollution: Criteria pollutants – Ozone, Particulate Matter, Carbon Monoxide, Nitrogen, Oxides, Sulphur Dioxide, Lead; Acid Rain Cycle. Water as a resource; Lentic and Lotic Water Systems; Rain Water Harvesting; Water Pollution; Noise pollution-sources and effects of noise; Municipal Solid Waste: Hazardous Waste: Electronic Waste: Biomedical Waste; Solid Waste Management: Landfills, composting Process.	
UNIT 3: Energy	2 Hrs
Energy Types of energy: Conventional sources of energy, fossil fuel, Coal, Solar, wind; Non-conventional Sources of Energy, Biofuels - biomass, biogas.	
UNIT 4: Disaster	2 Hrs
Disasters & Management; Definition, Natural (Earthquakes, landslides, floods), Man-made disasters (biological, chemical, nuclear, radiological explosions) – definition, causes and management and/or mitigation strategies; Bhopal & Chernobyl Disasters.	
UNIT 5: Environmental acts	2 Hrs
Environmental Impact Assessment (EIA); Air pollution monitoring and Ambient Air Quality Standards (AAQS); Environment Protection Act, 1986.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Critically elucidate the basic concepts that govern environmental quality, ambient air quality standards.	L3
2.	Distinguish different Energy resources and their environmental implications	
3.	Distinguish natural and manmade disasters and prevention	L3
4.	Demonstrate different types of pollution and waste streams	L3
5.	Apply the process of environmental impact assessment and implications of Indian Environment Laws	

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

TEXT BOOKS:

1. Benny Joseph (2005). “Environmental Studies”, Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. R. J. Ranjit Daniels and Jagadish Krishnaswamy (2014). “Environmental Studies” (2014), Wiley India Pvt Limited, New Delhi.

REFERENCE BOOKS:

1. P. Aarne Vesilind, Susan M. Morgan, Thomson (2008). “Introduction to Environmental Engineering” (2008), Thomson learning, Second Edition, Boston.
2. R. Rajagopalan (2005). “Environmental Studies – From Crisis to Cure” Oxford University Press, New Delhi.

KANNADA KALI [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II					
Course Code	:	24EN1110	Credits	:	01
Hours / Week	:	01 Hours	Total Hours	:	13 Hours
L–T–P-J	:	1–0–0-0			

Course Learning Objectives:

This course enables students:

- To introduce Kannada language & culture to Non – Kannada speakers.
- To train them to communicate in colloquial Kannada with connivance.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.

UNIT – I	08 Hours
Introduction to Karnataka & Kannada Culture, Evolution of Kannada. Introduction to Kannada Alphabets. Introduction to Kannada Numbers.	
UNIT – II	08 Hours
Kannada words, sentences & phrase making for colloquial communication.	

TEXT BOOKS:

1. Kannada Kali –Dr. Lingadevaru Halemane
2. Kannada Paatagalu– Editor: Dr. Chandrashekara Kambara.
3. SLN Sharma & K Shankaranarayana “Basic Grammar”, Navakarnataka Publications.
4. Spoken Kannada. Publication: Kannada Sahitya Parishat Bengaluru.

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ENGINEERING PHYSICS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I /II					
Course Code	:24EN1111		Credits	:	04
Hours / Week	:	03 Hours	Total Hours	:	39 + 26 Hours
L–T–P-J	:	3–0–2-0			

Course Learning Objectives:

This Course will enable students to:

1. To introduce the fundamental ideas of quantum mechanics that are necessary for understanding and addressing engineering challenges.
2. To comprehend solids' band structure, semiconductors' electrical conductivity, and semiconductor devices such as LEDs, photodiodes, and solar cells, as well as their applications.
3. To examine many types of engineering materials, including electronic, electrical, mechanical, and magnetic materials, as well as dielectric material properties and applications in science and engineering.
4. To comprehend various crystal systems and determine structure using miller-indices.
5. Describe thin-film phenomena, thin-film production processes, and applications in science and engineering.
6. To understand how to create Nano materials utilizing a top-down and bottom-up method, as well as to explore Nano science and technology, as well as its practical applications in engineering, biology, and medicine.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

SYLLABUS	
MODULE – I	08 Hours

QUANTUM MECHANICS:

- Foundations of quantum theory, Wave function and its properties, de-Broglie hypothesis, Heisenberg Uncertainty principle. One dimensional time independent Schrodinger wave equation, Eigen values and Eigen functions. Applications: one dimensional motion of an electron in a potential-well. Basics of Quantum computing - Concepts of Superposition, entanglement, Interference and Qubit. [5 hours] (Text book 1: Chapter 1.5 and Chapter 2 all units)

- LASER PHYSICS: Introduction to lasers. Conditions for laser action. Requisites of a Laser system Principle, Construction and working of Nd-YAG and Semiconductor Laser. Application of Lasers in Defense (Laser range finder), Engineering (Data storage) and Applications of Lasers in medicine [3 hours]
  (Text book 1: Chapter 5.1, 5.2, 5.3, 5.4, 5.5)

MODULE – II	08 Hours

- Semiconductor Physics: Band structure, Fermi level in intrinsic and extrinsic semiconductors, Density of energy states in conduction and valence bands of a semiconductor (Mention the expression), Expression for concentration of electrons in conduction band (Derivation), Hole concentration in valance band (Mention the expression), Intrinsic carrier concentration, Conductivity of semiconductors, Hall effect, Numericals. (5 hours)
  (Text Book-2: Chapter 24.1 to 24.9, Chapter 25.9 to 25.11)

- Semiconducting devices for optoelectronics applications: - Principle and working of LED, photodiode, Solar cell, BJT [3 hours] (Text Book-2: Chapter 25.1 to 25.8)

MODULE – III	08 Hours

- Dielectrics: Introduction – Dielectric polarization – Dielectric Polarizability, Susceptibility and Dielectric constant - Types of polarizations: Electronic, Ionic and Orientation polarizations (qualitative) – Lorentz Internal field (Expression only) – Claussius - Mossoti equation (derivation) – Applications of Dielectrics – Numericals. (4 hours)
  (Text book 1: Chapter 4.1, 4.2, 4.3, 4.4, 4.5)

- Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability - Classification of magnetic materials: Dia, para, Ferro, antiferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials - Engineering applications. Numiricals (4 hours)
  (Text book 1: Chapter 4.9, 4.10, 4.11)

MODULE – IV	08 Hours

- Crystallography: Lattice, unit cell, lattice parameters, crystal systems, Bravais lattices, Packing fraction for SCC, BCC and FCC crystal systems. Introduction to Miller Indices. Determination of Crystal structure by Miller Indices. Expression for Inter-planar distance. X-ray diffraction, Bragg's law and Determination of Crystal structure by Powder method. Numericals [4 hours] (Text book 1: Chapter 7 all units)

- Mechanical Engineering Materials – mechanical properties: stress- strain curve for different materials. Introduction to Tensile strength, Compressive strength, Ductility, Toughness, Brittleness, Impact strength, Fatigue, Creep. Testing of engineering materials: Hardness Tests: Brinell and Vickers hardness test& Numericals- (4 hours) Text Book-2: Chapter 2.1 to 2.7)

MODULE – V	07 Hours

- Thin films technology: Introduction to thin-films-Advantages of thin-films over bulk materials. Thin film deposition processes- Physical vapour deposition (Thermal evaporation technique, and sputtering technique) process, Applications of Thin films. [3 hours] (Ref. Text Book-2: Chapter 2. All units)

- Nano Science &technology: Introduction to Nano materials, Classification of nano materials, Size dependent properties of materials, Top-down and Bottom-up approach- Ball-milling and Photolithography, Process. Fundamental Principles of Biophysics & Applications of Nano technology in Biology and Engineering. [4 hours] (Text Book-1: Chapter 8.1 to 8.7)

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Describe the concepts of Quantum mechanics and applications of Schrodinger time independent wave equation in one dimension.	L1 & L3
2	Illustrate Semiconductors, Semiconductor devices like Photo diode, LED, Solar cell and its applications.	L2 & L3
3	Distinguish the different engineering materials such as Electronic, electrical and mechanical materials properties and their applications in engineering. Apply the concept of magnetism to magnetic data storage devices.	L2 & L3

4	Classify Lattice parameters of different crystalline solids by using X-ray diffraction methods and its applications in science and engineering	L1 & L3
5	Interpret Basic concepts of thin films and thin film deposition processes and their applications leads to Sensors and engineering devices.	L2
6	Categorize Nano materials, Properties, and fabrication of Nano materials by using Top-down and Bottom –up approach's - Applications for Science and technology.	L2 & L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													1
CO2	2													1
CO3	2													1
CO4	1													1
CO5	1											1		2
CO6	3											2		3

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. P. S. Aithal, H. J. Ravindra, Textbook of Engineering Physics (2011), Acme learning Private Limited, New Delhi, India.
2. Shatendra Sharma, Jyotsna Sharma, Engineering Physics (2019), Pearson, Noida, Uttar Pradesh, India.

REFERENCE BOOKS:

1. M. Young (1977), Optics & Lasers an Engineering Physics approach, Springer
2 K.L. Chopra, Thin film Phenomena, McGraw Hill, New York.
3 S. O. Pillai (2018), Solid State Physics, revised edition, New Age International Publishers, New Delhi
4 M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy (2018), A textbook of Engineering Physics, S Chand, New Delhi.

E-Resources:

1. https://nptel.ac.in/courses/106/101/106101060/
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

Activity Based Learning (Suggested Activities in Class)

1. Demonstration of solution to a problem through Project demo model.

ENGINEERING PHYSICS LAB

Total Contact Hours: 26

Following are experiments to be carried out in Engineering Physics Lab
LABORATORY EXPERIMENTS:

List of Experiments:

1. I-V characteristics of a Zener Diode

I–V Characteristics of a Zener diode in forward and reverse bias condition (Module 2)

2. Planck's constant

Measurement of Planck's constant using LED (Module 2)

3. Transistor characteristics

Input and output characteristics of a NPN transistor in C-E configuration (Module2)

4. Dielectric constant

Determination of dielectric constant of a dielectric material (Module 2)

5. Torsional Pendulum

Determination of moment of inertia of a circular disc using torsional pendulum

6. Diffraction grating

Determination of wavelength of a laser light using diffraction grating (Module 4)

7. LCR series and parallel resonance

Study the frequency response of a series and parallel LCR circuit (Module 3)

8. Band gap energy

Determination of energy gap of an intrinsic semiconductor (Module 2)

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INTRODUCTION TO ELECTRONICS ENGINEERING
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	24EN1112	Credits	:	03
Hours / Week	:	03 Hours	Total Hours	:	39 Hours
L–T–P-J	:	3–0–0			

Course Learning Objectives:

This course enables students to

1. Understand the fundamental principles of diodes and their applications, including the band diagram of insulators, conductors, and semiconductors, diode construction, and V-I characteristics.
2. Analyze diode circuits under different biasing conditions and comprehend the behavior of diodes in applications such as AND gates, OR gates, rectifiers, and voltage regulators and simulate the same circuits using LTspice software.
3. Comprehend the construction, operation, and characteristics of bipolar junction transistors (BJTs), including input and output characteristics, different biasing techniques, and transistor amplification.
4. Simulate common emitter amplifier circuits with voltage divider bias using LTspice software.
5. Demonstrate an understanding of operational amplifiers (Op-amps), including their symbols, operation modes, properties, and applications such as amplifiers, comparators, and oscillators.
6. Demonstrate an understanding of digital electronics, including binary number systems, Boolean algebra, logic gates, sequential logic circuits, and the application of Flip-Flops.
7. Simulate digital circuits and components using LTspice software.
8. Familiarize themselves with microprocessors and microcontrollers, specifically Arduino boards, and understand their architecture and components.
9. Set up the Arduino development environment, write and upload code to the Arduino board, and execute simple Arduino programs.
10. Interface various sensors and engage in hands-on activities to reinforce understanding, including LED blinking and designing and implementing a complete Arduino-based system as a student project.

Teaching-Learning Process (General Instructions)
These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I	09 Hours
Diodes and its application: Band diagram of insulators, conductors and semiconductors; semiconductor types: intrinsic and extrinsic (n-type and p-type); overview of diode construction; diode under no-bias, forward bias and reverse bias; V-I characteristics of diode; simplified equivalent circuit of practical diode and ideal diode; overview of diode specifications: peak inverse voltage, reverse leakage current and maximum forward current; numerical on series diode configuration with DC input. Applications: AND gate and OR gate using diodes, half wave rectifier and full-bridge full wave rectifier with smoothing capacitor; simulation of rectifier circuits with smoothing circuit using LTspice software; Zener diode: Zener region and voltage regulator; numerical on rectifier and voltage regulator. (Textbook 1: Chapter 1: 1.1 to 1.7, 1.9, 1.12, 1.15, Chapter 2: 2.3, 2.5, 2.6, 2.7, 2.11)	
UNIT – II	08 Hours
Transistors: Construction of npn and pnp BJT transistors; transistor operation; input and output characteristics of CB and CE configurations; significance of different regions of operation: active, cut-off and saturation (transistor as a switch); alpha, beta and current relations; transistor amplifying action; numerical on current relations and amplification; Need for biasing: Q-point; types of biasing: fixed, emitter stabilized and voltage divider; simulation of common emitter amplifier with voltage divider bias using LTspice software; numerical on biasing circuits; construction and characteristics of n-channel depletion type MOSFET; (Textbook 1: Chapter 3: 3.1 to 3.5, Chapter 4: 4.1 to 4.5, Chapter 6.1 and 6.7)	

UNIT – III	08 Hours
Operational amplifiers: Op-amp symbols, terminals and operation: single mode, differential mode and common mode; basic properties of ideal and practical Op-amp: input offset voltage, input resistance, output resistance, gain, bandwidth, CMRR, slew rate; basic Op-map applications: inverting amplifier, non-inverting amplifier, summing amplifier, differential amplifier, differentiator and integrator; Op-amp comparator; feedback: positive and negative feedback; criteria for stability and oscillations (Barkhausen criterion); RC phase shift and Wein bridge oscillators; simulation of summing amplifier and oscillators in LTspice software; (Textbook 1: Chapter 10: 10.1, 10.4 to 10.7, Chapter 14: 14.5 to 14.7)	
UNIT – IV	08 Hours
Digital Electronics: Binary number system: conversion and representation; logic levels: high and low; Boolean algebra: operators and DeMorgan's law; logic gates with truth-table and	
representation: AND, OR, NOT, XOR, NAND, NOR; combination of gates and associated numerical; sequential logic circuits: SR latch using NAND/NOR gate, SR FLIP-FLOP, J-K Flip-Flop, D Flip-Flop; application of Flip-Flops: 4-bit binary counter and 4 stage shift register; simulation of counter using LTspice; (Textbook 2: Chapter 1: 1.1 to 1.3, Chapter 2: 2.1 to 2.5, Chapter 4: 4.1 to 4.3, Chapter 5.1 to 5.5, Chapter 6.1 to 6.4)	
UNIT – V	06 Hours
Electronic Prototyping with Arduino: Introduction to microprocessor and microcontrollers (Architecture) , introduction to the Arduino board (UNO, R3) and components; setting up the Arduino development environment; writing and running a simple Arduino program in wokwi environment; introduction to various sensors and actuators compatible with Arduino in wokwi environment; student project: Designing and implementing a complete Arduino-based system. E-Resources: 1 and 2	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Demonstrate a solid understanding of the fundamental principles underlying electronic components, such as diodes, transistors, operational amplifiers, logic gates, and microcontrollers.	L2
2	Apply knowledge of electronic components to analyze circuits for various applications, such as rectification, amplification, filtering, and digital logic operations.	L4
3	Analyze the performance of operational amplifiers (Op-amps) in various circuit configurations, including amplifiers, comparators, and oscillators, to optimize their functionality and address design requirements.	L4
4	Demonstrate proficiency in using simulation software (e.g., LTspice) to simulate and analyze electronic circuits, validate designs, and troubleshoot circuit performance.	L4
5	Design and implement electronic systems using Arduino microcontrollers, integrating sensors, actuators, and programming concepts to achieve specific functionalities and solve practical problems.	L6

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		3							2	3		
CO2	3	3	2	1	3							2	3		
CO3	3	3	2	2	3							2	3	2	
CO4	3	3	2	2	3							2	3	2	
CO5	3	3	3	1	3							3	3	3	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. R. L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", 11th Ed, Pearson Education, 2013.
2. M. Moris. Mano and Michael D. Ciletti, "Digital Electronics", 4th Ed, Pearson Education, 2006.

REFERENCE BOOKS:

1. David A Bell, “Electronic Devices and Circuits”, 5th Ed, Oxford university press, 2008.
2. Millman & Halkias, “Electronics Devices and Circuits”, 2nd Ed, McGraw Hill, 2010.

E-Resources:

1. Arduino- https://docs.arduino.cc/learn/
2. Wokwi- https://wokwi.com/arduino/
3. NPTEL- https://nptel.ac.in/courses/122/106/122106025
4. Virtual Labs- http://vlabs.iitkgp.ac.in/be/

Activity Based Learning (Suggested Activities in Class):

1. Real world problem solving using group discussion and hands-on activities. E.g., Interfacing different types of sensors using Arduino.
2. Simulation of different electronic circuits. E.g., Rectifiers and Amplifiers.

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ENGINEERING GRAPHICS & DESIGN THINKING
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I/II

Course Code	:	24EN1113	Credits	:	03
Hours / Week	:	04 Hours	Total Hours	:	26+26 Hours
L–T–P–J	:	2–0–2–0			

Course Learning Objectives:

This Course will enable students to:

1. Create awareness and emphasize the need for Engineering Graphics & design thinking through Manual Sketching & Autocad Software
2. Learn using professional CAD software for construction of geometry
3. Understand the concepts of orthographic and isometric projections
4. Draw orthographic projection of points, lines, planes and solids by Manual Sketching & AutoCad Software
5. Draw development of surfaces of solids
6. Draw isometric projections of planes and solids
7. Create simple engineering 3D components
8. Work in a team for creating conceptual design of products
9. Learn application of design methods and tools on real world problem through Autocad Software & Physical Models

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MANUAL & COMPUTER SKETCHING	
UNIT – I Introduction	06 Hours
Introduction to Engineering Graphics: Fundamentals, Drawing standard - BIS, dimensioning, Lines, lettering, scaling, symbols, dimensioning & tolerances, conventions, Introduction to orthographic projection. Types of projections & their principles - (For CIA only) (For CIA only) (Text Book-1: Chapter 3 & 8) Introduction to Computer Aided Drafting software- Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D. Selection of drawing sheet size and scale. Commands and creation of Lines, coordinate points, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, coloring, mirror, rotate, trim, extend, break, chamfer, fillet and curves - (For CIA only) (Text Book-2: Chapter 23 &24; Text Book-1: Chapter 26)	
UNIT – II Projections of Points, Lines and Planes	12 Hours
Projection of Points - Orthographic projections of points in all the quadrants, Orthographic projections of lines- inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Orthographic projections of planes -triangle, square, rectangle, pentagon, hexagon and circular laminae. (First Angle Projection only) (Text Book-1: Chapter 9,10,12)	
UNIT – III Projection of Solids & Development of Surfaces	14 Hours
Projection of regular solids like prisms, pyramids, cylinder & cone inclined to both the planes (change of position method) (First Angle Projection only) (Text Book-1: Chapter 13) Development of lateral surfaces of regular solids – Prisms, pyramids cylinders and cones. (Text Book-2: Chapter 16)	
UNIT – IV Isometric Projections	14 Hours
Isometric projection - Principles of Isometric Projection, Isometric Scale, Isometric View, Isometric projection of combination of two solids (Text Book-1: Chapter 17) Transformation of Projections- Conversion of Isometric Views to Orthographic Views & Conversion of orthographic views to isometric projections. (Text Book-1: Chapter 20; Text book- 2: Chapter 21)	

UNIT – V Introduction to Design Thinking for Innovations	10 Hours
A brief history of Design, Engineering Design process, Product development cycle, creation of models and their presentation in standard 3D view. Theory, Practice & Examples in Design thinking, Storytelling, Creativity and Idea Generation, Concept Development, Testing and Prototyping. (For CIA only) (Text Book-3: Part 1- Chapter 1&2, Part3-Chapter 10)	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Make use of instruments, dimensioning & tolerance principles, conventions and standards related engineering drawing	L1
2	Construct orthographic projections of points, lines, planes and solids	L3
3	Develop lateral surfaces of solids and construct isometric projections of solids	L3
4	Apply the design thinking principles for innovative product development	L3
5	Make use of AutoCad for modelling engineering components	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO2	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO3	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO4	2	1	0	0	0	0	0	0	0	0	0	0	3	0	2
CO5	3	1	0	0	0	0	0	0	0	0	0	0	3	0	2

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Engineering Drawing, Bhatt N.D., 54th Edition, Charotar Publishing House, Gujarat, India, 2023
2. Engineering Drawing & Graphics AutoCAD, K Venugopal, Fifth Edition, New Age International Publishers, 2011.
3. Engineering Design- A Project Based Introduction, C. L. Dym and Patrick Little, John Wiley & Sons, 2022

REFERENCE BOOKS:

1. A Textbook of Computer Aided Engineering Drawing, Gopalakrishna, K. R. and Sudheer Gopala Krishna, Subash Publishers, Bangalore, India, 2017
2. Engineering Drawing with Introduction to AutoCAD, Dhananjay. A. J, Tata McGraw- Hill Publishing Company Ltd, 2018
3. Product Design and Development, Karl T Ulrich, Steven D Eppinger, Seventh Edition, McGraw-Hill Education, 2020

E-Resources:

1. https://archive.nptel.ac.in/courses/112/102/112102304/
2. https://nptel.ac.in/courses/112103019
3. https://nptel.ac.in/courses/112/105/112105294/
4. https://fractory.com/engineering-drawing-basics/

Activity Based Learning (Suggested Activities in Class)

1. Activity which makes students to apply the concepts learned in the course to the practical engineering graphics will be discussed in class.
2. Activity provides space to students giving responsibility for their own design & engineering drawing methods for the products
3. Activity that makes the students for the development of skill set in computer drafting
4. Activity that makes the students to have critical thinking, developing a mindset, problem-solving and teamwork in design thinking process.
5. Real world problem solving and puzzles using group discussion.
6. Demonstration of solution to a problem through experiential learning.

ENGINEERING GRAPHICS & DESIGN THINKING LABORATORY

Total Contact Hours: 26

Following are practical/laboratory experiments to be carried out:

1. Problems to be solved in first quadrant system.
2. Manual & Computer Sketching problems for all the modules in sketch book and also take print out of the problems.
3. Usage of various commands in AutoCad software and few simple exercises on the above commands
4. Practice Problems on Projections of Points, Lines and Planes using Manual Sketching & AutoCad Software
5. Solve Problems on Projection of Solids & Development of Surfaces
6. Practice problems on Isometric Projections
7. Individual/Group work on Introduction to Design Thinking for Innovations (Examples on Solid Modeling - Using 3D Modelling Software & Physical Model Prototype).

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BIOLOGY FOR ENGINEERS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II			
Course Code : 24EN1114		Credits : 02	
Hours / Week : 02 Hours		Total Hours : 26 Hours	
L–T–P–J : 2–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. Acquire an understanding on basic modern biological concepts with an emphasis on how bio-processes are analogous to engineering field, as a multidisciplinary field.
2. Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions are arrived citing body functional examples.
3. Explain aspects that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods like power point presentations and group discussion may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three higher order thinking questions in the class.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT:	
UNIT 1: Biomimetics	5 Hrs
Biology for Engineers, Body Fluid: Blood- Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes engineering analogies	
UNIT 2: Bioenergy	5 Hrs
Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Anabolism- Bioenergy from Sun-Photosynthesis, catabolism	
UNIT 3: Biomechanics (Human Body Movement Mechanics)	5 Hrs
Normal Human Movement: Force-Vector of Body; Movement Angles; Muscle contraction - Relaxation; Posture – Static & Dynamic; Ideal and abnormal posture, Practical: Stepping-Lifting- Sit-Stand.	
UNIT 4: Bioelectronics	6 Hrs
Brain & Computer: Senso-neural networks, Biosensors and IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock and Circadian rhythm	
UNIT 5: Biopharma	5 Hrs
Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Drug Discovery	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply and Utilize essential knowledge of the biological mechanisms of living organisms from the perspective of engineers and find solutions to solve bio-engineering problems with appropriate tools.	L3
2	Distinguish and make use of optimal designs in engineering that are bio-mechanical in nature and build and use by observing and understanding bio-physiological processes involved in sensing, locomotion, and knowledge application of range of bio-chemicals.	L3
3	Demonstrate that bio-chemical, bio-sensory, bio-processes could be path-finders to optimise similarities for functional aspects of electronic, computer, mechanical, electrical machines.	L3

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through experiential learning.
3. Demonstrations using real objects, taking students on an educational tour.

REFERENCES:

- Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson. “Biology: A global approach”, Global Edition, 10/E, 2014
- David Nelson, Michael Cox. “Lehninger Principles of Biochemistry”. W H Freeman & Company, Seventh Edition, 2017.
- Janine M Benvus. “Biomimicry: Innovation inspired by Nature”. William Morrow Paperbacks, 2002.
- Lecture Notes, PPT slides by course instructor.

CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I/II

Course Code	: 24EN1115	Credits	: 01
Hours / Week	: 01 Hours	Total Hours	: 13Hours
L–T–P–J	: 1–0–0–0		

Course Learning Objectives:

This Course will enable students to:

1. Acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2. Make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3. Channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
4. Acquaint students with latest legislation and Laws with related regulatory framework.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods like power point presentations and group discussion may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three higher order thinking questions in the class.
6. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

COURSE CONTENT	
UNIT 1: Introduction and Basic Information about Indian Constitution	6 Hrs
Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Indian Constitution and its Salient Features, The Sources of Indian Constitution. The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule,	

Financial Emergency, and Local Self Government – Constitutional Scheme in India	
UNIT 2: Union Executive and State Executive	7 Hrs
Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Court	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Identify and explore the basic features and modalities about Indian constitution.	L1
2	Differentiate and relate the functioning of Indian parliamentary system at the Centre and State level.	L2
3	Differentiate different aspects of Indian Legal System and its related bodies.	L2
4	Discover and apply different laws and regulations related to engineering practices.	L1
5	Correlate role of engineers with different organizations and governance models	L1

TEXT BOOKS:

1. The Indian Constitution, Madhav Khosla, Oxford University Press.
2. The Constitution of India, PM Bakshi. Latest Edition, Universal Law Publishing.

REFERENCE BOOKS:

1. The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Granville Austin: Oxford University Press.
2. Our Constitution: An Introduction to India's Constitution and Constitutional Law, Subhash C. Kashyap, NBT, 2018.
3. Introduction to the Indian Constitution, Brij Kishore Sharma, 8th Edition, PHI Learning Pvt. Ltd.

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SINGLE AND MULTI VARIABLE CALCULUS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – II				
Course Code	: 24EN1201	Credits	:	03
Hours / Week	: 03 Hours	Total Hours	:	39 Hours
L–T–P–J	: 3–0–0-0			

Course Learning Objectives:

This Course will enable students to:

1. Apply sophisticated techniques of differential calculus to solve problems involving functions of multiple variables.
2. Apply double and triple integrals in various coordinate systems (Cartesian, polar, cylindrical, and spherical) and effectively employ them to calculate areas, volumes.
3. Acquire a comprehensive understanding of fundamental concepts related to functions of multiple variables, including limits, continuity, and partial derivatives.
4. Analyze critical points of functions of two or more variables using partial derivatives and Lagrange multipliers, evaluate extreme values.
5. Apply vector calculus principles, such as line integrals, surface integrals, and the divergence theorem effectively to vector field.
6. Analyze the convergence and divergence of sequences and infinite series of real numbers by employing various convergence criteria and tests.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

UNIT – I	09 Hours
Differential Calculus Functions of two or more variables: Definition, Region in a plane, Level curves, Level surfaces, Limits, Continuity, Partial derivatives, Differentiability, Extreme values and saddle points, Lagrange multipliers. (Textbook 1: Chapter 14: 14.1 – 14.4, 14.7, 14.8) Self-Learning Component: Single variable calculus	
UNIT – II	09 Hours
Integral calculus Double integral and iterated integrals - Cartesian and polar coordinates, Triple integral, Change of variables, Multiple integrals in cylindrical and spherical coordinates. (Textbook 1: Chapter 15: 15.1 – 15.5, 15.7)	
UNIT – III	09 Hours
Vector Calculus Line Integrals, Vector Fields, Work, Circulation and flux, Path independence, Potential functions, and Conservative fields, Green's theorem in the plane, Surface area and surface integrals, Surface area of solid of revolution, Parametrized surfaces, Stokes' theorem, The Divergence theorem. (Textbook 1: Chapter 16: 16.1-16.8), (Textbook 2: Chapter 10: 10.1, 10.2, 10.4 – 10.7, 10.9)	
UNIT – IV	6 Hours
Sequence and Series, I: Sequences of real numbers and their convergence criteria, Infinite series, Sequence of partial sums, Tests for convergence/divergence - nth term test, Boundedness and monotonicity, Integral, Condensation, Comparison, Ratio and root tests (Textbook 1: Chapter 10: 10.1-10.5)	
UNIT – V	06 Hours
Sequence and Series II: Alternating series, Absolute and conditional convergence, Rearrangement theorem, Power series, Taylor and Maclaurin series (one and two variables). (Textbook 1: Chapter 10: 10.6-10.8)	

Course Outcomes:

At the end of the course the student will be able to:

1. Apply the principles of differential calculus to solve problems involving functions of two or more variables.
2. Utilize double and triple integrals in Cartesian, polar, cylindrical, and spherical coordinates to compute areas, volumes, and evaluate mathematical expressions.
3. Extend a comprehensive understanding of the concepts related to functions of multiple variables, encompassing topics such as limits, continuity, and partial derivatives, and effectively apply them to practical situations and problem-solving scenarios.
4. Analyze and evaluate critical points, including extreme values and saddle points, in functions of two or more variables using partial derivatives and Lagrange multipliers.
5. Analyze vector calculus concepts, such as line integrals, surface integrals, and the divergence theorem, in the context of vector fields and their applications.
6. Apply convergence criteria and various tests, such as the nth term test, boundedness and monotonicity, integral, condensation, comparison, ratio, and root tests, to analyze and determine the convergence or divergence of sequences and infinite series of real numbers.

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1						1					
CO2	3	2	1						1					
CO3	3	2	1						1					
CO4	3	2	1						1					
CO5	3	2	1						1					
CO6	3	2	1						1					

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Thomas' Calculus, George B. Thomas, D. Weir and J. Hass, 2014, 13th edition, Pearson.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6 th Edition, Elsevier Limited.
3. Calculus: Early Transcendentals, James Stewart, 2017, 8 th edition, Cengage Learning.
4. Engineering Mathematics, K.A. Stroud and Dexter J. Booth, 2013, 7 th Edition, Palgrave Macmillan.

5. Basic Multi Variable Calculus, Marsden, Tromba and Weinstein, W.H. Freeman, Third Edition

E-Resources:

1. https://www.youtube.com/playlist?list=PLtKWB- wrvn4nA2h8TFxzWL2zy8O9th_fy
2. https://www.youtube.com/playlist?list=PLU6SqdYcYsfJqbZvQECrwnlQrp4fg 6isX

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem through programming.

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C PROGRAMMING FOR PROBLEM SOLVING
[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – II

Course Code	:	24EN1202	Credits	:	04
Hours/Week	:	05 Hours	Total Hours	:	26(L) + 13(T) + 26 (P) Hours
L–T–P–J	:	2–1-2–0			

Course Learning Objectives:

This Course will enable students to:

1. Elucidate the basic architecture and functionalities of C programming language.
2. Apply programming constructs of C language to solve the complex problems
3. Explore data structures like arrays, structures, unions and pointers in implementing solutions to real world problems
4. Design and Develop Solutions to problems using structured programming constructs such as functions.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show Video/animation films to explain functioning of various concepts.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that possible, it helps improve the students' understanding.

UNIT – I	07 Hours
Basics and overview of C: Introduction to Problem Solving using Algorithms and Flowchart: Key features of Algorithms: Sequence, Decision, Repetition with examples. Background, structure of C program, keywords, Identifiers, Data Types, Variables, Constants, Input / Output statements, Operators (Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associativity, Expression Evaluation, Type conversions. Conditional Branching Statements-if and switch statements, iterative statements (loops)-while, for, do-while statements, Loop examples, Nested loops, break, continue, go to statement. (Text Book-1: Chapter 2 & Chapter 3)	
UNIT – II	05 Hours
Arrays: Introduction, declaration & initialization of array, reading and writing array elements,	
Operations on array: Traversal, searching (Linear and Binary search), sorting (Bubble sort and Selection Sort). Declaration and Initialization of two-dimensional arrays. Matrix Operations (addition, subtraction, multiplication, transpose) using two-dimensional array. Strings: Definition, declaration, initialization, and representation. String handling functions and character handling functions. (Text Book-1: Chapter 5:5.1 to 5.9 & Chapter 6)	
UNIT – III	06 Hours
Pointers: Definition and declaration and initialization of pointers. Accessing values using pointers. Accessing array elements using pointers. Functions: Definition and declaration. Built-in functions and User-defined functions. Categories of functions with example. Pointers as function arguments, array as function argument, Call-by-value and call-by-reference. Recursion. (Text Book-1: Chapter 7: 7.1 to 7.17 & Chapter 4:4.1 to 4.8, 4.10)	
UNIT – IV	04 Hours
Structures: Purpose and usage of structures. Declaration of structures. Assignment with structures. Structure variables and arrays. Nested structures. Student and employee database implementation using structures. Unions: Declaration and initialization of a union. Difference between structures and unions. Example programs. (Text Book-1: Chapter 8: 8.1, 8.2,8.6)	

UNIT – V	04 Hours
Memory allocation in C programs: Dynamic memory allocation, memory allocation process, allocating a block of memory, releasing the used space, altering the size of allocated memory. Files: Defining, open, read, write, seek and closing of both textual and random files. (Text Book-1: Chapter 7: 7.18 to 7.20 & Chapter 9: 9.1 to 9.5, 9.8)	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply programming constructs of C language to solve the real-world problem.	L3
2	Choose appropriate data type for implementing solutions to solve problems like searching and sorting.	L3
3	Examine suitable user-defined data structures in implementing solutions, using modular programming constructs.	L4
4	Analyze efficient ways for managing data and storage.	L4
5	Justify a solution using a modern IDE and associated tools, conduct a code review and contribute in a small-team.	L5

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													
CO2		2												
CO3			2										1	
CO4				2										
CO5					3				2				1	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Reema Thareja, "Programming in C". Oxford University Press, Second Edition, 2016.

REFERENCE BOOKS:

1. Brian W. Kernigham and Dennis M. Ritchie, (2012) "The C Programming Language", 2nd Edition, PHI.
2. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science - A Structured Approach Using C", Cengage Learning, 2007.

3. Vikas Gupta, "Computer Concepts and C Programming", Dreamtech Press 2013.

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105171/ MOOC courses can be adopted for more clarity in understanding the topics and verities of problem-solving methods.
2. https://www.w3schools.com/c/index.php
3. https://www.guvi.in/courses/web-development/c-programming/
4. https://www.tutorialspoint.com/cprogramming/index.htm
5. https://pythontutor.com/

Activity Based Learning (Suggested Activities in Class)

- Demonstration of solution to a problem through designing the Flowchart or any design notations using draw.io in the group of four and justify using snippets or algorithms.

C PROGRAMMING FOR PROBLEM SOLVING LABORATORY

Total Contact Hours: 26

List of Laboratory/Practical Experiments activities to be conducted
1. Programming Basics: Swapping Numbers, Simple Interest, and Factorial. 2. Quadratic Equation Solver 3. Number Operations: Palindrome Check and Power Calculation. 4. Fibonacci Series and Greatest Common Divisor (GCD) Calculation. 5. Calculator Emulation 6. String Manipulation 7. Sorting an Array of Integer Elements. 8. Searching an Array of Elements. 9. Pointer Demonstration using Functions. 10. Case Study on Strings and Functions.

COGNITIVE AND TECHNICAL SKILLS [As per Choice Based Credit System (CBCS) scheme] SEMESTER – I/II			
Course Code : 24EN1103 24EN1203		Credits : 04	
Hours/Week : 04 Hours		Total Hours : 52 Hours	
L–T–P–J : 0–0-4–0			

Course Learning Objectives:

This Course will enable students to:

- Apply cognitive strategies to technical tasks for efficiency and innovation.
- Develop critical thinking and analytical reasoning abilities.
- Develop effective communication for technical and non-technical audiences.
- Understand and apply technical principles in practical contexts

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. Interactive Teaching: Adopt the Active learning that includes brainstorming,
3. discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
4. Encourage Collaborative (Group Learning) Learning in the class.
5. To make Critical thinking, ask at least three Higher order Thinking questions in the class.
6. Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that possible, it helps improve the students' understanding.

UNIT – I	12 Hours
Basic C Programming • C - Basic - Part 1 - Introduction to Programming • C - Basic - Part 2 - Data Types, Variables, Operators • C - Basic - Part 3 - Expressions, Precedence, Operators • C - Basic - Part 4 - Conditional Statements, Switch Statements • C - Basic - Part 5 - Looping • C - Basic - Part 6 - Digit Manipulation, Nested Loops, Patterns • C - Basic - Part 7 - Patterns, Number Problems • C - Basic - Part 8 - Array Basics • C - Basic - Part 9 - Structure • C - Basic - Part 10 - Pointers	
UNIT – II	10 Hours
Quantitative • Numbers, Problems on Hcf and Lcm, Divisibility, Numbers and Decimal Fractions Probability • Permutations & Combinations • Data Interpretion & Data Interpretation on Multiple Charts • Co-Ordinate Geometry, Mensuration • Time and Work	
UNIT – III	10 Hours
Reasoning • Data Arrangements Attention to Details • Flowcharts • Syllogism • Critical Reasoning • Coding and Decoding	
UNIT – IV	10 Hours
Verbal • Grammar Foundation • Parts of Speech • Tenses • Synonyms • Antonyms • Sentence Formation	

Course Outcomes:

- Analyze complex problems, identify root causes, and propose effective solutions
- Develop innovative strategies to address challenges in real-world scenarios
- Communicate technical information clearly to diverse audiences, both technical and nontechnical.
- Apply lateral thinking techniques to generate unique and practical ideas.

TRANSFORMS AND NUMERIAL TECHNIQUES [As per Choice Based Credit System (CBCS) scheme] SEMESTER – III				
Course Code	: 24CY2301	**Credits**	:	03
Hours / Week	: 03 Hours	**Total Hours**	:	39 Hours
L–T–P–J	: 3–0–0–0			

Course Learning Objectives:

This Course will enable students to:

1. **Apply** their knowledge of Laplace transforms and inverse Laplace transforms to proficiently solve linear ordinary differential equations with constant coefficients, facilitating the analysis and modelling of complex systems.
2. **Analyze** periodic functions using Fourier series, assessing the convergence properties and precision of the series expansion, thereby enhancing their ability to understand and manipulate periodic phenomena.
3. **Utilize** complex exponential form, Fourier transforms of basic functions, and Fourier sine and cosine transforms to solve problems involving Fourier integrals, developing proficiency in applying these techniques to various mathematical scenarios.
4. **Employ** numerical methods, including Euler's Method, Runge-Kutta 4th order, Adams- Bashforth, and Adams-Moulton Methods, to solve differential equations and effectively analyze dynamic systems, enabling them to model real-world phenomena and make accurate predictions**.**
5. **Apply** finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to effectively solve different types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations, enhancing them problem-solving skills in the context of differential equations and their applications.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I: Laplace Transform and Inverse Laplace Transform	**09 Hours**
Laplace Transforms of Elementary functions (without proof), Laplace Transforms of $e^{at}f(t), t^n f(t)$ and $\frac{f(t)}{t}$, Periodic functions, Unit step function and impulse functions Inverse Laplace Transforms- By the method of Partial Fractions, Logarithmic and Trigonometric functions, Convolution Theorem, Inverse Laplace transform using Convolution Theorem Solution to Differential Equations by Laplace Transform.	
UNIT – II: Fourier Series	**09 Hours**
Periodic Functions, Trigonometric Series, Fourier series Standard function, Functions of any Period 2L, Even and Odd functions, Half-range Expansions. Practical Harmonic analysis (calculate average power and RMS values of periodic waveforms)	
UNIT – III: Fourier Transform	**06 Hours**
Calculation of Fourier integrals using complex exponential form, Fourier transform of basic functions Fourier sine and cosine transforms.	

UNIT – IV: Numerical Methods for Solving Ordinary Differential Equations	**07 Hours**
Euler's Method-Basic principles of Euler's method for solving first-order ODEs, Runge-Kutta 4th order, Multistep Methods-Explanation of multistep methods (Adams-Bashforth, Adams–Moulton Methods), Second-Order ODE. Mass–Spring System (Euler Method, Runge–Kutta Methods)	
UNIT – V: Numerical Methods for Partial Differential Equations	**08 Hours**
Classification of PDEs (elliptic, parabolic, hyperbolic), Difference Methods (Laplace and Poisson Equations), Derivation of finite difference approximations, Crank–Nicolson Method, Method for Hyperbolic PDEs	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Apply** Laplace transforms and inverse Laplace transforms to solve linear ordinary differential equations with constant coefficients, demonstrating proficiency in system analysis and modelling.	L3
2	**Analyze** periodic functions using Fourier series and evaluate the convergence properties and precision of the series expansion.	L2 & L3
3	**Solve** problems involving Fourier integrals by applying complex exponential form, Fourier transforms of basic functions, and Fourier sine and cosine transforms.	L3
4	**Utilize** numerical methods such as Euler's Method, Runge-Kutta 4th order, Adams-Bashforth, and Adams-Moulton Methods to solve differential equations and analyze dynamic systems	L2 & L3
5	**Apply** finite difference methods, including the Crank-Nicolson method and appropriate techniques for hyperbolic PDEs, to solve various types of partial differential equations (PDEs) such as elliptic, parabolic, and hyperbolic equations.	L3

Table: Mapping Levels of COs to POs / PSOs														
COs	**Program Outcomes (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	1					1					
CO2	3	2	2						1					
CO3	3	2	2	1					1					
CO4	3	2	2	1					1					
CO5	3	2	2	1					1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 2015, 10th Edition, Wiley India.

REFERENCE BOOKS:

1. Higher Engineering Mathematics, B.S. Grewal, 2015, 43rd Edition, Khanna Publishers.
2. Higher Engineering Mathematics, John Bird, 2017, 6 th Edition, Elsevier Limited.

E-Resources:

1. https://nptel.ac.in/courses/111106139
2. https://nptel.ac.in/courses/111101164
3. https://nptel.ac.in/courses/111105038

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DATA STRUCTURES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 24CY2302	**Credits**	: 04
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th)+26(P) Hours
L–T–P-J	: 3–0–2-0		

Prerequisites:

Proficiency in a C programming language.

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the basic approaches for analyzing and designing data structures.
2. **Introduce** dynamic memory allocation and C language concepts required for building data structures
3. **Develop** essential skills to construct data structures to store and retrieve data quickly and **efficiently**.
4. **Utilize** different data structures that support different sets of operations which are suitable for various applications.
5. **Explore & Implement** how to insert, delete, search and modify data in any data structure- Stack, Queues, Lists, Trees.
6. **Develop** applications using the available data structure as part of the course for mini-project.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teachers can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture methods, but different *types of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, note taking, annotating, and roleplaying.

3. Show ***Video/Animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**08 Hours**
INTRODUCTION: Introduction to Data Structure, Classification, C Structure and Union, Array Definition, Representation, Operations (Insertion, Deletion, Search and Traversal), Two/Multidimensional Arrays, sparse matrix, C Pointers TB1: 1.1, 1.2,1.3.1-1.3.4; TB2: 2.5; RB1: 5.1 – 5.12, 6.4	
UNIT – II	**09 Hours**
INTRODUCTION TO ADT: **Stack:** Definition, Array Representation of Stack, Operations on Stacks. **Applications of Stack:** Expression evaluation, Conversion of Infix to Postfix, Infix to Prefix Recursion, Tower of Hanoi **Queue:** Definition, Representation of Queues, Operations of Queues, Circular Queue. **Applications of Queue:** Job Scheduling, A Maze Problem TB1: 2.1, 2.2, 2.3, 3.2, 3.3; TB2: 3.3,3.4,3.5	
UNIT – III	**09 Hours**
DYNAMIC DATA STRUCTURES: **Linked List:** Types, Representation of Linked Lists in Memory. Traversing, Searching, Insertion & Deletion from Linked List. Circular List, Doubly Linked List, Operations on Doubly Linked List (Insertion, Deletion, Traversal). **Applications:** Stack & Queue Implementation using Linked Lists. **Case Study**: Josephus problem. TB1: 4.2,4.3,4.5	

UNIT – IV	**08 Hours**

TREES: Basic Terminology, Binary Trees and their representation, Complete Binary Trees, Binary Search Trees, Threaded Binary Trees, Operations on Binary Trees (Insertion, Deletion, Search & Traversal). **Applications:** Expression Evaluation **Case Study:** Game Tree TB1: 5.5.3,5.5.4,5.6; TB2: 5.1,5.2,5.3,5.5,5.7

UNIT – V	**05 Hours**
Efficient Binary Search Trees: Optimal Binary Search Trees, AVL Trees, Red Black Trees, Splay Trees. **Case Study**: B Trees TB2: 10.1,10.2,10.3,10.4, 11.2	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Demonstrate** the key C programming concepts such as pointers, structures, unions and arrays data structures to perform operations such as insertion, deletion, searching, sorting, and traversing.	L3
2	**Utilize** the fundamental concepts of stacks and queues to solve the standard applications like tower of Hanoi, conversion and evaluation of expressions, job scheduling and maze.	L3
3	**Implement** Singly Linked List, Doubly Linked List, Circular Linked Lists, stacks and queues using linked list**.**	L3
4	**Develop** critical thinking and problem-solving skills by designing and implementing efficient algorithms for Non-linear tree data structure and perform insertion, deletion, search and traversal **operations** on it**.**	L3
5	**Apply** advanced techniques, such as balancing algorithms for AVL trees, Splay trees and Red-Black trees to maintain the balance and efficiency of binary trees.	L3

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3												2	
CO2	3		3									2	2	
CO3	3		3									2	2	
CO4	3	2	3									2	2	
CO5	3	2	3									2	2	

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. A.M. Tannenbaum, Y Langsam, M J Augentien "Data Structures using C", 1st Edition, Pearson, 2019.
2. Ellis Horowitz, Susan Anderson-Freed, and Sartaj Sahni, "Fundamentals of Data structures in C", 2nd Edition, Orient Longman, 2008.

REFERENCE BOOKS:

1. Brian. W. Kernighan, Dennis. M. Ritchie, "The C Programming Language", 2nd Edition, Prentice-Hall, 1988.
2. Gilbert & Forouzan, "Data Structures: A Pseudo-code approach with C", 2nd Edition, Cengage Learning,2014.
3. Jean-Paul Tremblay & Paul G. Sorenson, "An Introduction to Data Structures with Applications", 2nd Edition, McGraw Hill, 2013.
4. R.L. Kruse, B.P. Learly, C.L. Tondo, "Data Structure and Program design in C", 5th Edition, PHI ,2009.

E-Resources:

1. https://nptel.ac.in/courses/106102064
2. https://www.coursera.org/learn/data-structures?specialization=data-structures-algorithms
3. https://www.udemy.com/topic/data-structures/free/
4. https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures
5. https://cse01-iiith.vlabs.ac.in/
6. https://kremlin.cc/k&r.pdf

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving using group discussion.
2. Role play E.g., Stack, Queue, etc.,
3. Demonstration of solution to a problem through programming.
4. Flip class activity E.g., arrays, pointers, dynamic memory allocation, etc.,

LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either C programming language

1. To Implement C programs with concepts of pointers, structures.
2. To implement multidimensional array Matrix Multiplication.
3. To search elements in data structure with different search methods.
4. To implement stack, queue and their variations using arrays.
5. To implement stack, queue and their variations using singly linked lists
6. To implement conversion & evaluation of expression using stacks.
7. To Implement doubly circular Linked Lists and variations and use them to store data and perform operations on it.
8. To Implement Addition/multiplication of 2 polynomial using linked lists
9. To implement binary tree traversal techniques.

OPEN-ENDED EXPERIMENTS

1. A man in an automobile search for another man who is located at some point of a certain road. He starts at a given point and knows in advance the probability that the second man is at any given point of the road. Since the man being sought might be in either direction from the starting point, the searcher will, in general, must turn around many times before finding his target. How does he search to minimize the expected distance travelled? When can this minimum expectation be achieved?
2. The computing resources of a cloud are pooled and allocated according to customer demand. This has led to increased use of energy on the part of the service providers due to the need to maintain the computing infrastructure. What data structure will you use for allocating resources which addresses the issue of energy saving? Why? Design the solution.
3. Mini-Project on applying suitable data structure to a given real-world problem.

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DIGITAL LOGIC DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 24CY2303	**Credits**	: 04
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th) + 26(P) Hours
L–T–P-J	: 3–0–2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Translate** the elements of digital logic functions to digital system abstractions using Verilog.
2. **Illustrate** simplification of Boolean expressions using Karnaugh
3. **Mode**l combinational logic circuits for arithmetic operations and logical operations
4. **Analyse** and model sequential elements flip-flops, counter, shift registers.
5. **Outline** the concept of Mealy Model, Moore Model and apply FSM to solve a given design problem.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	08 Hours
INTRODUCTION: Number System- Binary, Hexa, Decimal, Octal and its conversion. Canonical Notation - SOP & POS forms, Minimization of SOP and POS forms. **ARITHMETIC CIRCUITS AND VERILOG MODELLING** Adders: Half adder, full adder, Ripple carry adder, parallel adder /subtractor, fast adders-CLA, comparator- 2 bit. Simplification using K-Maps Introduction to Verilog, Syntax of Verilog coding, Modelling styles in Verilog, Verilog Operators, Test bench for simulation	

UNIT – II	07 Hours
Combinational Circuit Building Multiplexers 4:1, 8:1, decoders 3:8, 2:4, demultiplexers 1:4, encoders 8:3, 4:2, code converters- B to G and G to B- Simplification using K-Maps **Verilog for combinational circuits**, if else, case-casex, casez, for loop, generate.	

UNIT – III	08 Hours
Sequential Circuits-1 Basic Latch, Gated latches, Flip Flops SR, D, JK, T, master-slave flip-flops JK, Characteristic equations, 0's and 1's Catching Problem, race round condition, Switch debounce, shift registers- SISO, SIPO, PISO, PIPO, Setup time, Hold time, Propagation Delay	

UNIT – IV	08 Hours
Sequential Circuits-2 Binary counters – asynchronous and synchronous, mod-n counter, ripple counter- 4 bit. Verilog blocking and non-blocking, Mealy Model, Moore Model, State machine notation, Construction of Finite State Machine.	

UNIT – V	**08 Hours**
Introduction to Electronic Design Automation: FPGA Design Flow, ASIC Design flow, architectural design, logic design, simulation, verification and testing, 3000 Series FPGA architecture. **Applications**: Design 4 Bit ALU, 7 Segment display, Vending Machine, 3 Pipeline.	

Laboratory Experiments

Experiments are conducted using Verilog tool /Kits	
1.	Introduction to Xilinx tool, FPGA flow
2.	Adder – HA, FA using data flow and behavior modelling styles
3.	Adder – HA, FA using structural modelling style
4.	Combinational designs – I (blocking and non-blocking/looping examples) **a.** Multiplexer: 4:1, 8:1 MUX. **b.** De Multiplexer: 1:4, 1:8 DEMUX.
5.	Combinational designs – II (different types of case statements) **c.** Encoder with and without Priority: 8:3 and 4:2. **d.** Decoder: 3:8 and 2:4.
6.	Design of 4-bit ALU
7.	Flip Flop: D FF, T FF, JK FF
8.	Design of Mod – n Up/Down Counter with Synchronous reset
9.	Design of Mod – n Up/Down Counter with Asynchronous reset.
10.	Design of Universal shift Register using FSM

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Interpret** Boolean Expressions of digital design in simplified form	L2
2	**Build** the various elements of digital logic system with Verilog	L3
3	**Construct** Combinational and Sequential logic circuits	L3
4	**Analyse** the hardware model of a digital system at different levels of abstraction in Verilog	L4
5	**Evaluate** the functionality of digital design by implementing on FPGA kits	L5
6	**Design digital** systems using FSM	L3

Table: Mapping Levels of COs to POs / PSOs

Cos	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	-	1	-	-	-	-	-	-	-	1	-	1	-	-
CO2	3	2	1	2	3	-	-	-	1	-	1	1	2	1	-
CO3	3	2	3	1	2	-	-	1	1	-	1	1	2	1	-
CO4	3	3	2	3	3	1	-	1	-	1	2	1	2	2	1
CO5	3	3	2	3	3	1	-	-	-	1	-	-	2	2	1
CO6	3	3	3	3	3	2	-	1	2	2	2	2	2	1	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. M. Morris Mano Michael D. Ciletti , "Digital Design with an Introduction to the Verilog HDL", 6th Edition, Pearson Education, 2014.

2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog design", McGraw Hill, 2014.

3. Nazein M. Botros, "HDL programming (VHDL and Verilog)", Dreamtech Press, 2006.

4. Douglas J Smith, "HDL Chip Design", Doone publications 1996.

REFERENCE BOOKS:

1. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2014.
2. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2015.
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, 2016.

E-Resources:

1. https://archive.nptel.ac.in/courses/106/105/106105165/
2. https://nptel.ac.in/courses/117105080

Activity Based Learning (Suggested Activities in Class)

1. Design problem solving and Programming using group discussion. E.g., Traffic light controller, Digital Clock, Elevator.
2. Demonstration of solution to a problem through simulation.

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DISCRETE MATHEMATICS AND GRAPH THEORY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 24CY2304	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–J	: 3–0–0–0		

Course Learning Objectives:

This Course will enable students to:

1. **Learn** the set theoretic concept and its application in theory of computation.
2. **Determine** the concepts of mathematical induction, recursive relations and their application.
3. **Illustrate** the association of functions, relations, partial ordered set and lattices with problems related to theoretical computer science and network models.
4. **Discuss** the basics of graph theory and its application in computer networks. Learn the concepts of counting techniques and its application.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only traditional lecture method, but different type of teaching methods may be adopted to develop the course outcomes.
2. **Interactive Teaching**: Adopt the Active learning that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain functioning of various concepts.
4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that possible, it helps improve the students' understanding.

UNIT – I	08 Hours
SET THEORY: Sets and subsets, Operations on Sets: Basic set operations, algebraic properties of sets, The Addition Principle **RELATIONS AND ITS PROPERTIES:** Relations and their properties, N-Ary Relations and their applications, Representing relations. ***Textbook – 2: 1.1, 1.2; Textbook – 1: 7.1., 7.2, 7.3***	
UNIT – II	**06 Hours**
RELATIONS AND ORDER RELATIONS: Closure of relations, Equivalence Relations, Partial Orderings, Functions, The Growth of Functions. **Self-Study:** Transitive Closure and Warshall's Algorithm. ***Textbook – 1: 7.4., 7.5, 7.6, 3.2***	
UNIT – III	**08 Hours**
MATHEMATICAL INDUCTION AND RECURSION: Mathematical Induction, Recurrence Relations: Rabbits and the Fibonacci Numbers, The Tower of Hanoi, Code word Enumeration, Solving Linear Recurrence Relations **Self-Study:** Basic Connectives and Truth Tables ***Textbook-1: 4.1;6.1, 6.2;1.1***	
UNIT – IV	**09 Hours**
GRAPH THEORY: Graphs and Graph Models. Graph Terminology and Special Types of Graphs: Basic Terminology, Some Special Simple Graphs, Bipartite Graphs, Complete Bipartite Graphs. Representing Graphs and graph isomorphism: Adjacency lists, Adjacency Matrices, Incidence Matrices, Connectivity: Paths, Connectedness in Undirected and Directed Graphs, Vertex and Edge connectivity and their applications. ***Textbook-1: 8.1, 8.2, 8.3, 8.4***	
UNIT – V	**08 Hours**
GRAPHS AND ITS APPLICATIONS: Euler and Hamilton Paths and their applications, Planar Graphs and their Applications, Graph Coloring and its applications. ***Textbook-1: 8.5, 8.7, 8.8***	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Identify** the membership of the Set and Relations and perform basic Algebraic operations.	L3
2	**Illustrate** the concept of Mathematical Induction and create linear recurrence relations for the given problem.	L4
3	**Construct** different types of graphs based on the properties and the real time applications of graph theoretical concepts.	L3
4	**Analyze** the methods for optimizing the solution for graph coloring problem, Eulerian and Hamiltonian circuits/planes.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	2					1	1	1		2	2	1
CO2	3	3	2					1	1	1		2	2	1
CO3	3	3	3					1	1	1		1	2	1
CO4	3	3	3					1	1	1		2	2	1
AVG	3	2.5	2.5					1	1	1		1.75	2	1

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its applications", Tata McGraw Hill, 2003.
2. Bernard Kolman, Robert C. Busby, Sharon Ross, "Discrete Mathematical Structures", 3rd Edition, PHI 2001.

REFERENCE BOOKS:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", IV Edition, Pearson Education, Asia, 2002.
2. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with applications to computer Science", Tata McGraw Hill, 1987.
3. J K Sharma, "Discrete Mathematics", 3rd edition, 2013, Macmillan India Ltd.

E-Resources:

1. Discrete Mathematics with Algorithms by M. O. Albertson, J. P. Hutchinson - J. 1988, Wiley.
2. Discrete Mathematics for Computer Science, Gary Haggard, John Schlipf, Sue Whitesides, Thomson Brooks/Cole, 2006.
3. http://ocw.mit.edu/courses/mathematics/
4. http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html
5. http://cglab.ca/~discmath/notes.html
6. https://www.cs.odu.edu/~toida/nerzic/content/web_course.html

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion.
2. Demonstration of solution to a problem using graph theory.

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INTRODUCTION TO COMPUTER NETWORKS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Course Code	: 24CY2305	**Credits**	: 04
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th) + 26(P) Hours
L–T–P-J	: 3–0–2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Outline** the basic principles of computer networking and how computer network hardware and software operate.
2. **Evaluate** the operation and performance of practical data link protocols using the principles of framing, error detection and correction.
3. **Apply** the principles of network layer design to the analysis and evaluation of routing algorithms, congestion control techniques, internetworking and addressing.
4. **Investigate** the basic transport layer facilities and essentials of transport. protocol
5. **Illustrate** the working of various application layer protocols.

Teaching-Learning Process (General Instructions)

1. These are sample new pedagogical methods, where teachers can use to accelerate the attainment of the various course outcomes.
2. ***Lecture method*** means it includes not only traditional lecture methods, but different *types of teaching methods* may be adopted to develop the course outcomes.
3. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, note taking, annotating, and roleplaying.
4. Show ***Video/Animation*** films to explain functioning of various concepts.
5. Encourage ***Collaborative*** (Group Learning) Learning in the class.

6. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
7. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
8. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**08 Hours**
INTRODUCTION: Networks, network types, internet history, standards and administration (TB1-Ch1); Network models: Protocol layering, TCP/IP protocol suite, the OSI model (TB1-Ch2); Transmission media: Introduction, guided media, unguided media (TB1-Ch7); Switching: Introduction, circuit-switched networks, packet switching (TB1-Ch8).	
UNIT – II	**08 Hours**
Link layer addressing; (TB1-Ch10) Error detection and correction: Cyclic codes, checksum, forward error correction; (TB1-Ch10) Data link control: DLC services, data link layer protocols; (TB1-Ch11 & TB2-Ch3) Media access control: Random access, virtual LAN. (TB1-Ch12, Ch15)	
UNIT – III	**08 Hours**
Network layer design issues; (TB2-Ch5) Routing algorithms; (TB2-Ch5) Congestion control algorithms; (TB2-Ch5) Quality of service, and internetworking; (TB2-Ch5) The network layer in the internet: IPv4 addresses, IPv6; (TB2-Ch5, TB1-Ch19) Internet control protocols, OSPF (Open Shortest Path First), IP (Internet Protocol); (TB2-Ch5)	
UNIT – IV	**08 Hours**
The transport service, elements of transport protocols; (TB2-Ch6) Congestion control; (TB2-Ch6)	

The internet transport protocols: UDP (User Datagram Protocol), TCP (Transport Control Protocol); (TB2-Ch6) Performance problems in computer networks, and network performance measurement. (TB2-Ch6)	
UNIT – V	**07 Hours**
Introduction, client server programming, WWW (World Wide Web) and HTTP (Hyper Text Transfer Protocol); (TB1-Ch27) FTP (File Transfer Protocol); (TB1-Ch26) E-mail, telnet, (TB1-Ch26 & TB2-Ch7) DNS (Domain Naming System); (TB2-Ch7) SNMP (Simple Network Management Protocol) (TB1-Ch28)	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course, the student will be able to:		
1	**Elaborate** the basic concepts of data communications including the key aspects of networking and their interrelationship, packet switching, circuit switching and cell switching as internal and external operations, physical structures, types, models, and internetworking.	L6
2	**Apply** the concept of Hamming distance, the significance of the minimum Hamming distance and its relationship to errors as well as the detection and correction of errors in block codes.	L3
3	**Estimate** the mechanics associated with IP addressing, device interface, the association between physical and logical addressing, and how the Internet protocols IPv4, and IPv6 operate.	L6
4	**Evaluate** the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts.	L5

5	**Infer** the significance, and purpose of protocols (FTP, SMTP), standards, and use in data communications and networking and **analyze** the most common DNS resource records that occur in a zone file.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3		-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-	1	-

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low) TEXT BOOKS:

1. Behrouz A. Forouzan, —Data Communications and Networking||, TataMcGraw- Hill,5thEdition, 2012.
2. Andrew S. Tanenbaum, David.J. Wetherall, —Computer Networks||, Prentice-Hall, 5th Edition, 2010.

REFERENCE BOOKS:

1. Chwan-Hwa Wu, Irwin, —Introduction to Computer Networks and Cyber Security||, CRC publications, 2014.
2. Douglas E. Comer, —Internetworking with TCP/IP —, Prentice-Hall, 5thEdition,2011.
3. Peterson, Davie, Elsevier, —ComputerNetworks,5thEdition,2011
4. Comer, —Computer Networks and Internets with Internet Applications,4thEdition,2004.

E-Resources:

1. http://computer.howstuffworks.com/computer-networking-channel.htm
2. https://www.geeksforgeeks.org/layers-osi-model/
3. https://www.wikilectures.eu/w/Computer_Network
4. https://technet.microsoft.com/en-us/network/default.aspx

Activity Based Learning (Suggested Activities in Class)

5. Real world problem solving using group discussion.
6. Flip class activity

LABORATORY EXPERIMENTS

1. Analyse the various line coding techniques used for data transmission of a digital signal over a transmission line
2. Design a program for error-detecting code using CRC-CCITT (16- bits).
3. Design a program to find the shortest path between vertices using Belman- ford algorithm
4. Given a graph derive the routing table using distance vector routing and link state routing algorithm
5. Try out some simple subnetting problems.
6. Using TCP/IP sockets, write a client–server program to make the client send the file name and to make the server send back the contents of the requested file if present. Implement the above program using message queues or FIFOs as IPC channels
7. Implement a webserver program to fetch a URL request and display the home page of the same in the browser
8. Implement a simple DNS server to resolve the IP address for the given domain name

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EMBEDDED SYSTEM DESIGN

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	: 24CY2306	**Credits**	: 3
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th) + 26(P) Hours
L–T–P-J	: 3–0–2-0		

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the fundamental concepts of embedded system design and IoT.
2. Gain **knowledge** of various hardware and software components used in embedded systems and IoT.
3. **Develop** skills to design and implement embedded systems for different applications.
4. Learn to **analyze** and optimize the performance of embedded systems.
5. **Enhance** problem-solving and critical thinking abilities in the context of designing and developing integrated embedded systems and IoT solutions

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Interactive Lectures:*** Engage students through discussions, case studies, and real-life examples.
2. ***Hands-on Projects:*** Assign practical projects to students to enhance their understanding and application of concepts.
3. ***Group Discussions:*** Encourage collaborative learning and problem-solving through group discussions and brainstorming sessions.
4. ***Case Studies:*** Analyze real-world embedded system designs to understand their challenges and solutions.
5. ***Simulations and Virtual Labs:*** Use simulation tools and virtual labs to provide a virtual hands-on experience.
6. ***Guest Lectures:*** Invite industry experts to share their experiences and provide insights into real-world embedded system design practices.

7. ***Online Forums:*** Establish an online platform for students to discuss and share their ideas and questions related to the course.
8. ***Demonstrations:*** Conduct live demonstrations of embedded system prototypes to showcase practical implementations.
9. ***Assignments and Assessments:*** Assign regular assignments and assessments to evaluate students' understanding and progress.
10. ***Industry Visits:*** Organize visits to embedded system manufacturing companies to expose students to real-world applications.

UNIT – I	**07 Hours**

INTRODUCTION TO EMBEDDED SYSTEMS

Introduction: What is an Embedded System, Embedded Systems VS. General Computing Systems, History of Embedded Systems, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, Wearable Devices—The Innovative Bonding of Lifestyle with Embedded Technologies ***(Text Book-3: Chapter 1)***

Embedded System Core: General Purpose and Domain Specific Processors, Application Specific c Integrated Circuits (ASICs), Programmable Logic Devices (PLDs), Commercial off-the-shelf Components (COTS)

(Text Book 3: Chapter 2.2)

UNIT – II	**9 Hours**

EMBEDDED SYSTEMS HARDWARE & SOFTWARE DESIGN

Sensors and actuators: 7-segment LED displays, stepper motor, relays, optocouplers, and matrix keyboard.

(Text Book 3: Chapter 2.3)

Communication Interfaces: I2C, SPI, CAN, UART, Bluetooth, and ZigBee.

(Text Book 3: Chapter 2.4)

Other System Components: Reset Circuit, Brown-out protection circuit, Oscillator Unit, Real-Time Clock (RTC), Analog to Digital Converter (ADC), Timers and Watchdog Timer unit.

Programming Concepts and Embedded Programming in C: High -Level Language C programming, C program elements (compiler build stages, macros, functions, Bitwise Operations, Looping constructs, Pointers and AAPCS)

(Reference Book 2: Chapter 5.1 to 5.6)

UNIT – III	**8 Hours**
REAL-TIME OPERATING SYSTEMS	
Operating System Basics: The Kernel, Types of Operating Systems, Tasks, Process and Threads ***(Text Book 3: Chapter 10.1, 10.2, 10.3)*** **Thread Management:** Introduction to RTOS, Function pointers, Thread Management, Semaphores, Thread Synchronization, Process Management, Dynamic loading and linking ***(Text Book 2: Chapter 3)*** **Time Management:** Cooperation, blocking semaphores, First In First Out Queue, Thread sleeping, Deadlocks, Monitors, Fixed Scheduling ***(Text Book 2: Chapter 4)***	
UNIT – IV	**6 Hours**
FUNDAMENTALS OF IOT: The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Hardware Design challenges, Software Development challenges, Security and Privacy challenges. **UNIT – V** **IOT PLATFORM DESIGN ARCHITECTURE** **8 Hours** Introduction, Architecture Reference Model (ARM), CISCO IoT Reference Model, IoT Application Design Principles Architecture– Introduction, Process Specification, Information Specification, Knowledge Specification, Functional View, Deployment and Operational View, Other Relevant architectural views, Data Analytics for IoT, IoT application design using Arduino Uno/Nano, Raspberry Pi, ESP-32, ESP-8266.	

UNIT – III	**8 Hours**
REAL-TIME OPERATING SYSTEMS	
Operating System Basics: The Kernel, Types of Operating Systems, Tasks, Process and Threads ***(Text Book 3: Chapter 10.1, 10.2, 10.3)*** **Thread Management:** Introduction to RTOS, Function pointers, Thread Management, Semaphores, Thread Synchronization, Process Management, Dynamic loading and linking ***(Text Book 2: Chapter 3)*** **Time Management:** Cooperation, blocking semaphores, First In First Out Queue, Thread sleeping, Deadlocks, Monitors, Fixed Scheduling ***(Text Book 2: Chapter 4)***	
UNIT – IV	**6 Hours**

FUNDAMENTALS OF IOT:

The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Hardware Design challenges, Software Development challenges, Security and Privacy challenges.

UNIT – V **8 Hours**

IOT PLATFORM DESIGN ARCHITECTURE

Introduction, Architecture Reference Model (ARM), CISCO IoT Reference Model, IoT Application Design Principles Architecture– Introduction, Process Specification, Information Specification, Knowledge Specification, Functional View, Deployment and Operational View, Other Relevant architectural views, Data Analytics for IoT, IoT application design using Arduino Uno/Nano, Raspberry Pi, ESP-32, ESP-8266.

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Apply embedded system design principles to solve real-world problems.	Apply - Level 3
2	Design and implement embedded systems with hardware/software, considering performance.	Synthesis - Level 5
3	Analyze embedded system performance, reliability, and limitations.	Analyze - Level 4
4	Apply IoT concepts to design basic IoT systems with connectivity.	Apply - Level 3
5	Assess ethical, societal, and environmental impacts of embedded systems and IoT.	Evaluate - Level 6

Table: Mapping Levels of COs to POs / PSOs															
COs	Program Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3								2	2	3	3	
CO2	3	3	3		3	2	2	1	3			2	3	3	
CO3	3	3	1		3							2	3	2	
CO4	3	3	3		3	2							3	3	
CO5						3	3	3							3

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. K.V. Shibu, Introduction to Embedded Systems, 2nd Edition, McGraw Hill Education, 2017.
2. Jonathan Valvano, Embedded Systems: Real-Time Operating Systems for ARM Cortex-M
3. Internet of Things: Principles and Paradigms by Rajkumar by Buyya, Amir Vahid Dastjerdi.
4. Building the Internet of Things by Maciej Kranz.
5.

REFERENCE BOOKS:

1. James K. Peckol, "Embedded Systems: A Contemporary Design Tool", Wiley, 2009.
2. Raj Kamal, "Embedded Systems- Architecture, Programming and Design", 3rd Edition, McGraw Hill Education, 2017.
3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, " A hands on Approach", University Press
4. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry.

E-Resources:

1. MOOC Course: "Introduction to Embedded Systems" by University of California, Irvine (Link: [www.coursera.org/embedded-systems])
2. MOOC Course : "Introduction To Internet Of Things" by Swayam. (Link:[https://onlinecourses.nptel.ac.in/noc22_cs53/preview])
3. Website: Embedded.com (Link: [www.embedded.com])
4. Online Tutorial: "Embedded Systems Tutorial" by Tutorials point (Link: [www.tutorialspoint.com/embedded_system])
5. Online Course : "Introduction to IoT and Digital Transformation" by CISCO Networking Academy. (Link : https://www.netacad.com/courses/introduction-iot?courseLang=en-US

Activity Based Learning (Suggested Activities in Class)

1. **Project-based Learning:** Assign a semester-long project where students design and implement an embedded system for a specific application.
2. **Hackathons:** Organize hackathons where students work in teams to solve a given problem using embedded system design techniques.
3. **Guest Speaker Series:** Invite professionals from the industry to share their experiences and projects related to embedded system design.
4. **Case Studies:** Provide students with real-world case studies of successful embedded system designs and ask them to analyze and present their findings.
5. **Prototyping Sessions:** Conduct hands-on sessions where students build and test small- scale embedded system prototypes using development boards and sensors.

LINUX PROGRAMMING

[**As per Choice Based Credit System (CBCS) scheme**]

SEMESTER – III

Subject Code	: 24CY2307	**Credits**	: **02**
Hours / Week	: **03 Hours**	**Total Hours**	: **26 Hours**
L–T–P–J	: **1–0–2–0**		

Course Learning Objectives: This course will enable students to:

1. **Apply** core Linux concepts and basic system commands to navigate, manage files, and compare operating system environments (Linux vs Unix vs Windows).
2. **Implement** Linux installation and configuration on virtual machines and **operate** system utilities for managing user sessions and desktop environments.
3. **Execute** intermediate-level Linux commands for file processing, text manipulation, user management, and basic networking operations.
4. **Utilize** advanced Linux commands to manage system processes, monitor performance, handle storage devices, and perform system-level administration.
5. **Develop** and **execute** Bash shell scripts for task automation, using control structures, loops, functions, and job scheduling tools (e.g. cron).

Teaching-Learning Process (General Instructions):

These are sample **new pedagogical methods**, where teacher can use to accelerate the attainment of the various course outcomes.

1. **Lecture method** means it includes not only **traditional lecture method**, but different type of teaching methods may be adopted to develop the course outcomes.
2. **Interactive Teaching:** Adopt the Active learning that includes brainstorming, discussing, **group work**, focused listening, **formulating questions**, notetaking, annotating, and roleplaying.
3. Show **Video/animation** films to explain **functioning of various concepts**.

4. Encourage **Collaborative** (Group Learning) Learning in the class.
5. To make **Critical thinking**, ask at least three Higher order Thinking questions in the class.
6. Adopt **Problem Based Learning**, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Show the **different ways to solve** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every **concept can be applied to the real world** - and when that possible, it helps improve the students' understanding.

MODULE – I	**06 Hours**
Basic Linux Commands: Understanding Linux Concepts, application, Unix vs Linux vsWindows**;**System utility commands (**date, uptime, hostname, which, cal, bc,** etc.), system maintenance commands (**shutdown, reboot, halt, init**, etc.)**;** Download, Install, and Configure Linux Operating System: Oracle Virtual Box, **Ubuntu** Linux Installation (**mandatory**), different ways to installing Linux**;**Introduction to File System, File system structure description, File system navigation commands, File System Paths, Directory listing overview**;**Creating Files and Directories, Finding Files and Directories command (**find, locate, pipe**)**;** file permissions (**chmod**), file ownership (**chown, chgrp**), getting help (**man, whatis**, etc.), adding text to file, standard output to a file (tee command)**;** **Textbook –T1-> Chapter-11 and Chapter-32; T2-> Chapter8, Chapter10, Chapter11, Chapter14, Chapter15;**	

MODULE– II	**10 Hours**
Intermediate Linux Commands: Filters and Text Processing Commands **(cut, sort, grep, awk, uniq, wc**)**;** Compare Files (**diff, cmp**, etc.), Compress and un-compress files or directories (**tar, gzip, gunzip**)**;**Truncate file size (**truncate**), Combining and Splitting Files (**cat and split**)**,** mount and unmount file commands (e.g., **sudo mount /dev/sdX1 /mnt,sudoumount /mnt,sudoumount -f /mnt**)**;** Linux vs. Windows commands, Linux File Editors (**vi text editor**), user account management**;**recover root password (single user mode), switch users and sudo access, monitor users**;**talkingto users (**users, wall, write**); networking commands (**ifconfig, ip, ping, traceroute, etc.**),connect Linux VM via Putty**;** **Textbook – T1->Chapter4.4, Chapter4.5, Chapter-5; T2->Chapter-15**	

MODULE– III	04 Hours
Advanced Linux Command: Processes and schedules (**systems, ps, top, kill, crontab, at,** etc.), System Monitoring Commands (**top, df, dmesg, iostat 1, netstat, free, etc.**); System logs monitor (/var/log), Finding System Information (**uname, cat /etc./redhat-release, cat /etc./*rel*, dmidecode**, etc.), Terminal Commands (**clear, exit, script, etc.**); storage commands: disk partition (**df, fdisk,** etc.), add disk and create standard partition, Logical Volume Management (**LVM**);add disk and create LVM partition, Extend disk using LVM, Adding swap space, file system check (**fsck and xfsrepair**), system backup (**dd command only**). **Textbook--T1->Chapter-2, Chapter-11; T2->Chapter-16, Chapter-18**	
MODULE – IV 10	**Hours**
Shell Programming Basics: Introduction to **bash shell scripting**, **hello world printing**, comment**;** variables, constant, sourcing a script, troubleshooting and debugging a script**;** syntax, script, variables, data types, operators**; if...else, loops: for, do while, switch; functions; arrays, schedule (cron);**Hello World Script, Print Current Date and Time, **Read Input from User;** Simple Calculator (Addition, Subtraction), file creation and deletion, check if a file exists**;** If-Else Example (**Even or Odd Number**), **Loop Through a List of Files;** Countdown Timer (**using while loop**), Display Disk Usage (**using df and du**), display System Uptime (using uptime). **Textbook-- T1->Chapter23.9,23.10, Chapter24.2,24.3; T2->Chapter-24 and 27**	

Course Outcomes (COs)	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
CO1	Given the USB sticks with Ubuntu 24.04 LTS ISO files, student can **build** and configure Linux operating system-based host machine. Same operation can be **solved** using the Oracle VirtualBox and Ubuntu 24.04 LTS ISO files.	**L3**
CO2	Given the Linux Operating System andthe basic linux commands whoami, cd, mkdir, rm, adduser, pid, etc. student can **examine** the basic files and directory structures, user's credentials, network and system parameters.	**L4**
CO3	Given the Linux Operating System, basic linux commands**,** and bash shell platform student can **develop** basic bash scripts to automate system tasks.	**L3**
CO4	Given the Linux operating System, advanced linux commands (specifically, top, df, dmesg, netstat, free, etc.) and bash shell platform student can **design** data processing, network and system monitoring, user and process management tools effectively.	**L3**

Text Books

1. **Author:** Paul Cobbaut
   Title: *Linux Fundamentals*
   Edition: – New edition
   Publisher: linux-training.be **Year of Publication:** 2015 (CEST)
2. **Author:** William E. Shotts, Jr.
   Title: *The Linux Command Line*
   Edition: 2nd Edition
   Publisher: No Starch Press
   Year of Publication: 2019

Reference Books

1. **Author:** Christopher Negus
   Title: *Linux Bible*
   Edition: – **Publisher:** Wiley
   Year of Publication: 2005

2. **Author:** Daniel J. Barrett **Title:** *Linux Pocket Guide*
   Edition: 3rd Edition
   Publisher: O'Reilly Media
   Year of Publication: 2016
3. **Author:** Jason Cannon
   Title: *Linux for Beginners: An Introduction to the Linux Operating System and Command Line*
   Edition: –
   Publisher: CreateSpace Independent Publishing Platform **Year of Publication:** 2014

E-Resources:

- https://www.tutorialspoint.com/unix/shell_scripting.htm • https://linuxjourney.com/.
- https://www.geeksforgeeks.org/introduction-linux-shell-shell-scripting/
- https://linuxcommand.org/tlcl.php
- https://nptel.ac.in/courses/117106113
- https://www.edx.org/learn/linux/the-linux-foundation-introduction-to-linux
- GNU Bash Manual
- The Linux Documentation Project (TLDP)
- OverTheWire – Bandit (Linux WarGame)
- Codecademy – Learn the Command Line
- LearnShell – Interactive Shell Tutorials
- Coursera – Linux for Developers (Linux Foundation)
- MIT OCW – Operating System Engineering (6.828)
- Advanced Bash-Scripting Guide (TLDP)
- Linux Programming Interface – Companion Site
- Stack Overflow – Linux Questions
- Stack Overflow – Bash Questions
- Reddit – r/linux
- Reddit – r/bash

Lab Problems:

- Create a script that takes a single argument (a filename) and prints its contents to the screen.
- Write a script that asks the user for their name and greets them.
- Create a script that lists all files in the current directory.
- Write a script that checks if a file exists and prints a message indicating whether it does or not.
- Write a script that takes multiple arguments (filenames) and concatenates their contents into a single output file.
- Create a script that searches for a specific string in all files in the current directory and prints the filenames of those that contain the string.
- Write a script that sorts a list of numbers in ascending order and prints the result.
- Create a script that monitors a directory for new files and sends an email notification when a new file is detected.
- Write a script that backs up a directory by compressing its contents into a tarball.

- Write a script that implements a simple calculator, allowing users to perform arithmetic operations (+, -, *, /) on two numbers.
- Create a script that analyzes system logs to detect potential security threats and sends an alert to the administrator.
- Write a script that automates a daily backup process, including rotating old backups and sending notifications.
- Create a script that monitors system resources (CPU, memory, disk usage) and sends alerts when thresholds are exceeded.
- Write a script that implements a simple chat server, allowing multiple users to communicate with each other.
- Write a script that solves the " Tower of Hanoi" problem for a given number of disks.
- Create a script that generates a random password of a specified length and complexity.
- Write a script that implements a simple game (e.g., Tic-Tac-Toe, Hangman) in the terminal.
- Create a script that analyzes a large dataset and generates statistics (e.g., mean, median, mode).
- Write a script that automates a complex workflow, involving multiple steps and conditional logic.

WEB TECHNOLOGIES

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	:	24CY2308	**Credits**	:	3
Hours / Week	:	03 Hours	**Total Hours**	:	39(Th) Hours
L–T–P-J	:	1–0–2-0			

Course Learning Objectives:

This Course will enable students to:

1. Understand the basics of server-side scripting using PHP
2. Explain web application development procedures
3. Impart servlet technology for writing business logic
4. Facilitate students to connect to databases using JDBC
5. Familiarize various concepts of application development using JSP

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Interactive Lectures:*** Engage students through discussions, case studies, and real-life examples.
2. ***Hands-on Projects:*** Assign practical projects to students to enhance their understanding and application of concepts.
3. ***Group Discussions:*** Encourage collaborative learning and problem-solving through group discussions and brainstorming sessions.
4. ***Case Studies:*** Analyze real-world embedded system designs to understand their challenges and solutions.
5. ***Simulations and Virtual Labs:*** Use simulation tools and virtual labs to provide a virtual hands-on experience.
6. ***Guest Lectures:*** Invite industry experts to share their experiences and provide insights into real-world embedded system design practices.

UNIT – I	07 Hours
Introduction to PHP: Declaring variables, data types, arrays, strings, operations, expressions, control structures, functions, reading data from web form controls like Text Boxes, radio buttons, lists etc., Handling File Uploads, connecting to database (My SQL as reference), executing simple queries, handling results, Handling sessions and cookies. File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.	
UNIT – II	**9 Hours**
Client-side Scripting: Introduction to JavaScript: JavaScript language – declaring variables, scope of variables functions, event handlers (on click, on submit etc.), Document Object Model, Form validations. Simple AJAX applications.	
UNIT – III	**6 Hours**
XML: Introduction to XML, Defining XML tags, their attributes and values, Document type definition, XML Schemas, Document Object model, XHTML Parsing XML Data - DOM and SAX parsers in java	
UNIT – IV	**7 H ours**
Introduction to Servlets: Common Gateway Interface (CGI), Lifecycle of a Servlets, deploying a Servlets, The Servlets API, Reading Servlets parameters, reading initialization parameters, Handling Http Request & Responses, Using Cookies and sessions, connecting to a database using JDBC.	
UNIT – V	**9 Hours**
Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session tracking, connecting to database in JSP.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Identify the difference between the HTML PHP and XML documents.	
2	Identify the engineering structural design of XML and parse tree and Analyze the difference between and PHP and XML	
3	Understand the concept of JAVA SCRIPTS	
4	Identify the difference between the JSP and Servlet and Design web application using MVC architecture	
5	Understand the JSP and Servlet concepts and Apply JDBC and ODBC technologies to create database connectivity	

Table: Mapping Levels of COs to POs / PSOs															
COs	**Program Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3								2	2	3	3	
CO2	3	3	3		3	2	2	1	3			2	3	3	
CO3	3	3	1		3							2	3	2	
CO4	3	3	3		3	2							3	3	
CO5						3	3	3							3

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP – Steven Holzner, Tata McGraw-Hill

REFERENCE BOOKS:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dremtech
2. Java Server Pages – Hans Bergsten, SPD O'Reilly
3. Java Script, D.Flanagan, O'Reilly, SPD.
4. Beginning Web Programming-Jon Duckett WROX.
5. Programming world wide web, R.W. Sebesta. Fourth Edition, Pearson.
6. Internet and World Wide Web – How to program, Dietel and Nieto, Pearson.

DEVOPS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – III

Subject Code	:	24CY2309	**Credits**	:	3
Hours / Week	:	03 Hours	**Total Hours**	:	39(Th) Hours
L–T–P-J	:	1–0–2-0			

Course Learning Objectives:

This Course will enable students to:

1. Introduce the fundamental principles, practices, and roles involved in DevOps, highlighting its impact on modern software delivery.
2. Develop understanding of cloud computing concepts and how DevOps integrates with various cloud platforms for scalable deployments.
3. Equip students with hands-on experience in version control using Git and automation through Continuous Integration tools like Jenkins.
4. Explore containerization technologies such as Docker for consistent software environments.
5. Understand container orchestration using Kubernetes for automated deployment, scaling, and management of containerized applications.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Interactive Lectures:*** Engage students through discussions, case studies, and real-life examples.
2. ***Hands-on Projects:*** Assign practical projects to students to enhance their understanding and application of concepts.
3. ***Group Discussions:*** Encourage collaborative learning and problem-solving through group discussions and brainstorming sessions.
4. ***Case Studies:*** Analyze real-world embedded system designs to understand their challenges and solutions.
5. ***Simulations and Virtual Labs:*** Use simulation tools and virtual labs to provide a virtual hands-on experience.
6. ***Guest Lectures:*** Invite industry experts to share their experiences and provide insights into real-world embedded system design practices.

UNIT – I	07 Hours
Introduction to DevOps, DevOps Principles in detail, DevOps Engineer Skills in the market, Knowing DevOps Delivery Pipeline, Market trend of DevOps, DevOps Technical Challenges, Tools we use in DevOps	
UNIT – II	**9 Hours**
DevOps on Cloud, Essentials of Cloud computing? Cloud and virtualization architecture, Cloud deployment architecture, Cloud providers – An overview, why we need DevOps on Cloud? Introducing to Amazon web services	

UNIT – III	**6 Hours**
GIT – A Version controlling tool, knowing about Version control, Git – A CLI Essentials of GIT in industry, how to setup GIT - Installing Git, First-Time Git Setup, getting a Git Repository, Working with various commands in GIT	
UNIT – IV	**7 H ours**
Jenkins - Essentials of Continuous Integration, an example scenario where CI is used, know about Jenkins and its architecture in detail, Jenkins tool Management in detail, know about User management in Jenkins Docker -Introduction, Real-world Shipping Transportation Challenges, Introducing Docker and its technology, Understanding of Docker images and containers, working with container, How to Share and copy a container	
UNIT – V	**9 Hours**
Kubernetes, Introduction to Kubernetes, Kubernetes Cluster Architecture — An overview- Understanding concepts of Pods, Replica sets, deployments and namespaces, Understanding the concepts of services and networking, Persistent volumes and persistent volume claims —an overview, Design of Pods , Understanding labels, selectors, jobs, and schedulers	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	Explain the principles, components, and workflow of DevOps and identify the skills required for a DevOps engineer.	
2	Demonstrate the integration of DevOps with cloud environments and understand the architecture and services of cloud providers like AWS	

3	Utilize Git effectively for version control, repository management, and collaborative development in real-world projects.\	
4	Implement continuous integration and automation using Jenkins and containerization using Docker for efficient software delivery	
5	Design, deploy, and manage scalable containerized applications using Kubernetes with understanding of pods, deployments, services, and networking	

Text Books

1. **Gene Kim, Jez Humble, Patrick Debois, and John Willis**, *The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*, IT Revolution Press, 2016.
2. **Len Bass, Ingo Weber, Liming Zhu**, *DevOps: A Software Architect's Perspective*, Addison-Wesley Professional, 2015.
3. **Kief Morris**, *Infrastructure as Code: Managing Servers in the Cloud*, O'Reilly Media, 2nd Edition, 2021.
4. **Nigel Poulton**, *Docker Deep Dive*, Independently Published, 4th Edition, 2023.
5. **Kelsey Hightower, Brendan Burns, and Joe Beda**, *Kubernetes: Up and Running: Dive into the Future of Infrastructure*, O'Reilly Media, 3rd Edition, 2023.

Reference Books

1. **Jez Humble and David Farley**, *Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation*, Addison-Wesley, 2010.
2. **John Arundel and Justin Domingus**, *Cloud Native DevOps with Kubernetes: Building, Deploying, and Scaling Modern Applications in the Cloud*, O'Reilly Media, 2022.
3. **Kevin Jackson, Cody Bunch, and Egle Sigler**, *OpenStack Cloud Computing Cookbook*, Packt Publishing, 4th Edition, 2018.
4. **James Turnbull**, *The Docker Book: Containerization is the New Virtualization*, Turnbull Press, 2014.

PROBABILITY AND STATISTICS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code	: 24CY2401	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P–J	: 3–0–0–0		

Course Learning Objectives:

This Course will enable students to:

1. **Apply** statistical principles and probability concepts to solve complex problems in real- world scenarios involving uncertainty and randomness.
2. **Evaluate** and select appropriate probability distributions and statistical techniques to analyze and interpret data accurately in various applications.
3. **Justify** the use of estimation methods and hypothesis testing techniques for drawing meaningful inferences about population parameters.
4. **Analyze** and interpret sample test results for different statistical relationships, such as means, variances, correlation coefficients, regression coefficients, goodness of fit, and independence, to make informed decisions.
5. **Identify** sample tests using appropriate statistical procedures to investigate the significance of observed data and communicate findings effectively.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.

6. **Adopt Problem Based Learning, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.**
7. **Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.**
8. **Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.**

UNIT – I: Probability	**09 Hours**
Definitions of Probability, Addition Theorem, Conditional Probability, Multiplication Theorem, Bayes' Theorem of Probability	
UNIT – II: Random Variables and their Properties and Probability Distributions	**09 Hours**
Discrete Random Variable, Continuous Random Variable, Joint Probability Distributions Their Properties, Probability Distributions: Discrete Distributions: Binomial, Poisson Distributions and their Properties; Continuous Distributions: Exponential, Normal, Distributions and them Properties.	
UNIT – III: Estimation and testing of hypothesis	**06 Hours**
Sample, Populations, Statistic, Parameter, Sampling Distribution, Standard Error, Un-Biasedness, Efficiency, Maximum Likelihood Estimator, Notion & Interval Estimation.	
UNIT – IV: Sample Tests-1	**07 Hours**
Large Sample Tests Based on Normal Distribution, Small Sample Tests: Testing Equality of Means, Testing Equality of Variances, Test of Correlation Coefficient	
UNIT – V: Sample Tests-2	**08 Hours**
Test for Regression Coefficient; Coefficient of Association, 2 – Test for Goodness of Fit, Test for Independence.	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Apply** the principles of probability to solve complex problems in various real-world scenarios.	L2 & L3
2	**Solve** and **compare** different probability distributions, including discrete and continuous random variables, in order to make informed decisions and predictions.	L2 & L3
3	**Apply** statistical estimation techniques, such as maximum likelihood estimation and interval estimation, to draw meaningful inferences about population parameters from sample data.	L3
4	**Examine** hypothesis testing methods, including large and small sample tests, to assess the significance of observed data and draw valid conclusions.	L4
5	**Analyze** statistical relationships and perform sample tests to assess the Equality of means in different populations, Correlation coefficients between variables to determine the strength and direction of the relationship. Independence of variables using appropriate statistical tests to assess the absence of any relationship.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2		2				1					
CO2	3	2	2		2				1					
CO3	3	2	2						1					
CO4	3	2	2		2				1					
CO5	3	2	2		2				1					

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Probability & Statistics for Engineers and Scientists, Walpole, Myers, Myers, Ye. Pearson Education.

REFERENCE BOOKS:

1. Probability, Statistics and Random Processes T. Veerarajan Tata McGraw – Hill
2. Probability & Statistics with Reliability, Queuing and Computer Applications, Kishor S. Trivedi, Prentice Hall of India ,1999

E-Resources:

1. https://nptel.ac.in/courses/106104233
2. https://nptel.ac.in/courses/117103067
3. https://nptel.ac.in/courses/103106120
4. https://www.coursera.org/learn/probability-intro#syllabus
5. https://nptel.ac.in/courses/111104073

Activity Based Learning (Suggested Activities in Class)

1. Tools like Python programming, R programming can be used which helps student to develop a skill to analyze the problem and providing solution.
2. Regular Chapter wise assignments/ Activity/Case studies can help students to have critical thinking, developing an expert mind set, problem-solving and teamwork.

Following are Assignments/ Activities Can be carried out using either R programming language or Python Programming or excel solver.

1. There are n people gathered in a room. What is the probability that at least 2 of them will have the same birthday? (Use excel solver, R Programming, Python Programming)
   a. Use simulation to estimate this for various n., and Produce Simulation Graph.
   b. Find the smallest value of n for which the probability of a match is greater than 0.5.
   c. Explore how the number of trials in the simulation affects the variability of our estimates.

2. Case Study 1: Customer Arrivals at a Coffee Shop

   a. A coffee shop wants to analyze the number of customer arrivals during its morning rush hour (7:00 AM to 9:00 AM). The shop has been recording the number of customer arrivals every 15 minutes for the past month.
   b. Data: The data consists of the number of customer arrivals recorded at the coffee shop during each 15-minute interval for the past month.

c. Here is a sample of the data:

Time Interval	Customer Arrivals
00 AM - 7:15 AM	**6**
15 AM - 7:30 AM	**4**
30 AM - 7:45 AM	**9**
45 AM - 8:00 AM	**7**
00 AM - 8:15 AM	**5**
15 AM - 8:30 AM	**8**
30 AM - 8:45 AM	**10**
45 AM - 9:00 AM	**6**

analyze the customer arrivals and determine the probability distribution that best fits the data. Specifically, explore both discrete and continuous probability distributions, including the binomial, Poisson, exponential, and normal distributions.

3. Case Study 2: Comparing the Performance of Two Groups
    a. Suppose you are a data analyst working for a company that manufactures a new energy drink. The marketing team conducted a promotional campaign in two different cities (City A and City B) to determine the effectiveness of the campaign in increasing sales. The sales data for a random sample of customers in each city was collected over a week. Your task is to compare the average sales between the two cities and test whether there is a significant difference in the variance of sales.
    b. **Data**: Let's assume the following sample data for the number of energy drinks sold in each city:

City A: [30, 28, 32, 29, 31, 33, 34, 28, 30, 32]
City B: [25, 24, 26, 23, 22, 27, 29, 30, 26, 24]

perform a two-sample t-test to test the equality of means and a test for equality of variances using Python's SciPy library.

4. **case study 3:** testing independence between two categorical variables.

    a. Data: Sample of 100 employees, and each employee is classified as either Male or Female. They were asked to rate their job satisfaction on a scale of 1 to 5, where 1 represents low satisfaction and 5 represents high satisfaction. The data is as follows:

Employee	Gender	Job Satisfaction
1	Male	4
2	Female	3
3	Male	2
4	Female	5
…	…	…
100	Female	4

    b. Test for independence between gender and job satisfaction, use the chi-squared test in R.

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DESIGN AND ANALYSIS OF ALGORITHMS

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code	: 24CY2402	**Credits**	: 04
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th)+13(P) Hours
L–T–P–J	: 3–1–0–0		

Course Learning Objectives:

This Course will enable students to:

1. **Analyze** the non-recursive and recursive algorithms and to represent efficiency of these algorithms in terms of the standard Asymptotic notations.
2. **Acquire** the knowledge of Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
3. **Master** the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs.
4. **Learn** Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem.
5. **Understand** the importance of Backtracking and Branch and Bound algorithm design techniques to solve a given problem.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods, where teacher can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only traditional lecture method, but different *type of teaching methods* may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt the* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain functioning of various concepts.

4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher order Thinking questions in the class.
6. Adopt ***Problem Based Learning***, which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
7. Show the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the students' understanding.

UNIT – I	**08 Hours**

INTRODUCTION:

What is an Algorithm? Fundamentals of Algorithmic Problem Solving.

(Text Book-1: Chapter 1: 1.1 to 1.2)

FUNDAMENTALS OF THE ALGORITHMS EFFICIENCY:

Analysis Framework, Asymptotic Notations and Standard notations and common functions ***(Text Book-2: Chapter 3: 3.1, 3.2)***,

Mathematical Analysis of Non-recursive and Recursive Algorithms,

(Text Book-1: Chapter 2: 2.1, 2.3, 2.4,)

UNIT – II	**08 Hours**

BRUTE FORCE:

Background, Selection Sort, Brute-Force String Matching. TSP

(Text Book-1: Chapter 3: 3.1, 3.2)

DIVIDE AND CONQUER:

General method, Recurrences: The substitution method, The recursion-tree method, The master method.

(Text Book-2: Chapter 4: 4.4, 4.5),

Merge sort, Quick sort, Binary Search, Multiplication of large integers,

Case study: Strassen's Matrix Multiplication.

(Text Book-1: Chapter 4: 4.1 to 4.3, 4.5)

UNIT – III	06 Hours
DECREASE & CONQUER: General method, Insertion Sort, Graph algorithms: Depth First Search, Breadth First Search, Topological Sorting **TRANSFORM AND CONQUER:** **Case study:** Heaps and Heap sort. **TIME AND SPACE TRADEOFFS:** Input Enhancement in String Matching: Horspool's algorithm, Hashing: Open and Closed hashing. ***(Text Book-1: Chapter 5: 5.1 to 5.3, Chapter 6: 6.3 to 6.4, Chapter 7: 7.2 to 7.3)***	
UNIT – IV	**9 Hours**
GREEDY TECHNIQUE: General method of Greedy technique, Single-Source Shortest Paths: General method, The Bellman-Ford algorithm, Single-Source Shortest Paths in DAGs, Dijkstra's Algorithm ***(Text Book-2: Chapter 24: 24.1 to 24.3).*** Minimum Spanning Trees: Prim's Algorithm, Optimal Tree problem: Huffman Trees; **Case study:** Kruskal's Algorithm. Fractional Problem ***(Text Book-1: Chapter 9: 9.1, 9.2, 9.4).*** **DYNAMIC PROGRAMMING:** General method, The Floyd-Warshall Algorithm, Johnson's algorithm for sparse graphs ***(Text Book- 2: Chapter 25: 25.1 to 25.3)***, The Knapsack problem ***(Text Book-1: Chapter 8: 8.4).***	
UNIT – V	**08 Hours**
LIMITATIONS OF ALGORITHMIC POWER P, NP and NP-complete problems ***(Text Book-1: Chapter 11: 11.3***) **BACKTRACKING:** General method, N-Queens problem, Subset-sum problem. ***(Text Book-1: Chapter 12: 12.1***) **BRANCH AND BOUND:** General method, Travelling Salesman problem, Approximation algorithms for TSP. **Case study:** Knapsack Problem. ***(Text Book-1: Chapter 12: 12.2, 12.3***)	

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Exemplify** the algorithm design techniques and standard Asymptotic notations. Analyze non-recursive and recursive algorithms to obtain worst-case running times of algorithms using asymptotic analysis	L3
2	**Interpret** the brute-force, divide-and-conquer paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize divide-and- conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	L3
3	**Demonstrate** the Decrease and Conquer, Transform and Conquer algorithm design techniques and analyze the performance of these algorithms.	L3
4	**Identify and interpret** the greedy technique, dynamic- programming paradigm as to when an algorithmic design situation calls for it. Recite algorithms that employ this paradigm. Synthesize dynamic-programming algorithms and analyze them	L3
5	**Illustrate** the Backtracking, Branch and Bound algorithm design paradigms and explain when an algorithmic design situation calls for it. Recite algorithms that employ these paradigms. **Summarize** the limitations of algorithmic power.	L3

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3										2		3
CO2	3	3	2									2		3
CO3	3	3										1		3
CO4	3	3	2									2		3
CO5	3	3										1		3

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low) TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, Pearson Education, 2011.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI, 2014.

REFERENCE BOOKS:

1. Horowitz E., Sahni S., Rajasekaran S, "Computer Algorithms", Galgotia Publications, 2001.
2. R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T. Tsai, "Introduction to the Design and Analysis of Algorithms A Strategic Approach", Tata McGraw Hill, 2005.

E-Resources:

1. https://nptel.ac.in/courses/106/101/106101060/
2. http://cse01-iiith.vlabs.ac.in/
3. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
4. https://www.coursera.org/specializations/algorithms

Activity Based Learning (Suggested Activities in Class)

1. Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Cabbage puzzle, Konigsberg bridge puzzle etc.,
2. Demonstration of solution to a problem through programming.

LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either C programming language or Object-oriented programming language:

1. Apply divide and conquer method and Design a C program to implementation of Binary Search algorithm.
2. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method.
5. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
6. Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
7. For a given weighted graph, construct an All-Pairs Shortest Paths problem using Floyd's algorithm and implement this algorithm to find the shortest distance and their shortest paths for every pair of vertices.
8. Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions

technique

9. Find Minimum Cost Spanning Tree for a given weighted graph using Prim's and Kruskal's algorithm.
10. From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm.
11. Mini project proposal should be submitted and Implementation should be done based on the problem stated in the proposal

Open ended experiments

1. Implement Fractional Knapsack problem using Greedy Method.
2. Implement N-Queens problem using Backtracking technique.
3. implementation of Travelling Sales man problem using Dynamic programming

DATABASE MANAGEMENT SYSTEM

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code	: 24CY2403	**Credits**	: 04
Hours / Week	: 03 Hours	**Total Hours**	: 39(Th)+26(P) Hours
L–T–P–J	: 3–0–2–0		

Course Learning Objectives:

This course will enable students to:

1. **Acquire** the concept of databases, Entity-Relationship Model and relational model for creating and designing databases for the real-world scenario.
2. **Develop** queries to extract data from the databases using a structured query language.
3. **Differentiate** SQL and NoSQL.
4. **Demonstrate** the operations on MongoDB, Database connectivity with front end and **Optimize** the Database design using Normalization Concepts.
5. **Understand** the importance of Transaction Management, Concurrency control mechanism and recovery techniques.

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain the functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher-order Thinking questions in the class.

6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.	
UNIT – I	**10 Hours**
INTRODUCTION TO DATABASE SYSTEMS: Introduction, Characteristics of the Database Approach, Advantages of using DBMS Approach, Data Models, Schemas, Instances and Data Independence, Three Schema Architecture, various components of a DBMS. ***(Text Book-1: Chapter 1: 1.1 to 1.4, 1.6, Chapter 2: 2.1,2.2, 2.4)*** **ENTITY-RELATIONSHIP MODEL:** Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; ER Diagrams ***(Text Book-1: Chapter 7: 7.3, 7.4, 7.5, 7.7)***.	
UNIT – II	**07 Hours**
RELATIONAL MODEL: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update operations and Dealing with Constraint Violations. ***(Text Book-1: Chapter 3: 3.1 to 3.3).*** **SQL –THE RELATIONAL DATABASE STANDARD:** SQL Data Definition and Data types, Specifying constraints in SQL, Basic Queries in SQL-Data Definition Language in SQL, Data Manipulation Language in SQL; ***(Text Book-1: Chapter 4: 4.1 to 4.4).***	
UNIT – III	**08 Hours**
SQL –THE RELATIONAL DATABASE STANDARD: Additional Features of SQL; Views (Virtual Tables) in SQL; Database Programming Issues and Techniques; ***(Text Book-1: Chapter 4: 4.5; Chapter 5: 5.1 to 5.4).*** **SQL AND NOSQL DATA MANAGEMENT:** Triggers, Database connectivity using Python, SQL vs NoSQL, Introduction to MongoDB, ***(Text Book-1: Chapter 5: 5.2,5.3)(Text Book-2 Chapter 1: 1.1 to 1.5)***	

UNIT – IV	07 Hours

NOSQL DATA MANAGEMENT:

Data Types, Data Modelling, CRUD Operations.

***(Text Book-2 Chapter 1: 1.1 to 1.5*) DATABASE**

DESIGN:

Design Guidelines, Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form;

(Text Book-1: Chapter 14: 14.1 to 14.5)

UNIT – V	07 Hours

TRANSACTION MANAGEMENT

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Concurrency Control Mechanisms; Error recovery methods.

***(Text Book-1: Chapter 20: 20.1 to 20.5, Chapter 21: 21.1 to 21.3, Chapter 22: 22.1 to 22.4*)**

Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Use** the basic concepts of database management system in the design and creating database blueprint using E-R model and relational model.	L3
2	**Formulate** SQL and NoSQL queries for building structure and unstructured databases	L3
3	**Demonstrate** database connectivity using vendor specific drivers	L3
4	**Apply** normalization techniques to design relational database management system	L3
5	**Adapt** Transaction Management, concurrency control and recovery management techniques in database management system.	L3

Table: Mapping Levels of COs to POs / PSOs														
COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	-	-	-	-	-	2	2	-	2	3	-
CO2	3	2	1	-	3	-	-	-	2	2	-	2	3	-
CO3	2	2	2	-	3	-	-	-	2	2	-	2	3	-
CO4	3	1	2	-	1	-	-	-	2	2	-	2	3	-
CO5	2	1	-	-	-	-	-	-	2	2	-	2	3	-

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low) TEXT BOOKS:

TEXT BOOKS:

1. Elmasri and Navathe," Fundamentals of Database Systems ", Seventh Edition, Pearson Education, 2021, 2015.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", First Edition, Pearson Education, Inc. 2012.

REFERENCE BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", Third Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudharshan: "Database System Concepts", Seventh Edition, Mc-GrawHill, 2019.
3. C.J. Date, A. Kannan, S. Swamynatham: "An Introduction to Database Systems", Eight Edition, Pearson Education, 2012.

E-Resources:

1. http://nptel.ac.in/courses/106106093/
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/lecture-notes/
3. http://agce.sets.edu.in/cse/ebook/DBMS%20BY%20RAGHU%20RAMAKRISHNAN.pdf
4. http://iips.icci.edu.iq/images/exam/databases-ramaz.pdf
5. https://db-class.org/
6. https://www.w3schools.com/mongodb/

Activity Based Learning (Suggested Activities in Class)

1. Database designing and data extraction using group discussion.
2. Collaborative Activity is minor project development with a team of 4 students.

LABORATORY EXPERIMENTS

Total Contact Hours: 26

Following are experiments to be carried out using either oracle or MySQL, Mongo Db.

1. Design any database with at least 3 entities and establish proper relationships between them. Draw suitable ER/EER diagrams for the system. Apply DCL and DDL commands.
2. Design and implement a database and apply at least 10 Different DML Queries for the following task.
    a. For a given input string display only those records which match the given pattern or a phrase in the search string. Make use of wild characters and like operators for the same. Make use of Boolean and arithmetic operators wherever necessary
3. Write SQL statements to join table and retrieve the combined information from tables.
4. Execute the Aggregate functions count, sum, avg, min, max on a suitable database. Make use of built in functions according to the need of the database chosen.
5. Retrieve the data from the database based on time and date functions like now (), date (), day(), time() etc., Use of group by and having clauses.
6. Write and execute database trigger. Consider row level and statement level triggers.
7. Write and execute program to perform operations on MongoDb Database.
8. Write and execute program to perform CRUD operations.

Open Ended Experiments

1. Consider the Table "employees", write a SQL query to remove all the duplicate emails of employees keeping the unique email with the lowest employee id, return employee id and unique emails.

table: employees

employee id	employee_name	email_id
101	Liam Alton	li.al@abc.com
102	Josh Day	jo.da@abc.com
103	Sean Mann	se.ma@abc.com
104	Evan Blake	ev.bl@abc.com
105	Toby Scott	jo.da@abc.com

2. A salesperson is a person whose job is to sell products or services. Consider the table "Sales" [given below]. Write a SQL query to find the top 10 salesperson that have made highest sale. Return their names and total sale amount.

Table: sales

TRANSACTION_ID	SALESMAN_ID	SALE_AMOUNT
501	18	5200.00
502	50	5566.00
503	38	8400.00
599	24	16745.00
600	12	14900.00

Table: salesman

SALESMAN_ID	SALESMAN_NAME
11	Jonathan Goodwin
12	Adam Hughes
13	Mark Davenport
59	Cleveland Hart
60	Marion Gregory

SCHOOL OF ENGINEERING

(A State Private University under the Karnataka Act No. 20 of 2013)
Approved by UGC & AICTE, New Delhi, Accredited by NAAC with A+ grade

Department of Computer Science and Engineering (Cyber Security)

INTRODUCTION TO CYBER SECURITY

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Subject Code	:	23CY2404	**Credits**	:	04
Hours / Week	:	03 Hours	**Total Hours**	:	39 (Th)+26(P)Hours
L–T–P–S	:	3–0–2–0			

Course Learning Objectives:

This course will enable students to:

1. **Give** insights into the Cyber-incident, Cyber-crime, Cyber-Physical systems and Cybersecurity.
2. **Understand** the cyber-attacks and tools for mitigating them.
3. **Learn** about the information gathering
4. **Understand** issues relating to ethical hacking
5. **Study & employ** network Defense measures

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain the functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher-order Thinking questions in the class.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.

UNIT – I Introduction	**08 Hours**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cybercrimes – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

NIT – II Attacks and Countermeasures	**08 Hours**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

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UNIT – III RECONNAISSANCE	08 Hours
Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – PortScanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.	
UNIT – IV	**08 Hours**
SYSTEM HACKING cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing	
UNIT – V	**07 Hours**
HACKING WEB SERVICES & SESSION HIJACKING Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.	

Course Outcomes:

At the end of the course the student will be able to:

1. **Explain** the basics of cyber security, cybercrime and cyber law.
2. **Classify** various types of attacks and learn the tools to launch the attacks
3. **Apply various tools to perform the information gathering.**
4. **Utilize** brute force, key logger, sniffing and spoofing techniques to assess the computational security of a system.
5. **Summarize** sql injection, cross-site scripting and session hijacking techniques to secure e-commerce-based web services.

Table: Mapping Levels of COs to POs / PSOs														
COs	**Program Outcomes (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	1				1			1	2	1
CO2	2	1			2				1			2	2	2
CO3	3	3	2	2	3							1	2	2
CO4	3	2		1	2		2	3				2	2	2
CO5	3	2	1	1	3		1	3				2	2	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. Anand Shinde, “Introduction to Cyber Security Guide to the World of Cybersecurity”, Notion Press, 2021. (Unit-1 &2)
2. Patrick Engebretson, “The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy”, Elsevier, 2011. (Unit-3)
3. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010

REFERENCE BOOKS:

1. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006
2. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner’s Guide (3rd ed.). Packt Publishing, 2011
3. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc24_cs94/preview
2. https://www.udemy.com/course/complete-ethical-hacking-bootcamp-zero-to-mastery/
3. https://www.coursera.org/projects/metasploit-for-beginners-ethical-penetration-testing
4. https://www.coursera.org/learn/kali-linux

Activity Based Learning (Suggested Activities in Class)

1. Organize a Capture the Flag (CTF) competition where students solve various hacking challenges, including web exploitation, cryptography, reverse engineering, and forensics.
2. Create a phishing simulation where students design and execute a phishing campaign within ethical and controlled boundaries.
3. Role-play various social engineering scenarios where students must gather information through techniques like pretexting, baiting, or tailgating.

4. Analyze real-world hacking incidents, discussing the techniques used, the impact, and the countermeasures that could have been implemented

LABORATORY EXPERIMENTS

Total Contact Hours: 26

1. Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup, ipconfig/ifconfig, ping to gather information about networks and domain registrars.
2. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan and udp port scan.
3. Using Nmap scanner to perform port scanning of various forms like ACK, SYN, FIN, NULL, XMAS.
4. Using Nmap scanner perform the following ping scan like ping scan, don't ping, ack ping, syn ping, udp ping, icmp ping, icmp echo ping, arp ping for host discovery.
5. Perform open source intelligence gathering using Netcraft, Whois Lookups, DNS, Reconnaissance, Harvester and Maltego
6. Study of packet sniffer tools like wireshark and tcpdump.

Open-Ended Experiments

1. Conduct research to identify potential zero-day vulnerabilities in a specific software or hardware system. Document the research methodology, tools used, and any findings. Discuss ethical considerations and responsible disclosure practices.
2. Perform a comprehensive penetration test on a simulated network.
3. Analyze and improve password security.

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AI Essentials for Cyber Security

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – VI

Subject Code	: 24CY2405	Credits	: 04
Hours / Week	: 03 Hours	Total Hours	: 39 (Th)+26(P)Hours
L–T–P–S	: 3–0–0–2		

Course Learning Objectives:

This course will enable students to:

1. **Give** insights into the Cyber-incident, Cyber-crime, Cyber-Physical systems and Cybersecurity.
2. **Understand** the cyber-attacks and tools for mitigating them.
3. **Learn** about the information gathering
4. **Understand** issues relating to ethical hacking
5. **Study & employ** network defense measures

Teaching-Learning Process (General Instructions)

These are sample new pedagogical methods that teachers can use to accelerate the attainment of the various course outcomes.

1. ***Lecture method*** means it includes not only the traditional lecture method but a different *type of teaching method* that may be adopted to develop the course outcomes.
2. ***Interactive Teaching:*** *Adopt* ***Active learning*** that includes brainstorming, discussing, group work, focused listening, formulating questions, note-taking, annotating, and roleplaying.
3. Show ***Video/animation*** films to explain the functioning of various concepts.
4. Encourage ***Collaborative*** (Group Learning) Learning in the class.
5. To make ***Critical thinking***, ask at least three Higher-order Thinking questions in the class.
6. Discuss how every ***concept can be applied to the real world*** - and when that's possible, it helps improve the student's understanding.

UNIT – I	**08 Hours**

Introduction to AI-ML Basics for cyber security-What is ML? -Why use ML in cyber security?-Data in ML-Different Types of ML Algorithms-Supervised and Unsupervised Algorithms- ML architecture

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UNIT – II	**08 Hours**
What is Time Series forecasting? Classes of Time series forecasting- Time series decomposition- Time series in cyber security-DDoS Attacks Prediction- Ensemble Learning Methods-Voting Ensemble methods to detect cyberattacks	

UNIT – III	**08 Hours**
Introduction to the type of abnormalities in URLs- Using heuristics to detect malicious pages-ML techniques to detect malicious URLs- Logistic Regression -SVM and multiclass classification	
UNIT – IV	**08 Hours**
Characteristics of CAPTCHA-Using AI to crack CAPTCHA-EMAIL Spoofing-Spam Detection-Efficient Anomaly detection using K-Means- Detecting anomalies in a network using K-Means	
UNIT – V	**07 Hours**
Decision Tree and Context based malicious event detection- Basics of LLMs-Fundamentals of prompt engineering- Basics of AI powered threat analysis	

Course Outcomes:

At the end of the course the student will be able to:

1. **Explain** the basics of cyber security, cybercrime and cyber law.
2. **Classify** various types of attacks and learn the tools to launch the attacks
3. **Apply various tools to perform the information gathering.**
4. **Utilize** brute force, key logger, sniffing and spoofing techniques to assess the computational security of a system.
5. **Summarize** sql injection, cross-site scripting and session hijacking techniques to secure e-commerce-based web services.

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Table: Mapping Levels of COs to POs / PSOs														
COs	**Program Outcomes (POs)**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	1				1			1	2	1
CO2	2	1			2				1			2	2	2
CO3	3	3	2	2	3							1	2	2
CO4	3	2		1	2		2	3				2	2	2
CO5	3	2	1	1	3		1	3				2	2	2

3: Substantial (High) **2: Moderate (Medium)** **1: Poor (Low)**

TEXT BOOKS:

1. A. Hands-on Machine Learning for Cyber Security by Soma Halder, ISBN139781788992282

References

1. Machine Learning and Security by David Freeman, Clarence Chio Publisher: O'Reilly Media, Inc. Release Date: February 2018 ISBN: 9781491979891
2. Malware Data Science by Joshua Saxe with Hillary Sanders, ISBN-10: 1-59327-859-4 ISBN-13: 978-1-59327-859-5 Publisher: William Pollock

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Department of Computer Science and Engineering (Cyber Security)

COMPUTER ORGANIZATION AND ARCHITECTURE

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – IV

Course Code	: 24CY2406	**Credits**	: 03
Hours / Week	: 03 Hours	**Total Hours**	: 39 Hours
L–T–P-J	: 3–0–0-0		

Course Learning Objectives:

This Course will enable students to:

1. **Understand** the Architecture and programming of ARM microprocessor.
2. **Develop** program using Arm instruction set and appreciate the advanced features provided in the ARM
3. **Understand** the exception handling techniques.
4. **Study in** detail the concept of instruction level parallelism and concepts of pipelining.
5. **Understand** various cache memory mapping techniques and memory Organization.

Teaching-Learning Process

7. ***Lecture method*** along with traditional lecture method, different *type of teaching methods* may be adopted to develop the course outcomes.
8. ***Interactive Teaching:*** *incorporating* brainstorming, discussing, group work, focused listening, formulating questions, notetaking, annotating, and roleplaying.
9. Showing ***Video/animation*** films to explain functioning of various concepts.
10. Encourage ***Collaborative*** (Group Learning) Learning in the class.
11. To make ***Critical thinking***, asking Higher order Thinking questions in the class in the form of Quiz and writing programs with complex solutions.
12. Showing the ***different ways to solve*** the same problem and encourage the students to come up with their own creative ways to solve them.

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UNIT – I	**05 Hours**
An Overview of Computing Systems: History of Computers, The Computing Device, **The ARM7TDMI Programmers' Model:** Introduction, Data types, Processor Modes, Registers, Program Status Registers, The vector Table. **Assembler Rules and Directives:** Structure of Assembly Language Modules, Registers, Directives and Macros. **Loads, Stores and Addressing:** LODS and STORES instructions, Operand Addressing, ENDIANNES ***Text Book-1: 1.1 to 1.3; 2.1 to 2.6; 4; 5.3, 5.4, 5.5***	
UNIT – II	**05 Hours**
Constants and Literal Pools: The ARM Rotation Scheme, Loading Constants and address into Registers **Logic and Arithmetic:** Flags and their Use, compare instructions, Data Processing Instructions **Loops and Branches:** Branching, Looping, Conditional Execution, Straight-Line Coding **Subroutines and Stacks:** Stack, Subroutines, Passing parameters to subroutines, The ARM APCS. ***(Text Book-1: 6.1 to 6.4; 7.1 to 7.4; 8.2 to 8.6; 10.1 to 10.5***	
UNIT – III	**05 Hours**
Mixing C and Assembly Language: Inline Assembler Embedded Assembler, Calling Between C and Assembly. **Exception Handling:** Interrupts, Error Conditions, Processor Exception Sequence, The Vector Table, Exception Handlers, Exception Priorities, Procedures for Handling Exceptions. ***(Text Book-1: 11.1 to 11.8; 14.1 to 14.4***	
UNIT – IV	**12 Hours**
Pipelining: Basic and Intermediate Concepts Introduction, The Major Hurdle of Pipelining, How Pipelining Implemented, what makes Pipelining hard to Implement, Extending the MIPS Pipeline to Handle Multicycle Operations, The MIPS R4000 Pipeline, Crosscutting Issues. ***Text Book-2: C.1 to C.7***	
UNIT – V	**12 Hours**
Memory Hierarchy: Introduction, Cache Performance, Six basic cache Optimizations, Virtual Memory, Protection and examples of Virtual Memory, Fallacies and Pitfalls. ***Text Book-2: B.1 to B.6***	

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Course Outcome	Description	Bloom's Taxonomy Level
At the end of the course the student will be able to:		
1	**Apply** knowledge of the internal architecture and organization of ARM microprocessors to utilize their components and functionalities.	L3
2	**Apply** the instruction set of ARM Microprocessor by writing Assembly language programs.	L3
3	**Analyze and compare** the various exception handling techniques.	L4
4	**Examine** the concept of instruction-level parallelism and **analyze** the principles of Pipelining techniques.	L4
5	**Compare** and **Contrast** memory hierarchy and its impact on computer cost/performance.	L4

Table: Mapping Levels of COs to POs / PSOs

COs	Program Outcomes (POs)												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3		2										2	
CO2	3		3		1								2	
CO3	3	3	1										2	
CO4	3	3	1										2	
CO5	3	3	1										2	

3: Substantial (High) 2: Moderate (Medium) 1: Poor (Low)

TEXT BOOKS:

1. William Hohl, "ARM Assembly Language", 2nd Edition, CRC Press, 2009.
2. John L Hennessy, David A Patterson, "Computer Architecture, A Quantitative Approach",
5th Edition, Morgan Kaufmann publishers, 2012.

REFERENCE BOOKS:

1. David A Patterson, John L Hennessy, "Computer Organization and Design", 4th Edition, Morgan Kaufmann publishers, 2010.
2. Steve Furber, "ARM System-on-chip Architecture", 2nd Edition, Pearson Publications, 2000.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill, 2002.

E-Resources:

1. https://www.udemy.com/topic/arm-cortex-m/
2. https://www.edx.org/school/armeducation
3. https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Activity Based Learning (Suggested Activities in Class)

1. Mini project implementation using Assembly Language Programming.
2. Demonstration of solution to a problem through programming.

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