Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Curriculum Structure and Syllabus

of

Second Year B. Tech. Information Technology
(Regulations 2023)

Effective from Academic Year 2026-27
(Updated with minor changes)

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

EOMS Policy

"We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute's social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS)."

Course Approval Summary

Board of Studies - Department of Information Technology

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS Chairman
1.	Data Structures	BIT23PC01	2-3	
2.	Data Structures Laboratory	BIT23PC02	4-6	
3.	Computer Organization and Architecture	BIT23PC03	7-8	
4.	Object-Oriented Programming	BIT23PC05	9-11	
5.	Data Science Laboratory	BIT23VS01	12-13	
6.	Design Thinking and Innovation Management	BIT23EM01	14-15	
7.	Computer Networks Technology	BIT24PC01	55-56	
8.	Computer Networks Technology Laboratory	BIT24PC02	57-58	
9.	Database Management System	BIT24PC03	59-60	
10.	Database Management System Laboratory	BIT24PC04	61-62	
11.	Community Engagement Project	BIT24EL01	63-64	
12.	Business Finance for Engineers	BIT24EM01	67-68	

Chairman
BoS, Information Technology
PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26, Pradhikaran, Nigdi, Pune-44

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Board of Studies–Civil Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	E-Waste Management	BCI23OE01	33-34	
2.	Total Quality Management	BCI23OE02	48-49	
3.	Building Services and Maintenance	BCI23OE03	50-51	

Chairman
BoS, Civil Engineering
PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26, Pradhikaran, Nigdi, Pune-44

Board of Studies–Electronics and Telecommunication Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Electrical Machines	BET23OE01	20-21	

Chairman
BoS, Electronics & Telecommunication Engineering
PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26, Pradhikaran, Nigdi, Pune-44

2.	Introduction to Signals and Systems	**BET23OE02**	22-23	
3.	Biology for Engineers	**BET23OE03**	36-37	
4.	Human Behavior, Ethics & Wisdom	**BET23OE04**	38-39	

Board of Studies–Mechanical Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Material Science	**BME23OE01**	28	Chairman BoS, Mechanical Engineering PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2.	Drawing for Engineers	**BME23OE02**	29-30	
3.	Fundamentals of Mechanical Components and Systems	**BME23OE03**	31-32	
4.	Industry 4.0	**BME23OE04**	44-45	
5.	Energy Storage Management	**BME23OE05**	46-47	

Board of Studies–Applied Science and Humanities

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Universal Human Values	**BSH23VE01**	16-18	Chairman BoS, Applied Sciences & Humanities PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44
2.	Professional Development Training	**BSH24AE05**	65-66	
3.	Constitution of India	**BSH24VE02**	69-70	
4.	Applied Mathematics (Suggested for Mechanical branch)	**BSH24OE01**	72-73	
5.	Computational Techniques (Suggested for E&TC branch)	**BSH24OE02**	74-75	
6.	Applied Mathematics (Suggested for Civil branch)	**BSH24OE03**	76-77	
7.	Computational Techniques (Suggested for Computer and IT branches)	**BSH24OE07**	78-79	
8.	Mathematical Optimization (Suggested for CSE -AIML branch)	**BSH24OE08**	80-81	
9.	Statistical Data Analysis using R	**BSH23OE04**	24-25	
10.	Advanced Materials & Characterizations	**BSH23OE05**	26-27	
11.	Neural Network and Fuzzy Logic Control	**BSH23OE06**	42-43	

Board of Studies–Computer Engineering

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	Android App Development with Kotlin	BCE23OE03	52-53	Chairman BoS, Computer Engineering PCET's, Pimpri Chinchwad College of Engineering Sector No. 26, Pradhikaran, Nigdi, Pune-44

Board of Studies–Computer Science and Engineering (AIML)

Sr. No.	Name of the Course	Course Code	Page number	Signature and stamp of BoS chairman
1.	AI for Financial Modelling	BCS23OE01	40-41	Chairman, Board of Studies Computer Science & Engineering (AI & ML) PCET's Pimpri Chinchwad College of Engineering Sector 26, Pradhikaran, Nigdi, Pune - 411044.

Approved by Academic Council:

Chairman
Academic Council
PCET's, Pimpri Chinchwad College of Engineering
Sector No. 26, Pradhikaran, Nigdi, Pune-44

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

PCCOE "Knowledge Brings Freedom"

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CURRICULUM FRAMEWORK
(Regulations 2023)

LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	PEC	Programme Elective Course
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective Course
7	VSEC	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	EEM	Entrepreneurship/Economics/Management Course
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	LLC	Liberal Learning Courses

COURSE WISE CREDIT DISTRIBUTION

Sr. No.	Type of Course	No. of Courses	Total Credits	
			No.	%
1	Basic Science Course	**8**	**14**	8.75
2	Engineering Science Course	**5**	**12**	7.50
3	Programme Core Course	**22**	**46**	28.75
4	Programme Elective Course	**11**	**20**	12.50
5	Multidisciplinary Minor	**6**	**14**	8.75
6	Open Elective Course	**3**	**6**	3.75
7	Vocational and Skill Enhancement Course	**4**	**8**	5.00
8	Ability Enhancement Course	**2**	**4**	2.50
9	Entrepreneurship/Economics/Management Course	**2**	**4**	2.50
10	Indian Knowledge System	**1**	**2**	1.25
11	Value Education Course	**2**	**4**	2.50
12	Experiential Learning Courses	**4**	**22**	13.75
13	Liberal Learning Courses	**2**	**4**	2.50
	Total	**72**	**160**	**100.00**

SEMESTER-WISE COURSE DISTRIBUTION

Course Distribution: Semester Wise										
Sr. No.	Type of Course	No. of Courses / Semester								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	4	4							8
2.	Engineering Science Course	3	2							5
3.	Programme Core Course		1	4	4	5	4	4		22
4.	Programme Elective Course					2	4	4	1	11
5.	Multidisciplinary Minor			1	1	2	1	1		6
6.	Open Elective Course			2	1					3
7.	Vocational and Skill Enhancement Course	1	1	1			1			4
8.	Ability Enhancement Course		1		1					2
9.	Entrepreneurship/Economics/Management Course			1	1					2
10.	Indian Knowledge System	1								1
11.	Value Education Course			1	1					2
12.	Experiential Learning Courses				1			1	2	4
13.	Liberal Learning Courses	1	1							2
Total		**10**	**10**	**10**	**10**	**09**	**10**	**10**	**3**	**72**

SEMESTER-WISE CREDIT DISTRIBUTION

Credit Distribution: Semester Wise										
Sr. No.	Type of Course	No. of Credits / Semester								Total
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	7	7							14
2.	Engineering Science Course	7	5							12
3.	Programme Core Course		2	8	8	12	8	8		46
4.	Programme Elective Course					4	8	6	2	20
5.	Multidisciplinary Minor			2	2	4	2	4		14
6.	Open Elective Course			4	2					6
7.	Vocational and Skill Enhancement Course	2	2	2			2			8
8.	Ability Enhancement Course		2		2					4
9.	Entrepreneurship/Economics/Management Course			2	2					4
10.	Indian Knowledge System	2								2
11.	Value Education Course			2	2					4
12.	Experiential Learning Courses				2			4	16	22
13.	Liberal Learning Courses	2	2							4
Total		**20**	**20**	**20**	**20**	**20**	**20**	**22**	**18**	**160**

Curriculum Structure

Second Year B.Tech.

Information Technology

CURRICULUM STRUCTURE

Second Year B.Tech. (Information Technology) Semester – III

Second Year B.Tech Information Technology (Regulations 2023) (With effect from Academic Year 2026-27)																	
Semester III																	
Course Code	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hours/Week)**					**Evaluation Scheme and Marks**						
											FA		**SA**	**TW**	**PR**	**OR**	**Total**
		L	**P**	**T**	**Total**	**L**	**P**	**T**	**O**	**Total**	**FA1**	**FA2**					
BIT23PC01	Data Structures	2	-	-	**2**	2	-	-	1	3	10	10	30	-	-	-	50
BIT23PC02	Data Structures Laboratory	-	2	-	**2**	-	4	-	-	4	-	-	-	50	25	25	100
BIT23PC03	Computer Organization and Architecture	2	-	-	**2**	2	-	-	1	3	10	10	30	-	-	-	50
BIT23PC05	Object-Oriented Programming	1	1	-	**2**	1	2	-	1	4	25	-	-	-	25	-	50
-	Multidisciplinary Minor-1*	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
-	Open Elective – Engineering Sciences	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
-	Open Elective - Department Specific	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
BIT23EM01	Design Thinking and Innovation Management	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
BSH23VE01	Universal Human Values	2	-	-	**2**	2	-	-	-	2	25	25	-	-	-	-	50
BIT23VS01	Data Science Laboratory	-	2	-	**2**	-	4	-	-	4	-	-	-	50	50	-	100
Total		**15**	**5**	**0**	**20**	**15**	**10**	**0**	**3**	**28**	**110**	**85**	**180**	**100**	**100**	**25**	**600**

*Multidisciplinary Minor-1: kindly refer to the booklet of Multidisciplinary Minor

Note: Students are required to ensure that the same course is not selected under multiple categories such as Core Courses, Programme Electives, Open Electives, or through the Minor Degree in Multidisciplinary Studies. Each course should be credited only once towards the degree requirements

L-Lecture, **P**-Practical, **T**-Tutorial, **FA**–Formative Assessment, **FA1**-Formative Assessment 1, **FA2**-Formative Assessment 2, **SA**-Summative Assessment, **TW**-Term Work, **PR**-Practical Exam, **OR**-Oral Exam. **O-** Other i.e. self directed learning, self study, outside the class efforts.

CURRICULUM STRUCTURE

Second Year B.Tech. (Information Technology) Semester – IV

Second Year B.Tech Information Technology (Regulations 2023) (With effect from Academic Year 2026-27)																	
Semester IV																	
Course Code	Course Name	Credit Scheme				Teaching Scheme (Hours/Week)					Evaluation Scheme and Marks						
											FA		SA	TW	PR	OR	Total
		L	P	T	Total	L	P	T	O	Total	FA1	FA2					
BIT24PC01	Computer Networks Technology	2	-	-	**2**	2	-	-	1	3	10	10	30	-	-	-	50
BIT24PC02	Computer Networks Technology Laboratory	-	2	-	**2**	-	4	-	-	4	-	-	-	50	50	-	100
BIT24PC03	Database Management System	2	-	-	**2**	2	-	-	1	3	10	10	30	-	-	-	50
BIT24PC04	Database Management System Laboratory	-	2	-	**2**	-	4	-	-	4	-	-	-	50	50	-	100
-	Multidisciplinary Minor-2*	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
-	Open Elective-Mathematics	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
BIT24EL01	Community Engagement Project	-	2	-	**2**	-	4	-	-	4	-	-	-	100	-	-	100
BSH24AE05	Professional Development Training	-	2	-	**2**	-	4**	-	-	4	-	-	-	100	-	-	100
BIT24EM01	Business Finance for Engineers	2	-	-	**2**	2	-	-	-	2	10	10	30	-	-	-	50
BSH24VE02	Constitution of India	2	-	-	**2**	2	-	-	-	2	25	25	-	-	-	-	50
Total		**12**	**8**	**0**	**20**	**12**	**16**	**0**	**2**	**30**	**75**	**75**	**150**	**300**	**100**	**0**	**700**

*Multidisciplinary Minor-2: kindly refer to the booklet of Multidisciplinary Minor
**Practical will be held division wise and not batch wise

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Note: Students are required to ensure that the same course is not selected under multiple categories such as Core Courses, Programme Electives, Open Electives, or through the Minor Degree in Multidisciplinary Studies. Each course should be credited only once towards the degree requirements

L-Lecture, **P**-Practical, **T**-Tutorial, **FA**–Formative Assessment, **FA1**-Formative Assessment 1, **FA2**–Formative Assessment 2, **SA**-Summative Assessment, **TW**-Term Work, **PR**-Practical Exam, **OR**-Oral Exam. **O**-Other i.e. self directed learning, self study, outside the class efforts.

Note- "Exit Policy: Available as a separate document"

List of Open Elective – Engineering Sciences

Course Code	Course Name	Offering Department	
BET23OE01	Electrical Machines	E&TC	Choose any one
BET23OE02	Introduction to Signals and Systems	E&TC	
BSH23OE04	Statistical Data Analysis using R	AS&H	
BSH23OE05	Advanced Materials and Characterizations	AS&H	
BME23OE01	Material Science	Mechanical	
BME23OE02	Drawing for Engineers	Mechanical	
BME23OE03	Fundamentals of Mechanical Components and Systems	Mechanical	
BCI23OE01	E-Waste Management	Civil	

List of Open Elective - Department Specific

Course Code	Course Name	Offering Department	
BET23OE03	Biology for Engineers	E&TC	Choose any one
BET23OE04/BET24OE04	Human Behavior, Ethics & Wisdom	E&TC	
BCS23OE01	AI for Financial Modelling	CSE(AI&ML)	
BSH23OE06	Neural Network and Fuzzy Logic Control	AS&H	
BME23OE04	Industry 4.0	Mechanical	
BME23OE05	Energy storage management	Mechanical	
BCI23OE02	Total Quality Management	Civil	
BCI23OE03	Building Services and Maintenance	Civil	
BCE23OE03	Android App Development with Kotlin	Computer	

List of Open Elective- Mathematics

Course Code	Course Name	Offering Department	
BSH24OE01	Applied Mathematics (Suggested for Mechanical branch)	AS&H	Choose any one
BSH24OE02	Computational Techniques (Suggested for E&TC branch)	AS&H	
BSH24OE03	Applied Mathematics (Suggested for Civil branch)	AS&H	
BSH24OE07	Computational Techniques (Suggested for Computer and IT branches)	AS&H	
BSH24OE08	Mathematical Optimization (Suggested for CSE -AIML branch)	AS&H	

Course Syllabus

Semester III

Program	B. Tech. I.T.						Semester	III
Course	Data Structures						Code	BIT23PC01
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior knowledge of:

1. Programming.
2. Problem solving skills

is essential

Course Objectives:

1. To learn and apply linear data structures and their applications.
2. To apply data structures such as trees and graphs to the applications.

Course Outcomes:

After learning the course, the students will be able to:

1. Apply the concepts of dynamic, static memory allocation to implement array and linked list.
2. Make use of abstract properties of stack and queue data structures to design solutions of problems.
3. Apply tree, symbol table and hash table data structures to search and update the data.
4. Make use of graph data structure to solve problems.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Sequential and Linked Data Organization** **Concept of Data Structures:-** Concept of data, Data structure, linear and Nonlinear, Static and Dynamic memory allocation, Definition of ADT, Asymptotic Notations **Sequential Organization:** Single and multidimensional array and address calculation. **Linked Organization:** Concept of linked organization, Singly Linked List, Doubly Linked List, Circular Linked List (Operations: Create, Display, Search, Insert, Delete).	7
2.	**Stacks and Queues:** **Stack:** Concept of the Stack, Stack as an ADT, Implicit and Explicit Stack, Applications of stack. **Queue:** Concept of the Queue, Queue as an ADT, Types of Queues - Circular queue, Double-Ended Queue, and Priority Queue, Applications of Queue.	8
3.	**Trees** **Trees:** Trees terminology, Binary tree as an ADT. Conversion of the general tree to binary tree. **Concept of Binary Search Tree:** BST as ADT, Recursive and non-recursive algorithms for Binary Search Trees traversals. **Balanced Binary Tree:** AVL, Red and Black tree. **Symbol Tables & Hashing:** Symbol table- Static, Dynamic, hashing functions, collision techniques.	10
4.	**Graphs** **Graph:** Graph as an Abstract Data Type, Representation using adjacency matrix and adjacency list, Graph Traversal - Depth First Search & Breadth First Search,Minimum Cost Spanning Tree, Applications of graph.	5
	Total	**30**

Text Books:

1. John Canning, Alan Broder, Robert Lafore. *Data Structures & Algorithms in Python*. Addison-Wesley

Professional, October 2022.
2. Horowitz and Sahani—*Fundamentals of Data Structures in C++*, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926
3. Robert Lafore. *Data Structures & Algorithms in Java*. 2nd edition. Sams Publishing (Pearson), September 6, 2017 (©2018). ISBN-13: 9780134847993.

Reference Books:

1. Narasimha Karumanchi. *Data Structure and Algorithmic Thinking with Python*. Career Monk Publications, 2015.
2. R. Gillberg, B. Forouzn —*Data Structures: A Pseudo code approach with C*, Cenage Learning, ISBN: 9788131503140.
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser. *Data Structures and Algorithms in Java*. 6th Edition. Wiley, January 2014. ISBN-13: 9781118771334.

E-sources:

1. https://onlinecourses.nptel.ac.in/noc22_cs26/preview
2. https://nptel.ac.in/courses/106106133
3. https://nptel.ac.in/courses/106102064

Program	B. Tech. I.T.					Semester		III
Course	Data Structures Laboratory					Code		BIT23PC02
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
2	-	4	-	-	50	25	25	100

Prior knowledge of:

1. Computer Programming and Problem Solving

is essential

Course Objectives:

1. To apply various Linear data structures such as Arrays, Linked List, Stack and Queue for solving problems.
2. To apply various Non Linear data structures such as trees and graphs for application development.

Course Outcomes:

After learning the course, the students will be able to:

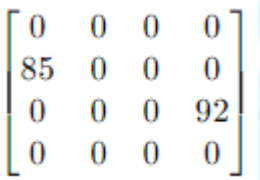
1. Analyze the problem requirements and determine the most appropriate data structure to solve it.
2. Implement different search and sort methods.
3. Apply Linear Data Structures for solving various real life problems.
4. Apply Non-Linear Linear Data Structures for solving various real life problems.

Guidelines:

Continuous assessment of the laboratory is done based on overall performance and laboratory assignments performance of students. Each laboratory assignment assessment will assign marks based on parameters with appropriate weights. Suggested parameters for overall assessment as well as each laboratory assignment assessment include - Neatness and cleanliness in Experimental write-up, Efficient Code, Innovation, Interpretation of results and conclusions, Punctuality, Overall behaviour, attitude and performance.

Detailed Syllabus

Assignment No.	(Assignment on Searching and Sorting)(Any - 2)
1	Write a program to perform linear search and binary search for finding a specific contact in a phone book and return the contact's details.Analyse their time complexity.
2.	A teacher at a local school needs to organize the grades of students to generate their final report cards. The school recently adopted a new grading system, and the grades are stored in a list. Write a program to sort the grades of students using the insertion sort algorithm. Read the grades of students from a file named "grades.txt". Each line in the file consists of a single integer representing a student's grade. Implement the insertion sort algorithm to arrange the grades in ascending order. Display the sorted grades on the console. Save the sorted grades to a new file named "sorted_grades.txt".
3.	Implement a system to sort a list of student records based on marks or names using appropriate sorting algorithms (e.g., bubble sort, selection sort, or Insertion Sort) to organize data efficiently.
(Assignment on Stack and Queue)(Any - 3)	
4.	Consider a hospital record system. Implement it using a singly linked list where each node represents a patient (name, ID, condition, etc.). The system should allow: a. Add patient records b. Remove patient records c. Display all patients

	d. Access/search a specific patient
5.	Implement a train route management system using a doubly linked list to store stations. It should support: a. Insert a station b. Delete a station c. Display all stations d. Search a station e. Print stations in reverse order
6.	Implement a singly circular linked list to manage a music playlist where songs play continuously in a loop, allowing insertion, deletion, display, and traversal of songs in cyclic order.
7.	Imagine you are developing a system to manage student grades in a school. The grades are stored in a matrix where rows represent students, and columns represent subjects. However, most students do not take all subjects, resulting in a sparse matrix where most elements are zero. Given the sparse matrix representing student grades below, implement a solution using arrays to efficiently manage and manipulate the grades data:  Perform operations such as calculating the average grade for each subject, identifying students with the highest grades, and finding the subject with the highest average grade.
(Assignment on Stack and Queue)(Any - 3)	
8.	Implement a stack to manage undo operations in a text editor. Each action (insert/delete) is pushed onto the stack, and undo functionality pops the last action to revert changes.
9.	Write a program to convert infix expressions to postfix and prefix notation using stacks. Given an infix expression as input, the system should efficiently convert it to postfix and prefix notations, considering operator precedence and parentheses. Implement functionalities to handle operators, operands, and parentheses while ensuring correct expression conversion.
10.	Implement a queue to manage customer orders in a restaurant. Orders are added at the rear when placed and processed from the front in FIFO order to ensure timely service.
11.	Implement a circular queue for managing customer orders in a drive-thru lane of a fast-food restaurant. Utilize the circular queue data structure to efficiently handle orders, ensuring fair processing and minimal waiting times. Implement functionalities to add new orders, process orders in a round-robin manner, and track the status of ongoing orders.
(Assignment on Tree)(Any - 2)	
12.	Implement binary search tree and perform following operations: a) Insert (Handle insertion of duplicate entry) b) Delete c) Search d) Display tree (Traversal) e) Display - Depth of tree f) Display - Mirror image g) Create a copy h) Display all parent nodes with their child nodes i) Display leaf nodes j) Display tree level wise.
13.	Implement an AVL tree to store and manage data efficiently, supporting insertion, deletion, and searching while maintaining balance automatically.
14.	Implement the B+ tree data structure to index the student records in the database. Design functions to add new student records, search for student records by student ID, and perform range queries to retrieve student records within a specified range of student IDs.
(Assignment on Graph and Hashing)(Any - 2)	

15.	Implement a graph to represent a network of cities and roads, and use Prim's or Kruskal's algorithm to find the minimum spanning tree that connects all cities with the minimum total cost.
16.	Implement a graph to represent a network of computers, and use Dijkstra's algorithm to find the shortest path for data transfer from a source computer to all other nodes in the network.
17.	Implement a basic student information system that utilizes hashing concepts to efficiently store and retrieve student records. The program should allow users to: • Add new student records. • Retrieve student information by their unique student ID. • Implement basic operations for managing student records.

Reference Books:

1. Karumanchi, N. (2017). Data structures and algorithms made easy: Data structure and algorithmic puzzles (5th ed.). CareerMonk Publications.
2. Mark Allen Weiss. Data Structures and Algorithm Analysis in C++. 4th Edition. Pearson, March 2013. ISBN-13: 9780132847377.
3. Narasimha Karumanchi. Data Structures and Algorithms Made Easy in Java: Data Structure and Algorithmic Puzzles. 2nd Edition. CareerMonk Publications, 2011. ISBN-13: 9788193245279.

E-resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs26/preview
2. https://onlinecourses.nptel.ac.in/noc25_cs81/preview

Program	B. Tech. I.T.				Semester		III	
Course	Computer Organization and Architecture				Code		BIT23PC03	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior knowledge of:

1. Logic Design

is essential

Course Objectives:

1. To understand the structure, function & characteristics of computer systems.
2. To learn the Instruction Set Architecture and CPU organization.
3. To understand the design of the various functional units of computers.

Course Outcomes:

After learning the course, the students will be able to:

1. Interpret various components of computer and their interconnection.
2. Explain processor architecture & its functions.
3. Discuss the concept of Memory Subsystem
4. Illustrate the concepts related to Input/ Output Subsystem.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Basic Structure of Computer** Organization and Architecture, Structure and Function, Evolution of the Intel x86 Architecture, Performance, Multicore CPU, A top level view of Computer function and interconnection: Computer Components, Computer Function, Interconnection structure, bus interconnection, Harvard and Von Neumann Architecture, Performance, Multiprocessors and Multicomputer.	7
2.	**CPU Design** CPU Organization, Hardwired Control, Micro-programmed Control, **Machine** Instruction formats, Instruction sets**: Addressing Modes and Formats**, Types of operations, Instruction set architectures - CISC and RISC, Organization of a processor - Registers, ALU and Control unit, Instruction cycle, Instruction Pipelining, Interrupts.	8
3.	**Memory Subsystem** Computer Memory System Overview, Memory Hierarchy, **Internal Memory:** Semiconductor Memories, DDR-DRAM,SRAM, Read Only Memory (ROM), Types of ROM, Error Corrections, **External Memory:** Magnetic Disks, RAID, SSD, HDD, Optical Memory, Cache Memory: Principles, Elements of Cache Design: Cache Addresses, Cache Size, Mapping Function, Replacement Algorithms, Line Size, Multilevel cache	8
4.	**I/O Subsystem** External Devices , I/O Modules: Module Function, I/O Module structure , Programmed I/O: Overview, I/O commands, I/O instructions, Memory mapped I/O, Interrupt Driven I/O: Interrupt Processing, Intel 82C59A Interrupt Controller, Direct Memory Access : DMA Function, Intel 8237A DMA Controller , I/O Device Interfaces	7
	Total	**30**

Text Books:

1. William Stallings “Computer organization and architecture Designing for Performance” 10th edition, Pearson
2. M. Moris Mano (2006),” Computer System Architecture”, 3rd edition, Pearson/PHI, India

Reference Books:

1. Andrew S. Tanenbaum ,Structured Computer Organization, 5th edition, Pearson Education Inc, 2006
2. John P. Hayes ,Computer Architecture and Organization, 3rd edition, Tata McGrawHill, 1998

E-sources:

1. https://nptel.ac.in/courses/106105163
2. https://archive.nptel.ac.in/courses/117/105/117105078/

Program:			B. Tech. I.T.				Semester:		III				
Course:			Object-Oriented Programming				Code:		BIT23PC05				
Credits			Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks						
L	P	Total	Lecture	Practical	Tutorial	Other	FA		SA	TW	OR	PR	Total
							FA1	FA2					
1	1	2	1	2	-	1	25	-	-	-	-	25	50

Prior knowledge of:

1. Problem Solving skill
2. Programming language

is essential

Course Objectives:

1. To apply the concepts of object oriented paradigm.
2. To design and implement models for real life problems by using object oriented programming.
3. To develop object oriented programming skills.

Course Outcomes:

After learning the course, the students will be able to:

1. Develop Java programs using classes and objects to solve given problems using object-oriented principles.
2. Construct hierarchy of classes through inheritance and polymorphism.
3. Apply the exception handling, multithreading and file handling to implement given problems.
4. Build an object-oriented solution to solve a real life problem.

Guidelines:

- All topics listed below must be covered.
- Continuous assessment of laboratory work should be based on parameters, such as timely completion, performance, innovation, efficient codes, and punctuality.
- Mini project assessment will be based on parameters such as identifying of mini project Topic, Implementation, Demonstration and Team Work.

Recommended Tools: Java, Intellij IDE

Detailed Syllabus

Unit	Description	Duration (Hrs)
1	Object-Oriented Programming (OOP) basics, Class and Object in Java, Constructors: Default, Parameterized, Copy. Constructor Overloading, Accessing and modifying object data, Array of Objects, Encapsulation, this keyword.	3
	Suggested Lab Assignments: **1. Classes, objects and constructors:** Implement a program to create a class called "Person" with a name and age attribute. Create two instances of the "Person" class, set their attributes using different types of constructor, and print their name and age. **2. Array of Objects**: Consider the class City having variable Name and Population.	6

	Implement a program to display details of five different cities. **3. Encapsulation-packages, access modifiers, and data hiding:** Develop a Java-based banking system tailored for the PCCOE Cooperative Bank to facilitate account management and transactions. The assignment requires implementing the following functionalities: 1. Add Account 2. Remove Account 3. Deposit Money 4. Withdraw Money.	
2	Inheritance and its types, Access Modifiers (private, public, protected, default), Polymorphism and its types, Packages, Abstract Classes, interface.	4
	Suggested Lab Assignments: **4. Inheritance and Polymorphism** **a) Polymorphism**: method overloading: Implement program for a geometric shapes application that utilizes function overloading for calculating properties such as area and perimeter. Implement overloaded methods for computing area and perimeter for different shapes (e.g., rectangles, circles, triangles) with varying sets of parameters. **b) Polymorphism**: Method overriding: Develop an application for a social media platform showcasing method overriding. Implement a base class "Post" with methods for posting and commenting, and derived classes representing different post types (e.g., text post, image post) overriding these methods with specific functionality. **5. Abstract classes**: Develop an application for a university's course registration system using abstract classes. Implement an abstract class "Course" with common attributes such as course code, title, and credits, and abstract methods for enrolling students and displaying course details. Derived classes representing specific course types (e.g., Information Technology, Mechanical Engg) extend the "Course" class and provide concrete implementations for student enrollment based on course-specific requirements. **6. Interface:** Create an application for a transportation system where different modes of transport (e.g., car, bus, train) demonstrate polymorphism in their pricing strategies. Implement a common "Transport" interface with a polymorphic method for calculating fares, and each transport type overrides this method to apply its specific fare calculation logic.	8
3	Exceptions and its types, try, catch, finally block, throw, throws, user-defined exception.	3
	Suggested Lab Assignments: **7.** Implementing Exception Handling in Java Using In-Built Exceptions. **8.** Implement a basic stack data structure using arrays and apply Java's try and catch blocks to handle stack overflow and underflow exceptions.	4
4	Multithreading, Creating threads using Thread class and Runnable interface Thread lifecycle and methods. Java I/O Streams: Streams in Java,Byte streams (InputStream, OutputStream) Character streams (Reader, Writer) File Handling in Java: File class, Reading from Files: FileReader and BufferedReader. Writing to Files: FileWriter and BufferedWriter.	5
	Suggested Lab Assignments: **9. Multithreading**: Design an application for performing matrix multiplication using multithreading to improve performance. Implement a matrix multiplication algorithm that divides the computation across multiple threads, with each thread responsible for computing a subset of the resulting matrix. [Use concept of exception handling in implementation]	6

	10. I/O: reading and writing to files, streams: Develop a Java program for analyzing log files using I/O operations to read and process log data from files. Implement a log files reader that reads log entries from a text file and analyzes them to extract useful information such as error counts, warning messages. Utilize file streams and buffered readers to efficiently read log files line by line and perform analysis tasks.	
	Implement a Mini Project using all the concepts of Object Oriented Programming The objective of this mini project is to let the students apply the programming knowledge into a real- world situation/problem and expose the students how programming skills helps in developing a good engineer. The mini project must be done in a group of 3-4 students. Each group must prepare a title that relates to Object Oriented Programming concepts and real-world situations. Sample Mini Project: ▪ Student Management System ▪ Library Management System ▪Airline Reservation System ▪ Hospital Management System ▪ Hotel Management System ▪ Billing System ▪ Bus / Railway Reservation System ▪ Build a Snakes & Ladders game ▪ Sudoku Solver ▪ Maze generator ▪ Dictionary implementation	6
	Total (Theory+ Lab)	**45**

Text Books:

1. E. Dr. Balagurusamy. Programming with Java: A Primer, 4e. 1 January 2010. ISBN-13: 978-0070702240 ISBN-10: 0070702241, Tata – McGraw-Hill Publication, 2019
2. Samanta, Debasis, “Object-Oriented Programming With C++ AND JAVA”, 6th Edition, PHI Learning, 2006

Reference Books:

1. Herbert Schildt, "JAVA: The Complete Reference" 10th Edition, The McGraw Hill Education, 2017 ISBN: 9781259589348.
2. Steve Freeman , Nat Prycer, "Growing Object-Oriented Software, Guided by Tests", 6th Edition, Pearson Education,2010

E-resources:

1. https://www.geeksforgeeks.org/courses/Java-backend-live

Program	B. Tech. I.T.				Semester			III
Course	Data Science Laboratory				Code			BIT23VS01
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
2	-	4	-	-	50	-	50	100

Prior knowledge of:

1. Linear algebra
2. Programming Skills

is essential

Course Objectives:

1. To learn how to manipulate datasets using Python libraries.
2. To apply data pre-processing techniques and interpret through various graphs.
3. To build a strong statistical and algorithmic foundation to infer insights.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate Data Science tools and Environment.
2. Apply pre-processing techniques and visualize the data using Python libraries.
3. Analyze different types of data modeling algorithms.
4. Summarize the report on the Data Science application.

Guidelines:

1. Laboratory Instructors may design a suitable set of assignments for each topic. All topics should be addressed. For every topic, at least three lab assignments should be framed and approved during the module meeting.
2. For each laboratory assignment, it is essential for students to write the title, aim, topic theory, algorithm, mathematical background, and data set description (as applicable).
3. Laboratory Journal- Program codes with sample output of all performed assignments are to be submitted as softcopy.
4. Term Work –Term work is a continuous assessment that evaluates a student's progress throughout the semester. Laboratory Instructors may design rubrics to assess assignments and mini-projects.
5. Practical Examination should be conducted on a given list of topics.

Detailed Syllabus

Sr. No.	List of Topics (Write a program in Python)
1.	**Data Science Tools and Environment, Python programming basics** · Introduction to the laboratory environment (e.g., Jupyter Notebook, Python IDEs) · Introduction to the Data Science · Python Programming for Data Science · Python Data Structures · Introduction to data manipulation libraries (e.g., Pandas, NumPy, MatPlotlib)
2.	**Data Acquisition and Cleaning** · Data importing from various sources (CSV, JSON, SQL databases) · Data scraping techniques (web scraping, API integration) · Data cleaning and preprocessing (handling missing values, outliers, etc.)

3.	**Data Visualization and Exploratory Data Analysis (EDA)** · Data visualization libraries (e.g., Matplotlib, Seaborn) · Exploratory Data Analysis techniques (summary statistics, data distribution analysis, correlation analysis)
4.	**Statistical / Algorithmic Data Modeling** · Hypothesis testing, probability distributions, etc. · Basics of classification and regression algorithms · Model evaluation techniques (performance metrics) · Hands-on exercises with sci-kit-learn library
5.	**Mini-Project Development and Presentation** · Development of Mini-Project and its presentations diverse examples of case studies in data science for Mini-project Predictive Maintenance in Manufacturing, Churn Prediction in Telecom Industry, Fraud Detection in Financial Transactions, Healthcare Predictive Analytics, etc.

Reference Books:

1. Grus Joel, *Data Science from Scratch*, O'Reilly Media Inc., ISBN: 9781491901427
2. McKinney Wes, *Python for Data Analysis,* O' Reilly media, ISBN : 978-1-449-31979-3. 4. Python

E-resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs32/
2. https://www.coursera.org/specializations/introduction-data-science
3. https://www.linkedin.com/learning/topics/data-science
4. https://www.mygreatlearning.com/academy/learn-for-free/courses/basics-of-data-visualization-for-data-science
5. https://www.simplilearn.com/data-science-free-course-for-beginners-skillup?source=SidebarWidget_SkillUp
6. https://www.scaler.com/topics/course/python-for-data-science/
7. https://www.mygreatlearning.com/data-science/free-courses
8. https://www.mygreatlearning.com/data-visualization/free-courses

Program:	B. Tech. I.T.						**Semester :** III	
Course:	Design Thinking and Innovation Management						**Code:**	BIT23EM01
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
02	02	-	-	-	10	10	30	50

Prior knowledge of:

Basic understanding of software development

is essential

Course Objectives:

1. To introduce design thinking principles for problem solving.
2. To develop skills in using design thinking and innovation tools to create digital solutions.

Course Outcomes:

After learning the course, the students will be able to:

1. **Utilize** design thinking principles to identify user needs for software solutions.
2. **Apply** the design thinking process to create user-centered requirements and ideas.
3. **Make use of** design thinking tools to generate and refine IT solution concepts.
4. **Apply** innovation management practices and risk assessment to IT product development.

Detailed Syllabus

Unit	**Description**	**Duration [Hrs]**
I	**Foundations of Design Thinking** Meaning and principles of Design Thinking ,Role of design thinking in modern IT problem-solving and digital innovation, Need for creativity, user-centricity, and ideation in software engineering, Opportunity assessment for software solutions: Identifying user pain points, system gaps, and digital opportunities, Product-Market Fit, Product-Technology Fit, and Product-Business Fit, Introduction to design mindset for IT project teams.	7
II	**Design Thinking Process** Five-stage Design Thinking frameworks, User research, empathy mapping, persona creation for digital systems, Problem framing, requirement understanding, and workflow mapping, Ideation techniques for IT solutions	8
III	**Tools for Design Thinking and Innovation** Phase 1:Brain-storming, Mind-mapping and Affinity-mapping; Phase 2: Concept Maps, Personas, Causal Diagrams, Journey Mapping ; Phase 3: Lateral Thinking, Removing Mental Blocks, SCAMPER, Rapid Idea Sketching; Phase 4: Paper Prototype, Soft Prototyping, Information Architecture; Phase 5: Hi-fidelity prototypes, Usability Studies; Phase 6: Business Models, Presentation Methods	8
IV	**Innovation Management** Innovation concepts in IT and technology-based industries, Sources and types of innovation in software (incremental, disruptive, architectural), Agile innovation, rapid experimentation, MVP development, Evolution of innovation management in IT companies, Risk management for technology innovation, Measuring innovation performance in software organizations.	7
	Total	**30**

Text Books:

1. Soni, P. (2020). Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving. Penguin Random House India.
2. Lee, J. H., Ostwald, M. J., & Gu, N. (2025). Design thinking: Creativity, collaboration and culture (2nd ed.). Springer.
3. Srinivasan, R., Ismail, M., & Srinivasan, A. (2025). A textbook on design thinking: Principles, processes and applications. S. Chand Publishing.

Reference Books:

1. Hehn, J., Mendez, D., Brenner, W., & Broy, M. (Eds.). (2022). *Design thinking for software engineering: Creating human-oriented software-intensive products and services*. Springer.
2. Meinel, C., & Leifer, L. (Eds.). (2023). *Design thinking research: Innovation – insight – then and now*. Springer.

E-resources:

1. https://onlinecourses.swayam2.ac.in/aic25_ge11/preview
2. https://www.designdisciplin.com/p/the-story-of-design-thinking
3. https://online.hbs.edu/blog/post/what-is-design-thinking

Program:	B. Tech.						Semester:	I
Course:	Universal Human Values						Code:	BSH23VE01
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	25	25	-	50

Course Objectives:

This course aims at enabling students,

1. To appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
2. To facilitate the development of a holistic perspective among students to lead their personal and professional lives in an ethical way.
3. To highlight plausible implications of such a holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour, and mutually enriching interaction with nature.

Course Outcomes:

After learning the course, the students should be able to:

1. Illustrate the relevance of Universal Human Values using real-life examples from personal, social, and professional contexts.
2. Interpret a human being as the co-existence of ‘Self’ and ‘Body’.
3. Apply the concept of harmony in family and society to given scenarios with appropriate value-based actions.
4. Apply Universal Human Values to promote coexistence with nature in personal and professional life.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Introduction to Value Education:** • Understanding Value Education • Self-exploration as the Process for Value Education • Continuous Happiness and Prosperity • Right Understanding • Current Scenario • Method to fulfil the Basic Human Aspirations	4
	Sharing Session: • Sharing about Oneself • Exploring Human Consciousness • Exploring Natural Acceptance	3
II	**Harmony in the Human Being:** • Human being: the Co-existence of the Self and the Body • Needs of the Self and the Body • The Body as an Instrument of the Self • Understanding Harmony in the Self • Harmony of the Self with the Body • Programme to Ensure Self-Regulation and Health	4

	Sharing Session: • Exploring the Difference between Needs of Self and Body • Exploring Sources of Imagination in the Self • Exploring Harmony of Self with the Body • AI Integration: Personal Habit Analysis	4
III	**Harmony in the Family and in Society:** • Harmony in the Family • 'Trust'—the Foundational Value in Relationship • 'Respect'—the Right Evaluation • Other feelings (Values) in Human-to-Human Relationship • Understanding Harmony in Society • Vision for the Universal Human Order • Five Dimensions of Human Order	4
	Sharing Session: • Exploring the Feeling of Trust • Exploring the Feeling of Respect and Exploring Systems to • Fulfil Human Goal	3
IV	**Harmony in Nature/Existence:** • Understanding Harmony in Nature, • Realizing Existence as Coexistence at All Levels • The Holistic Perception of Harmony in Existence **Implications of Holistic Understanding: A Look at Professional Ethics:** • Definitiveness of (Ethical) Human Conduct • Humanistic Constitution and Universal Human Order • Competence in Professional Ethics • Holistic Technologies, Production Systems and Management Models -Typical Case Studies • Strategies for Transitioning towards Value-Based Life and Profession.	4
	Sharing Session: • Exploring the Four Orders of Nature • Exploring Co-existence in Existence • Exploring AI for Holistic Technologies • Exploring Humanistic Models in Education • Exploring Steps of Transition towards Universal Human Order	4
	Total	**30**

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2019, A Foundation Course in HUMAN VALUES and Professional Ethics- Presenting a universal approach to value education through self-exploration, Excel Books

Reference Books: P.L. Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

1. A. Nagaraj, 1999, JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak,
2. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
3. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
4. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd.
5. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
6. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

e-sources:

1. http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
2. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
3. https://youtu.be/OgdNx0X923I

Open Electives

Engineering Sciences

Program :	B. Tech. I.T.					Semester:		III
Course :	**Electrical Machines** (offered by E&TC) (Open Elective- Engineering Sciences)					Code :		BET23OE01
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	2	-	-	-	10	10	30	50

Prior knowledge of

- Fundamental knowledge of electromagnetism & electrical parameters.

is essential.

Course Objectives:

This course aims at enabling students,

1. To impart basic knowledge for conceptual understanding of DC machines.
2. To explore the construction and performance characteristics of three phase AC machines.
3. To explore the construction and performance characteristics of single-phase AC machines.
4. To relate the applications of electrical machines to practical and industrial scenarios.

Course Outcomes:

After learning the course, the students should be able to:

1. Describe the constructional features and working principles of DC Machines.
2. Explain the constructional features and operation of three phase induction motors
3. Explain the constructional features and operation single phase induction motors
4. Relate the applications of electrical machines to their respective fields of study and industrial applications.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
1	**Introduction to Electrical Machines:** Overview of electrical machines and their significance, Classification of electrical machines, Fundamental principles: Faraday's Law, Lenz's Law, and Electromagnetic Induction. **DC Machines** Working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics, Necessity of a starter for DC motor, Speed control methods of DC shunt and DC series motor and industrial applications.	8
2	**Three phase induction motor** – constructional features, working principle, Rotating magnetic field, slip ring and cage types. slip, phasor diagram, expression for mechanical power and torque, torque-slip characteristics, starting torque, full load and pull-out torque, equivalent circuit. Industrial applications.	7
3	**Single phase induction motors:** Construction of single-phase induction motor, double field revolving theory. Types of single-phase induction motors: Split phase and shaded pole type induction motors, applications. Specifications of induction motors (KW rating, rated voltage, current rating, frequency, speed, class of insulation)	8

4	**Special Purpose Motors:** Construction, principle of working, characteristics ratings and applications of Brush less D.C. motors, Stepper motors (permanent magnet and variable reluctance type only), Permanent Magnet motor (A.C. & D.C.), SRM Switch reluctance motor.	7
	Total	

Text Books:

1. V. N. Mittal and Arvind Mittal,"Basic Electrical Engineering" , 2nd Edition. (McGraw-Hill),2010
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010

Reference Books:

1. J.B. Gupta, "Theory and Performance of Electrical Machines," S.K. Kataria & Sons.
2. A.E. Fitzgerald, Charles Kingsley, Stephen D. Umans, "Electric Machinery," McGraw-Hill Education.
3. D. C. Kulshreshtha, "Basic Electrical Engineering" , 1st Edition (Tata McGraw hill),2009
4. B. L. Theraja and A. K. Theraja S. Chand & Co. Pvt. Ltd. New Delhi, "A textbook of Electrical Technology Vol II",2020

E-Resources:

1. Electrical Machines – I-https://onlinecourses.nptel.ac.in/noc20_ee60/preview
2. Electrical Machines – I-https://archive.nptel.ac.in/courses/108/105/108105017/

PCCOE "Knowledge Brings Freedom"

Program :	B. Tech. I.T.	Semester: III	
Course :	**Introduction to Signals and Systems** (Offered by E&TC) (Open Elective- Engineering Sciences)	Code :	BET23OE02

Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior knowledge:
Linear Algebra & Differential Calculus **is essential.**

Course Objectives:

This course aims at enabling students,

1. To develop an understanding of students related to signal representation, classification, and operations.
2. To build the understanding of analyzing and classifying the systems and their applications
3. To apply the basic concept of Fourier transform and Laplace transform to the systems

Course Outcomes:

After learning the course, the students should be able to:

1. Represent, classify, and perform the operation on signals
2. Classify the system and utilize convolution for system analysis
3. Apply the basics of Fourier transform to analyze the signal in frequency domain
4. Apply the basics of the Laplace transform to analyze the signal in a complex frequency domain.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
1	**Introduction to Signals**: Representation of Standard signals, Classification of signals: Continuous-time and discrete-time signals, Periodic Signals and non-periodic, Operations on signals: Time shifting, Time reversal, Time scaling, Amplitude scaling, Signal addition, Subtraction, Signal multiplication.	**07**
2	**Introduction to System**: System Definition and Application, Classification of Systems: Continuous-time and Discrete-time systems, Linear and Non-Linear systems, Time variant and Time-invariant systems, Stable and Unstable systems, Causal systems, and non-causal systems. Convolution sum using graphical method.	**07**
3	**Fourier Transform**: Fourier Transform (FT) representation of aperiodic continuous time (CT) signals, Evaluation of magnitude and phase response, FT of standard CT signals, Application of Fourier transform	**08**
4	**Laplace Transform and Z Transform**: Definition of Laplace Transform (LT), ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform, Application of Laplace transforms.	**08**
	Total	**30**

Text Books:

1. A.V. Oppenheim, A.S. Willsky ―Signals and systems‖, Prentice-Hall signal processing series. 2nd Edition, 2015
2. A. Nagoor Kanni ―Signals and Systems‖, McGraw Hill, 2nd Edition, 2017

Reference Books:

1. B P Lathi ―Linear Systems and Signals‖, Oxford University Press, Third Edition, 2017
2. Simon Haykins and Barry Van Veen ―Signals and Systems‖, Wiley India, 2nd Edition. 2017
3. M.J. Roberts ―Signal and Systems‖, Tata McGraw Hill, Third Edition ,2019.
4. Charles Phillips ―Signals, Systems and Transforms‖, Pearson Education, 4th Edition. 2013
5. R. J. Beerends, H. G. ter Morsche ―Fourier and Laplace Transforms‖ Cambridge University Press, 2003.
6. Shaila Dinkar Apte, Signals and System, Cambridge University Press, Edition 1, 2018

Online courses Links:

1. https://onlinecourses.nptel.ac.in/noc23_ee14/preview
2. https://www.classcentral.com/course/engineering-iitbombay-signals-and-systems-part-1-2679

PCCoE "Knowledge Brings Freedom"

Program :	S. Y. B. Tech. [COMP-IT-RL-AIML]			Semester: IV			
Course :	Statistical Data Analysis Using R (OEC-Engineering Sciences) (Offered by AS&H)			Code :	BSH23OE04		
Credits	Teaching Scheme (Hrs./Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	CIE		SA	Total
				FA1	FA2		
2	2	-	-	10	10	30	50

Prior knowledge of: Basics of Statistics and Probability
is essential.

Course Objectives: After completion of the course, students will have an adequate background, conceptual clarity, and knowledge of mathematical principles related to data, preprocessing techniques for data visualization, and statistical techniques for prediction and decision-making.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply R software and data handling techniques for the given data.
2. Apply data pre-processing techniques to clean and transform datasets.
3. Draw inferences from data using appropriate visualization techniques.
4. Analyse the data for decision-making using statistical methods.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
I	**Fundamentals of R Software for Data** Introduction to Data: Definition, Types and Properties, R Packages for Data Science, Importing and Exporting Data in R Software, Accessing Databases with R Software.	**7**
II	**Data Wrangling** Pre-processing Data in R Software, Dealing with Missing Values, Data Formatting in R Software, Data Normalization in R Software, Binning in R Software, and Conversion of data types	**7**
III	**Data Visualization** Data visualisation for various data categories like Categorical, Numerical, or both using plots likeHistogram, Bar/ Line Chart, Box Plots (including group-by option), Scatter Plots, Mosaic Plot, etc., and their interpretations	**8**
IV	**Data Analysis** Sampling, Descriptive Statistics, Linear regression and Multiple linear regression. Model evaluation using visualization, prediction, and decision-making.	**8**
	Total	30

Reference Books:

1. Montgomery and Runger, “Applied Statistics and Probability for Engineers”, Wiley, India, 6 Edition, ISBN: 9788126562947.
2. R. Johnson, “Probability and Statistics for Engineers”, Prentice India Ltd, 8 Edition, ISBN 13:978-8120342132.
3. S.P. Gupta, “Statistical Methods”, Paperback publication, 43 edition, ISBN: 9788180549892, 8180549895.
4. Victor A. Bloomfield, “Using R for Numerical Analysis in Science and Engineering”, CRC Press, First Edition, ISBN: 9781315360492

e-sources:

NPTEL Course lectures links:

1. https://www.youtube.com/watch?v=VVYLpmKRfQ8&list=PL6C92B335BD4238AB (Probability)
2. https://nptel.ac.in/courses/111104100 (Introduction to R software)
3. https://www.youtube.com/watch?v=WbKiJe5OkUU&list=PLFW6lRTa1g83jjpIOte7RuEYCwOJa-6Gz (Descriptive statistics using R software)

Program:	B. Tech. I.T.						Semester: III	
Course:	Advanced Materials and Characterizations (OEC-Engineering Sciences) (Offered by AS&H)						Code:	BSH23OE05
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-	-	-	10	10	30	50

Prior knowledge of: basic physics, chemistry and nanotechnology is essential.

Course Objectives: This course aims at enabling students,

1. To learn the principles of advanced materials, technologies and characterizations.
2. To undertake research projects with applications of advanced materials.

Course Outcomes: After learning the course, the students should be able to:

1. Interpret structure, properties and applications of advance engineering materials.
2. Explain the properties and requirements of materials for some advanced applications
3. Analyze structural, optical, elemental & morphological properties of the materials
4. Analyze electrochemical & thermal properties of the materials

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Engineering Materials:** Polymer Composite eg. fiber- reinforced polymer (FRP) composites Advanced carbon materials eg. Graphene & CNT Alloys: a] Nano alloy eg. Cu-Ni nano alloy b] Memory alloy-Nitinol CdSe Thin films for solar cells.	7
II	**Materials for Special applications**: Battery and Supercapacitor: working principles, components, material requirement and properties of electrodes, electrolytes and spacers, Superconductors: Metallic, nonmetallic and ceramic superconductors, Applications, Gas Sensing: working principle and required material properties. Substrate Materials for quantum computer, Invar and Elinvar Materials: properties and applications, 2D materials: properties and their applications	7
III	**Structural, Optical, Elemental & Morphological Characterizations** : X-Ray Diffraction and phase identification, indexing lattice parameter determination, Grain size analysis, EDAX, Electron microscopy, scanning electron microscopy, Transmission electron microscopy (TEM), Fourier Transform Infrared Spectroscopy, Band gap measurements-UV Vis- IR Spectroscopy	8
IV	**Electrochemical and Thermal Characterizations**: Cyclic voltammetry: Instrumentation, currentpotential relation applicable for Linear Sweep Voltammetry (LSV) and Cyclic Voltammetry (CV), interpretation of cyclic voltammograms, charging-discharging behaviors of supercapacitor and batteries. Thermo-gravimetric analysis (TGA),Differential thermal analysis (DTA) analysis, Thermal expansion measurements, Thermal conductivity measurements, Ionic conductivity measurements. Specific heat capacity measurements, Debye temperature measurements	8
	Total	**30**

Text Books:

1. Transmission electron microscopy: a textbook for materials science, David B. Williams, C. Barry Carter, Springer, 2009

2. Advanced solid state physics-Graduate Texts in Condensed Matter, Hendrik Bluhm, Thomas Brückel, Markus Morgenstern, Gero Plessen, Christoph Stampfer, de Gruyter 2019

Reference Books:

1. Elements of X-ray Diffraction, B.D. Culity and S.R. Stock, Pearson Publication, Third edition 2014.

2. Introduction to Fuel Cells, Electrochemistry and Materials, San Ping Jiang, Qingfeng Li, Springer Publication, 2022.

3. Solid State Physics, S.O.Pilli, New age, International Publication Tenth edition 2022.

4. Introduction to Solid State Physics, C. Kittle, 8th edition Wiley, 2005.

5. Introduction to Superconductivity, Michael Tinkham, 2nd edition, Dover Publication 2004.

6. Electrochemical super capacitors, B. E. Conway, Springer, 1999.

7. Spectroscopy, G.R. Chatwal and S.K. Ananad, Himalaya Publications, 2016.

8. Introduction to Thermal Analysis, M.E. Brown, Kluwer academic Publishers, 2nd edition 2001.

9. Electrochemical Methods: Fundamentals and Applications, A, J Bard, Allen J. Bard, Larry R. Faulkner, Henry S. White, John Wiley & Sons, 31 May 2022.

10. Microscopy A Very Short Introduction by Srivastava, Oxford University Press, 2015.

11. Practical Guide to materials Characterization, Khalid Sultan, Wiley-VCH, 2023

12. Engineering Chemistry by Wiley India Pvt.Ltd,First edition 2011.

13. Introduction to Nanotechnology by Charles P. Poole, Frank Owens, John Wiley & Sons (2003)

14. Gas Sensing Fundamentals-Springer Series on Chemical Sensors and Biosensors- Claus-Dieter Kohl, Thorsten Wagner, Springer 2014

e-sources:

1. https://archive.nptel.ac.in/courses/113/106/113106034/

PCCOE "Knowledge Brings Freedom"

Program :	B. Tech. I.T.	**Semester:** III
Course :	**Material Science** **(**Open Elective –Engineering Sciences) (Offered by Mechanical Department)	**Code :** BME23OE01

Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	2	-			10	10	30	50

Prior Knowledge: Nil

Course Objectives:

This course aims at enabling students,

1. To Aquitaine students about materials, their properties, structure property relationship.
2. To create awareness about the importance of materials information in engineering.

Course Outcomes:

After learning the course, the students should be able to:

1. Compare different materials based on their structures.
2. Relate the structure of materials with their properties.
3. Suggest suitable material for given application based on its structure and properties.
4. Explore advanced materials in engineering applications.

Detailed Syllabus:

Unit	**Description**	**Duration [H]**
I	Introduction to materials: Classification of materials, structure of materials :Atomic structure, crystal structure and microstructure, material properties: Physical, Mechanical, Electrical, Magnetic etc.	**8**
II	Metals: Ferrous, non ferrous, alloys, structure and properties of commonly used metals, applications of metals in engineering.	**7**
III	Polymers: Structure of polymers and their properties, Thermoplastic and thermosetting plastics, advanced polymers such as temperature resistant polymers, shape change polymers, conducting polymers Ceramics: Structure of ceramics and their thermal, electrical and magnetic properties, applications of ceramics in engineering.	**8**
IV	Composites: Classification of composite materials and their applications. Processing of advanced materials such as semiconductors.	**7**
	Total	**30**

Text Books:

1. Material Science and Engineering An Introduction, William D. Callister, Wiley Publication,10th Edition 2009.
2. Material Science and Metallurgy, Dr. V. D. Kodgire, Everest publishing house, 45th Edition, 2021.

Reference Books:

1. Materials for Engineering, John Martin, Woodhead Publishing Limited, CRC Press, 3 rd Edition, 2006.

Online Courses:

NPTEL Course : Nature and properties of materials (https://onlinecourses.nptel.ac.in/noc20_me13/course)

NPTEL Course : Properties of materials (https://onlinecourses.nptel.ac.in/noc20_mm13/course)

Program:	B. Tech. I.T.	**Semester:**	III
Course :	**Drawing for Engineers** (Offered by Mechanical Department) (Open Elective- Engineering Sciences)	**Code :**	BME23OE02

Teaching Scheme					**Evaluation Scheme**			
Credit	**Lecture**	**Practical**	**Tutorial**	**Other**	**FA**			
					FA1	**FA2**	**SA**	**Total**
2	2	-	-	-	10	10	30	50

Prerequisite: Nil

-

Course Objectives:

1. Develop imagination of physical objects for communication of Engineering Drawing.
2. Develop the interpretation and manual drawing skills.
3. Develop the physical realization of the dimension of the objects.

Course Outcomes*:

After learning the course, students will be able to

1. **Understand** the basics of Engineering Graphics and **apply** the concepts in real life applications
2. **Analyze** 3D engineering objects and draw orthographic projections
3. **Analyze** 2D views of engineering objects and draw isometric views
4. **Analyze** 3D objects and draw development of lateral surfaces of solid

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1	**Part A: Introduction to engineering drawing** **Importance of engineering drawing to Civil, Electrical, Electronics, IT and Computer Engineers**, introduction to drawing instrument and their uses, drawing sheet layout and its sizes, types of lines and their applications, dimensioning terminology and methods **Part B: Projection of Points, Lines and Planes** Projection: Introduction to projection and different methods of projections, Projection of Point: Introduction, Point situated in all the quadrants. Projection of lines: Introduction, Projection of lines. Projection of Planes: Introduction, Types of planes, Projection of planes. **CPU circuit diagram, Electrical/Electronic board circuit diagram, Building floor plan**	**8**
2	**Orthographic projections** Orthographic projection of given real life components by first angle method of projection, types of sections.	**7**
3	**Isometric view** Isometric axes, scale, difference between isometric projection and isometric view, isometric view of simple solids and its dimensioning.	**8**
4	**Development of lateral surface of solids** Development of lateral surfaces of prism, pyramid, cylinder and cone. 3D and 2D drawing of branch specific industrial products and its lateral surface development.	**7**
	Total	**30**

Text Books:

1. Engineering Drawing with an introduction to AutoCAD- Dhananjay A. Jolhe, Revised Edition 2017, Tata McGraw Hill publishing company Ltd. New Delhi, India
2. Engineering Drawing, Plane and solid geometry- N. D.Bhatt, 54th edition 2023, Charotor publication house.

Reference Books:

1. Engineering Drawing- M.B Shah and B.C Rana, 2nd edition 2009, Pearson Publications.
2. Engineering Graphics- P.J. Shah, Revised edition 2019, S Chand Publications.
3. Fundamentals of Engineering Drawing- Warren J. Luzzader, 11th edition 2015, Prentice Hall of India New Delhi.
4. A text book of Engineering Drawing- R.K. Dhawan, Revised Edition 2019, S. Chand and company ltd. New Delhi, India

Program :	B. Tech. I.T.						**Semester:** III	
Course :	**Fundamentals of Mechanical Components and Systems** (Offered by Mechanical Department) (Open Elective- Engineering Sciences)						**Code :**	BME23OE03
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	2	-	-	-	10	10	30	50

Prerequisites: Nil

Course Objectives:

This course aims at enabling students,

1. Impart knowledge of mechanical engineering and describe the scope of mechanical engineering with multidisciplinary industries.
2. Impart knowledge of basic concepts of thermodynamics and heat transfer applied to industrial applications.
3. Understand, identify and get exposure to latest trends in manufacturing processes and materials.
4. Describe the fundamentals of automobile systems and the emerging trends of electric vehicles, hybrid electric vehicles and solar vehicles..

Course Outcomes:

After learning the course, the students should be able to:

1. **Identify** different materials and manufacturing processes for different applications.
2. **Apply** the fundamentals of thermodynamics and heat transfer to real life applications.
3. **Identify** the basic mechanical elements and the power transmission drives based on their applications.
4. **Comprehend** automotive system for the combustion vehicle, EV's, HEV's and solar vehicles..

Detailed Syllabus:

Unit	**Description**	**Duration [Hrs]**
1	**Materials and Manufacturing Engineering** Classification of materials, their properties and applications, phase change material (PCM), composite material. Introduction to manufacturing processes: classification and applications, sheet metal working and forging. Introduction to industry 4.0.	**8**
2	**Thermal Engineering** Introduction to thermodynamics: concept of a system, types of systems, energy interactions: heat and work, laws of thermodynamics, entropy, and modes of heat transfer, thermal resistance, insulation. Applications of hydraulic turbines, centrifugal pumps, compressor, household refrigerator, window and split air conditioner.	**7**
3	**Fundamentals of Design Engineering** Introduction to mechanical engineering: use of mechanical engineering in day to day life and its interdisciplinary use, Introduction to design thinking. Machine elements, power transmission drives and mechanisms.	**8**

4	**Automotive Engineering** Classification of automobile, specifications of two wheeler, four wheeler and multi axle vehicles, types of chassis layout and drives, working of I.C. Engine, gear boxes, clutch, brakes, drive train system. Emission standards. Concept and environmental importance of electric vehicles (EV), construction and working of EV, hybrid electric vehicles (HEV) and solar vehicles, challenges and future scope of EV's and HEV's.	**7**
	Total	**30**

Text Books:

1. Basic Mechanical Engineering- Basant Agarwal and C. M. Agarwal, Wiley publication, First edition, (2008).
2. Engineering Thermodynamics- P. K. Nag, Tata McGraw-Hill publishing Co. Ltd., Sixth edition, (2017).
3. Heat and mass transfer- R. K. Rajput, S Chand publication, Revised edition, (2007).
4. A Textbook of Automobile Engineering- Khalil U Siddiqui, New Age International Publishers, Fifth edition, (2012).

Reference Books:

1. Design of Machine Elements- V. B. Bhandari, Tata McGraw-Hill publishing Co. Ltd., Fourth edition, (2017).
2. Theory of Machine- S. S. Ratan, Tata McGraw-Hill publishing Co. Ltd., Fifth edition, (2019).
3. Thermal Engineering- Arora and Domkunwar, Dhanpat Rai and Sons, Sixth edition, (2013).
4. Elements of Workshop Technology- Hajra, Chaudhari Volume I, Media Promoters and Publishers, Mumbai, Fourteenth edition, (2008).
5. Elements of Workshop Technology- Hajra, Chaudhari Volume II, Media Promoters and Publishers, Mumbai, Twelfth edition, (2007).
6. Handbook of Industry 4.0 and SMART Systems- Diego GalarPascual, Pasquale Daponte, Uday Kumar, CRC Press, First edition, (2019).
7. Industry 4.0 - Dr. BhushanKelkar, Neuflex Publication, First edition, (2019).
8. Automobile Engineering Volume I- Dr. Kripal Singh, Standard Publishers Distributors, Eleventh edition, (2008).
9. Automation, production systems computer integrated manufacturing- MikellGroover, Pearson Publication, Fourth edition, (2014).
10. Automotive Electrical Equipment- P. L.Kohli, McGraw Hill Education (India) Pvt Ltd., First edition, (2001).

Program:	B. Tech. I.T.				Semester:		III	
Course:	**E-Waste Management** (Offered by Civil Department) (Open Elective- Engineering Sciences)				Code:		**BCI23OE01**	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA 1	FA 2		
2	2	-	-	-	10	10	30	50

Prior Knowledge:

1. Fundamentals of environmental science.
2. Fundamentals of sustainable development.

Course Objectives: This course aims at enabling students,

1. To impart the knowledge of issues and challenges of e-waste management.
2. To create awareness of potential health effects and risk associated with e-waste.
3. To build knowledge of e-waste legislation (policy and guidelines)and circular economy.
4. To get acquainted with recycling, recovering and disposal techniques.

Course Outcomes: After learning the course, the students should be able to:

1. Identify the issues and challenges of e-waste management for a sustainable environment.
2. Analyze potential health effects and risk assessment.
3. Illustrate e-waste laws and guidelines and apply a circular economy road map for an e-waste sustainable future.
4. Identify the e-waste recycling, recovery and disposal techniques and its significance for a sustainable future.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Electronic Waste Management – Issues and Challenges:** Introduction to E-Waste, classification and composition, need to manage / recycle, E-Waste generation in India and comparison with world scenario; facts & figures, estimation of waste electronic and electrical equipment (WEEE), economic assessment of E-Waste (Rare earth minerals, precious metals), effluents (solid, liquid and gas) generated during recycling, quantification of health hazard due to informal recycling of E-Waste,(Case study-based learning)	7
2	**E-Waste-Environmental and Public Health Issue:** Characteristics of Hazardous Substances, toxicity concerns, potential health effects and symptoms of long-term exposure, case study of heavy metal contamination due to E-Waste recycling, Introduction to risk assessment, epidemiologic data analysis and parameter for determining exposure and disease (numerical), classification of potential carcinogens, dose-response assessment, Potency Factor for Carcinogens (numerical), Hazard Index (HI) and Hazard Quotient (HQ) (numerical)	8
3	**E-Waste (Management & Handling) Rules / Guidelines and Circular Economy:** Regulatory frameworks in India, objectives of e-waste rules 2016, 2018, 2022 and 2024, hazardous and other wastes (Management and Transboundary Movement) Rules, application of rules to stakeholders, India's stand on liberalizing import rules, UN	7

	Sustainable Development Goals (SDGs) and E-Waste, circular economy startup in India with a case study.	
4	**Recycling and Recovery of Metals from Electronic Waste and Disposal Techniques:** E-Waste recycling machineries, recycling process of E-Waste, existing E-Waste recycling Techniques, case study/ examples (metal recovery process), mechanism of extraction of precious metal from leaching solution, recovery of precious metals from solutions by solvent extraction, extraction of precious and rare earth metals from End-of- Life (EOL) electronic products, disposal techniques, role and responsibility of extended producers' responsibility (EPR), E-Waste economy in the organized and unorganized sector, Case study on recycling and precious metal recovery from E-Waste.	8
	Total	**30**

Text Books:

1. E-Waste management challenges and opportunities in India,VarshaBhagatGanguly, Routledge India, 1st edition 2021.
2. E-Waste Management and procurement of Environment, Dr. Suresh Kumar and Dr. Jitendra Kumar Pradhan, Authorpress, 2021 edition.
3. E-Waste in India: Management, challenges and opportunities (Volume I & II), Dr. Suresh Kumar, Authorspress, September, 2021 edition.

Reference Books:

1. Fowler B, Electronic Waste – 1st Edition (Toxicology and Public Health Issues), 2017 Elsevier
2. Johri R., E-waste: implications, regulations, and management in India and current global best practices, The Energy and Resources Institute (TERI)TERI Press, New Delhi, 2008.
3. The Complete Technology Book on E-Waste Recycling (Printed Circuit Board, LCD, Cell Phone, Battery, Computers), ASIA PACIFIC BUSINESS PRESS Inc., 2015.

e-Resources

1. https://cpcb.nic.in/e-waste/
2. https://courses.iid.org.in/course/e-waste-recycling-business
3. https://www.suritex.co.in/
4. http://greenscape-eco.com/
5. https://onlinecourses.nptel.ac.in/noc20_ce12/preview
6. https://nielit.gov.in/gangtok/content/paid-course-e-waste-management
7. https://www.semanticscholar.org/paper/Electronic-waste-management-Hester Harrison/bc34471b0f9d94b0656b43df6b322116f2a7175c

Open Electives

Department Specific

Program:	B. Tech. I.T.	Semester:	III
Course :	**Biology for Engineers** (Offered by E&TC) (Open Elective- Department Specific)	Code :	BET23OE03

Teaching Scheme					Evaluation Scheme						
Credit	Theory	Practical	Total	Other	FA		SA	TW	PR	OR	Total
					FA1	FA2					
2	2	-	2	-	10	10	30	-	-	-	50

Pre-requisite: Basics of Human Anatomy and physiology
Basics of Electronics Engineering

Objectives:

1. To introduce biological engineering principles, procedures needed to solve real-world problems.
2. To provide an overview of human anatomy and physiology in order to support biomedical engineering solutions.
3. To introduce biomedical sensors, signal processing and diagnostic systems.
4. To provide a basic knowledge of the applications of biological systems in relevant industries.

Outcomes:

After completing the course the students should be able :

1. to understand basics of human physiological system and its cell functioning
2. to understand human immune system and significance of microbiology
3. to map role of biology in designing industrial applications
4. to understand biomedical sensors, its interfacing and related to measurement systems.

Detailed Syllabus:

Unit	Description	Duration (Hrs)
1	**CELL PHYSIOLOGY :** Introduction to the cell biology – Cell size and shape - Chemical composition - Classification of cell and its properties, Cell cycle; Cell signaling, Transport across cell membrane; Introduction to Human physiology – Circulatory system - Respiratory system - Excretory system - Nervous system.	08
2	**IMMUNOLOGICAL SCIENCE:** Immune system and its types; Functional properties of antibodies; Helper T cells and T cell activation; Importance of Microbiology.	07
3	**BIOLOGY AND ITS INDUSTRIAL APPLICATION:** Introduction : Bioreactors, biocontrol, biofilters, biopolymers, bioenergy, biomaterials, biochips, Nano-Biomolecules and its various types: Principles and Application of Biosensor; Basics of Biochips – Bio fertilizer – Bioinformatics – Bio fuel.	07
4	**INTRODUCTION TO BIOMEDICAL INSTRUMENTATION:** Need and Challenges in measurement of the parameters in living systems, Source of bioelectric potential: Resting and action potential, propagation of action potential, depolarization and re-polarization. Introduction to few important bio-potential such as Electrocardiogram(ECG), Electroencephalogram(EEG) and Electromygram (EMG).	08
	Total	**30**

Text Books:

1. Dr. Sohini Singh and Dr. Tanu Allen, "Biology for Engineers", Vayu Education Of India, New Delhi, 2014.
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurements, 2nd edition,Prentice Hall of India

Reference Books:

1. Arthur T. Johnson, "Biology for Engineers" CRC Press, 2011.
2. Goldsby RA, Kindt TK, Osborne BA and Kuby J (2003) Immunology, 5th Edition, W.H. Freeman and Company, New York.
3. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
4. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012
5. John G. Webster(Editor), Amit J. Nimunkar (Editor), Medical Instrumentation: Application and Design,5th edition Wiley publication
6. Joseph H. Carr, John M. Brown, Introduction to Biomedical equipment Technology, 4edition , Pearson publication

"Knowledge Brings Freedom"

Program :	S. Y BTech (Open for All Branches offered by E&Tc Department)	**Semester:** III
Course :	Human Behavior, Ethics & Wisdom	**Code :** BET23OE04

Credits	**Teaching Scheme (Hrs./Week)**			**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**FA**		**SA**	**Total**
				FA1	**FA2**		
02	**02**	**-**	**-**	**10**	**10**	**30**	**50**

Prior knowledge of is not essential.

Course Objectives:

This course aims at enabling students,

1. To develop a clear understanding of success in terms of academic, career, and life dimensions, and help students identify the ultimate human goal.
2. To enable students to build harmonious relationships and responsible behavior based on right understanding, values, and priorities.
3. To cultivate ethical conduct and holistic thinking for sustainable living, professional competence, and universal harmony.

Course Outcomes:

After learning the course, the students should be able to:

CO1. Differentiate the career success, academic success and life success
CO2. Identify the correct priority order in life and illustrate the human goal
CO3. Understand that the relationships are definite
CO4. Understand the Interconnectedness between all the orders in existence

Detailed Syllabus:

Unit	**Description**	**Duration [Hrs]**
1	**Understanding success and Living domain of Human** Academic success (marks), career success (recognition & position), life success (balance & contentment), ultimate goal of human being, Difference between happiness and excitement Continuous happiness vs temporary pleasure, Right Understanding (RU), Relationship (R), Physical Facility (PF) with right priority, how our choices are affected by RU, R, PF. Understand the human being On the basis of needs and activities	07
2	**Human Behavior** Behavior driven by: Desire or Fear or Understanding Relationship as the foundation of life, Understanding the expectations in 7 relationships Mother-Father/Son-Daughter, Husband-Wife, Brother-Sister, Friend-Friend, Teacher-Student, Colleague-Coworker, Societal Nine core human values in relationships (trust, respect, affection, care, etc.), Justice and fairness Marriage as: A foundation for family stability, Purpose of Marriage, Common Problems in Marriage Justice in Family, Ability to build Stable, respectful relationships, Parenting & Values	08

3	**Wisdom & Universal Harmony (Holistic Living)** Sustainable living, Human role in society Human Goal (Resolution, Prosperity, Fearlessness, Coexistence) Five dimensions to fulfill human goal - Education- Sanskar(Inculcation), Justice-Protection, Production-Work, Exchange-Storage, Health-Self regulation Universal order and interconnectedness - The four orders in nature - Interconnectedness and mutual fulfillment	08
4	**Ethics & Human Conduct** Natural acceptance, Responsibility and duty, Fair roles and responsibilities, Gender equality in dignity Definite Human Conduct -Behavior Work, Participation in relationships Right wealth, Right marital relationship, Right work and behavior Values, Policies, Character Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies,	07
	Total	30

Text Books::

1. A. Nagaraj, Jeevan Vidya: Ek Parichaya. Amarkantak, India: Jeevan Vidya Prakashan, 1999.
2. A. Nagaraj, Manava Vyavahãra Darsana. Amarkantak, India: Jeevan Vidya Prakashan, 2003.
3. R. R. Gaur, R. Asthana, and G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd rev. ed. New Delhi, India: Excel Books, 2019. ISBN: 978-93-87034-47-1.

Reference Books:

1. A. Nagaraj, Vyavahãrvãdï Samãjshãstra. Amarkantak, India: Jeevan Vidya Prakashan, 1999.
2. A. Nagaraj, Vyavharatmak Janvad. Amarkantak, India: Jeevan Vidya Prakashan, 2009.
3. A. Nagaraj, Abhyas Darshan. Amarkantak, India: Jeevan Vidya Prakashan, 2004.
4. M. K. Gandhi, Hind Swaraj or Indian Home Rule. Ahmedabad, India: Navajivan Publishing House, 1909.
5. S. R. Covey, The Seven Habits of Highly Effective People. New York, NY, USA: Free Press, 1989.
6. Aristotle, The Nicomachean Ethics. Translated by W. D. Ross. Oxford, U.K.: Oxford University Press, 1925.

Links for additional learning

http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
https://youtu.be/OgdNx0X923I
https://www.edx.org/learn/happiness/university-of-california-berkeley-the-science-of-happiness
https://www.youtube.com/watch?v=11E0ZaoGqEI

Program:	B. Tech. I.T.					Semester: III		
Course:	AI for Financial Modelling (offered by CSE-AI&ML) (Open Elective- Department Specific)					Code:	BCS23OE01	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-	-	-	10	10	30	50

Prior knowledge of financial concepts, basics of Excel is essential.

Course Objectives:

1. To understand the essentials of financial modeling
2. To learn to build a simple financial model.
3. To perform the analyses of financial models and Apply AI/ML methods for forecasting.
4. To use AI enabled platforms for finance tasks

Course Outcomes:

After learning the course, the students will be able to :

1. Learn the essentials of financial modeling
2. Understand core AI and machine learning concepts and algorithms relevant to finance.
3. Apply AI/ML methods for financial forecasting.
4. Use AI enabled tools and platforms for finance tasks

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Introduction to Financial Modelling :** Importance and Applications in Finance, Key Financial Statements (Income Statement, Balance Sheet, Cash Flow),Basic Excel Techniques for Financial Modelling, Overview of Financial Ratios and KPIs, Limitations of Traditional Modelling Techniques.	7
II	**Basics of Artificial Intelligence and Machine Learning:** Introduction to AI and Machine Learning, Types of Machine Learning (Supervised, Unsupervised),Common Algorithms in Finance: Linear Regression, Decision Trees, Clustering, Introduction to Python for AI (basics, IDEs, libraries: NumPy, Pandas),Data Preprocessing for Financial Datasets.	8
III	**AI Applications in Financial Modelling:** AI for Forecasting Revenue and Expenses, AI for Credit Risk Assessment across financial applications, AI in Fraud Detection, Portfolio Optimization Basics, Predictive Analytics in Budgeting and Planning.	8
IV	**Tools, Ethics, and Future Trends :** AI Tools for Finance: Power BI/Tableau, AutoML Platforms, Introduction to FinTech and Robo-Advisors, Ethical Considerations: Data Privacy, Bias, Model Interpretability. Case Studies of AI in Financial Services	7
	Total	**30**

Text Books:

1. Yves Hilpisch, “Artificial Intelligence in Finance: A Python-Based Guide”, O’Reilly Media Inc., July 2019, ISBN: 9781492055433
2. Jannes Klaas, “Machine Learning for Finance”, Packt Publishing, 2019, ISBN: 9781789136364

Reference Books:

1. Edward P.K.Tsang, “AI for Finance”, Routledge Taylor and Francis, 1st Edition, 2023, ISBN 9781032384436 .

Web References:

1. https://www.udemy.com/course/python-and-machine-learning-in-financial-analysis/
2. https://www.udemy.com/course/ai-for-finance/

Program:	B. Tech.						Semester: III	
Course:	Neural Network and Fuzzy Logic Control (OE –Department Specific) (Offered by AS&H)						Code:	BSH23OE06
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior Knowledge: Nil

Course Objectives:

1) To provide knowledge of Neural Networks and apply them for modelling and controlling real-time dynamic systems.
2) To apply fuzzy logic techniques for solving various engineering and decision-making problems.

Course Outcomes:

After learning the course, the students will be able to:

1) **Describe** learning rules, activation functions and basics of neural networks.
2) **Implement** back propagation and optimizer algorithms for weight updates of Neural Network.
3) **Apply** fuzzy set concepts for fuzzification and defuzzification.
4) **Perform** Mamdani and Sugeno fuzzy inference system in real world problems.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Architecture of Neural Network:** Introduction; biological neural networks; artificial neural networks; architecture of artificial neural networks—bias, activation functions, learning methods, and learning rules; types of neural networks such as single-layer, multi-layer, feed forward, and recurrent neural networks.	7
II	**Neural Networks for Control:** Loss functions; weight initialization; optimization algorithms; back propagation algorithm; associative memory networks and their types; discrete-time Hopfield networks.	8
III	**Fundamentals of Fuzzy Logic:** Classical sets; fuzzy sets; membership functions; cardinality of fuzzy sets; fuzzy complement; fuzzy composition; properties and operations on fuzzy sets; fuzzy relations; fuzzification; and defuzzification.	7
IV	**Fuzzy Logic Control:** Fuzzy rules; decision-making logic; linguistic variables; fuzzy inference systems including Mamdani FIS and Sugeno FIS; design of fuzzy controllers; fuzzy optimization; and applications of FIS to real-life problems.	8
	Total	**30**

Text Books:

1. Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, Prentice Hall, NewDelhi, 2004.
2. Ross T. J., “Fuzzy logic with engineering applications (Vol. 2)”, New York: Wiley, 2004, ISBN: 9783030375478

Reference Books:

1. Jack M. Zurada, “Introduction to Artificial Neural Systems,” PWS Publishing Co., Boston, 2002.
2. Zimmerman H.J., “Fuzzy set theory and its Applications,” Kluwer Academic Publishers Dordrecht,2001.
3. Driankov, Hellendroonb, “Introduction to fuzzy control,” Narosa Publishers,2001.
4. G Klir, B Yuan, “Fuzzy sets and fuzzy logic: Theory and application,” PHI, ISBN:
5. LauranceFausett, Englewood Cliffs, N.J., “Fundamentals of Neural Networks,” PearsonEducation, New Delhi, 2008.
6. B Yegnanarayana: Artificial Neural Networks for pattern recognition, PHI Learning Pvt. Ltd., 14- Jan-2009

E-sources:

- Online course “Fuzzy Logic and Neural Network” by Prof. Dilip Kumar Pratihar, IIT Kharagpur. https://nptel.ac.in/courses/127/105/127105006/

Program :	B. Tech. I.T.	Semester:	III
Course :	**Industry 4.0** (Offered by Mechanical Department) (Open Elective- Department Specific)	Code :	BME23OE04

Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior knowledge of Basic programming skills, Mathematical skills i**s essential.**

Course Objectives:

This course aims at enabling students,

1. To introduce revolutions of manufacturing industry
2. To introduce technological advancement in modern manufacturing industries
3. To Introduce concepts of smart manufacturing, emphasizing Industry 4.0 in manufacturing industries

Course Outcomes:

After learning the course, the students should be able to:

1. Correlate the recent manufacturing trends and technological pillars of Industry 4.0.
2. Apply pillars of Industry 4.0 to the manufacturing industry.
3. Adapt the changes in existing manufacturing practices and relate the role of industrial robotics and sensors.

Detailed Syllabus:

Unit	Description	Duration [Hrs]
1	**Industrial revolution and current state of industry:** Overview of industrial revolution, Introduction to Automation, hard automation, soft automation, classification of production system, adaptive control, overview of terminologies like CAD, CAM, CAE, CAPP etc.	**06**
2	**Introduction to Industry 4.0:** Introduction to industry 4.0, need for Industry 4.0, Framework for Industry 4.0, technological pillars in industrial 4.0, applications, challenges and scope for industry 4.0	**08**
3	**Technological developments in Industry 4.0:** Introduction to Smart Manufacturing, overview of big data and analytic techniques, cyber security, Internet of things (IoT), Industrial Internet of things (IIoT), Cloud computing, artificial intelligence.	**08**
4	**Robotics and Sensors:** Introduction to technological components of Robot, classification of sensors and its applications in Manufacturing industry, Role of robots in Industry 4.0, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics	**08**
	Total	**30**

Text Books:

1. Nine pillars of technologies for Industry 4.0, W. Leong, IET publishers, 2020
2. Industry 4.0, A. Gilchrist, Apress Publication, 2016
3. Industrial Automation: Hands On, Lamb, Frank. , McGraw-Hill Professional, 2013

Reference Books:

1. C. Schröder, The Challenges of Industry 4.0 for Small and Medium-sized Enterprises, 2021.
2. Chua C. K., Leong K. F., Lim C. S., Rapid Prototyping, World Scientific, 2012.
3. A. Nayyar and A. Kumar, A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development-Springer International Publishing, 2020. https://doi.org/10.1007/978-3-030-14544-6
4. K. Kumar, D. Zindani, J. P. Davim, Industry 4.0: Developments towards the Fourth Industrial Revolution, Springer Singapore, 2019.

E-sources:

1. https://nptel.ac.in/courses/108105063

Program :	B. Tech. I.T.				Semester:			
Course :	**Energy Storage Management** (Offered by Mechanical Department) (Open Elective- Department Specific)				Code :			BME23OE05
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	**2**	**-**	**-**	**-**	**10**	**10**	**30**	**50**

Prior knowledge of Fundamentals of Engineering and basic sciences **is essential.**

Course Objectives:

This course aims at enabling students,

1. To explore energy storage systems' fundamentals, technologies, and applications.
2. To enable students to understand the principles of energy storage systems design.
3. To provide a general awareness of energy storage audit, safety, and management.

Course Outcomes:

After learning the course, the students should be able to:

1. Differentiate and select energy storage systems based on performance and safety.
2. Select material and analyze the energy storage in thermochemical form.
3. Analyze energy storage system with batteries/supercapacitors/fuel cells.
4. Perform audit of Energy storage systems

Detailed Syllabus

Unit	Description	Duration [Hrs]
1	**Energy storage system:** Introduction, Need, Modes, Energy storage devices, Merits, and Demerits of different types of Storage, utilization, and system applications. **Performance:** Energy capture rate and efficiency, Discharge rate and efficiency, Dispatch ability and load flowing characteristics, Scale flexibility, durability, Cycle lifetime, mass.	**8**
2	**Thermochemical storage –** Types, Phase Change Materials (PCMs) and classifications, properties of the PCMs for different temperature ranges, Selection criteria of PCMs for heating and cooling in buildings, Application of PCM in energy storage. SHS mediums, Energy analysis of the latent heat storage based on different systems	**7**
3	**Energy Storage for transportation:** Mechanical Design and Packaging of Battery, Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Li-ion Batteries, Thermal run-away for battery systems, State of Charge and Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles **Fuel cell**: Operational principle, types, hybrid fuel cell-battery systems, hybrid fuel cell-supercapacitor systems,	**8**
4	**Energy Storage Management** Relationship between economic growth and energy use, Energy demand analysis in different economic sectors, increase energy conversion efficiencies by introducing energy storage, Energy audit of energy storage system, The carbon markets, Safety: Risks of fire, explosion, toxicity, Ease of materials, recycling, and recovery, Environmental consideration, and recycling	**7**
	Total	**30**

Text Books:

1. A. R. Pendse, “Energy Storage Science and Technology,” SBS Publishers & Distributors Pvt. Ltd., New Delhi, (ISBN – 13:9789380090122), 2011.
2. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, “Electrochemical Technologies for Energy Storage and Conversion,” John Wiley and Sons, 2012.
3. Lithium-Ion Batteries Basics and Applications by Reiner Korthauer, Springer.
4. Fuel cells from fundamentals to applications by Supramaniam Srinivasan, Springer.

Reference Books:

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,” Energy Storage in Power Systems” Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016.
3. Pistoia, Gianfranco, and Boryann Liaw. The behavior of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.
4. E. Lipman, A. Z. Weber, Fuel Cells and Hydrogen Production, A Volume in the Encyclopedia of Sustainability Science and Technology, Second Edition, Springer reference.
5. Handbook of Energy Audit by Sonal Desai Publisher Tata McGraw Hill.

"Knowledge Brings Freedom"

Program:	B. Tech. I.T.				Semester:		III	
Course:	**Total Quality Management** (Offered by Civil Department) (Open Elective- Department Specific)				Code:		BCI23OE02	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	_	10	10	30	50

Prior Knowledge: Basic definitions of Quality and importance of Quality in industry for safety and durability.

Course Objectives:

After Completing this course, student will have adequate background :

1. To understand the importance of Quality in construction.
2. To understand the need of Total Quality management &it's tools.
3. To understand role of ISO in quality management.

Course Outcomes:

After learning the course, the students should be able to:

1. Articulate quality and quality ideas as presented by many gurus and philosophers after learning.
2. Illustrate different quality control tools.
3. Apply ISO concepts and the cost of quality to quality assurance.
4. Analyze various techniques of TQM.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Unit I: Quality in Construction** a) Quality – Various definitions and interpretation. Importance of quality on a project in the context ofglobal challenges, Factors affecting quality, Reasons for poor quality & measures to overcome, Contribution of various Quality Gurus(Juran, Deming, Crossby, Ishikawa), b) Evolution of TQM- QC, TQC, QA, QMS, TQM.	7
2	**Unit II: TQM, Six Sigma and QC tools** a) TQM – Necessity, advantages, Quality Function Deployment(QFD), b) Six sigma – Importance, levels, Application of 6 Sigma, c) Implementation of 7 QC tools through case study.	8
3	**Unit III: Cost of Quality and ISO** a) Categories of cost of Quality, b) Study of ISO 9001 principles., Quality manual – Importance, contents, documentation, Corrective and Preventive actions, Conformity and NC reports.	7
4	**Unit IV: Techniques in TQM Implementation** a) Benchmarking in TQM, Kaizen in TQM, b) '5-S_techniques, Zero Defects, c)Quality Circle Concept and applications through Quality Circle Formation.	8
	Total	**30**

Text Books:

1. Total Quality Management-- Dr.GunmalaSuri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ.
3. Total Quality Management - Dr.S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Reference Books:

1. Juran‘s Quality Handbook – Juran Publication. (2016 Edition)
2. Management –Principal, process and practices by Bhat – Oxford University Press.(2008)
3. Financial management by Shrivastava- Oxford University Press (6th Edition 2022)
4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co. (2022)
5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

PCCOE "Knowledge Brings Freedom"

Program:	B. Tech. I.T.	Semester:	III
Course:	**Building Services and Maintenance** (Offered by Civil Department) (Open Elective- Department Specific)	Code:	BCI23OE03

Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior Knowledge:
NA

Course Objectives: This course aims at enabling students,
1. To impart knowledge about the building services
2. To examine the purpose and type of building maintenance.

Course Outcomes: After learning the course, the students should be able to:
1. Understand different building services provisions.
2. interpret the fundamental concepts relevant to functional requirement of building.
3. Relate the knowledge of Acoustic and Fire Protection.
4. Choose diverse maintenance methodologies applicable to building and infrastructure services.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Building Services:** Definitions, Objective and uses of services, different types of building, Classification ofbased on Occupancy, FSI, Carpet area, built-up area, Standard of Accommodation, Classification of buildingservices, Types of services and selection of appropriate services for given project**,** case studies.	7
2	**Escalator and Plumbing-** Classification of different types of escalators, Lift codes and Rules,Design Features of Escalator, Plumbing- Common Sanitary Fixtures, Layout of SanitaryFixtures, Water Pipe Sizing in Buildings, Building Services Detailing, Rain WaterHarvesting, Sanitation in buildings.	8
3	**Acoustics and Ventilation-** Material properties, acoustical design of assembly halls and buildings, noise and itscontrol, measuring equipment, Ventilation- Ventilation systems, health and comfortventilation, Fire protection and National Building Codes 2016- requirements, equipmentand their applications, security systems.	8
4	**Building Maintenance:** Role of maintenance in durability and serviceability of structures, Economic aspects of maintenance, Different types of maintenance and audits process. **Infrastructures services:** Different types of structures, infrastructure services, case studies.	7
	Total	**30**

Text Books:
1. Building Construction Dr. B. C. PunmiaLaxmi Publications (P) Ltd., New Delhi

2. Building Construction P. C. Varghese PHI Learning (P) Ltd., New Delhi

3. Building repair and Maintenance Management P. S. Gahlot CBS Publishers & Distribution(P) Ltd.

Reference Books:

1. Building Science & Planning by S.V. Deodhar, Khanna Publishers.

2. Design and Practical Hand Book on Plumbing by C.R Mohan, VivekAnand, Standard Publishers Distributors.

3. Hand book of Designing and Installation of Services in High Rise Building Complexes, by V.K. Jain, KhannaPubl

Program:	B. Tech. I.T.				**Semester:**		III	
Course:	**Android App Development with Kotlin** (Offered by Computer Engineering) (Open Elective- Department Specific)				**Code:**		BCE23OE03	
Credit	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
02	02	-	-	-	10	10	30	50

Prior knowledge of Basic programming knowledge **is essential**

Course Objectives:

1. To explore Kotlin programming language features.
2. To familiarize with the concepts of Kotlin.
3. To get acquainted with Android features, networks, and data handling techniques.
4. To develop an Android app with testing.

Course Outcomes:

After learning the course, the students will be able to:

1. Explore object-oriented programming with Kotlin.
2. Illustrate the concept of Kotlin fundamentals
3. Apply the network handling and Android UI techniques.
4. Deploy the Android application with testing.

Detailed Syllabus

Unit	**Description**	**Duration (H)**
1	**Introduction to Kotlin programming language** Introduction to Kotlin programming language, Setting up Android Studio development environment, Basics of Kotlin syntax and basic programming concepts, Variables, data types, and operators in Kotlin.	6
2	**Kotlin fundamentals** Conditional statements, Loops, Functions, parameters, Kotlin collections, Classes and objects, Properties, fields, and methods, Inheritance, polymorphism, and interfaces, Data classes and sealed classes.	9
3	**Android architecture, Android UI and Networking** Android Architecture, Activities and life cycle, Views, View groups, fragments and lifecycle, Working with RESTful APIs and JSON data, Using Retrofit and OkHttp for network communication, Implementing LiveData and ViewModel, Asynchronous programming.	9
4	**Android App Development and Testing** Case study: Picture gallery, Developing an App, Unit testing and UI testing with Junit and Espresso, Preparing and publishing app to Google Play store	6

Total	30

Text Books:

1. Laurence PO, Hinchman-Dominguez A, G. Blake Meike, Dunn M. “Programming Android with Kotlin”, O’Reilly Media, Inc.; 2021. ISBN:9781492063001

2. Lim G. “Beginning Android Development With Kotlin” Greg Lim; 2020. ISBN:9811477973, 9789811477973

Reference Books:

1. Trivedi Hardik. “Android application development with Kotlin”, BPB Publications; 2020.

2. Fazio M. “Kotlin and Android Development featuring Jetpack”, Pragmatic Bookshelf; 2021.

e-sources: 1. https://developer.android.com/

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Course Syllabus

Semester IV

Program	B. Tech. I.T.					Semester	IV	
Course	Computer Networks Technology					Code	BIT24PC01	
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior knowledge of:

1. Basic Mathematics
2. Fundamentals of communication

is essential

Course Objectives:

1. To understand TCP/IP and ISO OSI network layers and concepts of networking standards
2. To learn different techniques for framing, error control, flow control and routing
3. To understand various routing algorithms and modern network architectures with respect to design and performance

Course Outcomes:

After learning the course, the students will be able to:

1. Illustrate the working and functions of data link layer
2. Analyze the goals and requirements of Medium Access Control (MAC) techniques
3. Analyze the working of different routing algorithms
4. Illustrate role of application layer with its protocols, client-server architectures

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Unit I: Introduction To Computer Networks:** Evolution of Computer Networks, Layered Network Architecture: ISO's OSI Reference Model, functions of the seven layers of OSI Model , TCP/IP model, Physical Layer functions **Data Link layer:** Review of fundamentals of link layer protocols, Framing. **Error Detection and Correction:** need for error detection and correction, simple parity check, checksum, cyclic redundancy check, Hamming's code **Flow Control and Error Control** : need for flow and error control, Stop-and-wait flow control, Sliding-window flow control, Stop-and-wait ARQ, Go-back-N ARQ, Selective-repeat ARQ, Selective-repeat ARQ. HDLC: how HDLC works, piggybacking in HDLC, data transparency in HDLC.	8
2.	**Unit-II Medium Access Control:** **Medium Access Control (MAC) Techniques**- goals and requirements of Medium Access Control (MAC) techniques, key issues related to MAC techniques, Classify various contention based techniques such as ALHOA, CSMA, CSMA/CD and CSMA/CA. MAC techniques: Polling, Token passing. FDMA, TDMA, CDMA. **IEEE 802 LANs** - basic characteristics of LANs, operation of IEEE 802 LANs , 802.3 - CSMA/CD-based (Ethernet), 802.4 – Token bus based, 802.5 – Token ring-based, Compare performance of the three LANs , Introduction of High Speed LANs, Fast Ethernet and Gigabit Ethernet.	6
3.	**Unit-III Network Layer and Routing algorithms:** Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. Compare circuit switching, packet switching, message switching.	9

	IP Protocol: Classes of IP (Network addressing), IPv4, IPv6,Network Address Translation, Sub-netting, CIDR. Network layer Protocols: IP, ICMP, IGMP. **Network Routing and Algorithms:** Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, MPLS. Congestion control and QoS.	
4.	**Unit-IV Transport Layer And Application Layer** Relationship Between Transport and Network Layer, Process to Process Delivery, Services, Socket layer (TLS 1.0 and 1.1). Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), **Application Layer:** Application Layer: Address Resolution: Domain Name System (DNS). WWW: Hyper Text Transfer Protocol (HTTP) and HTTPS with SSL. Web Service. Email: SMTP, POP3,IMAP and Webmail. File Transfer: FTP, Dynamic Logical Addressing: Dynamic Host Control Protocol (DHCP), TELNET, SNMP.	7
	Total	**30**

Text Books:

1. Fourauzan B., "Data Communications and Networking",5thEdition,Tata McGraw Hill, Publications, ISBN:0–07 – 058408 – 7
2. Andrew S. Tanenbaum, “Computer Networks”, 5th Edition, Pearson India, 2012.

Reference Books:

1. Kurose, Ross, “Computer Networking a Top Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204 2.
2. L. Peterson and B. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan-Kaufmann, 2012.
3. Douglas E. Comer & M.S Narayanan, “Computer Network & Internet”, Pearson Education
4. Alberto Leon Garcia and Indra Widjaja, “Communication Networks, Fundamental Concepts and Key Architectures”, 2nd Edition, Tata McGraw-Hill. 2004, ISBN-10: 007246352X
5. S. Keshav, “Engineering Approach to Computer Networks”, Pearson Education, 1997, ISBN-13: 9780201634426

E-sources:

1. https://people.cs.clemson.edu/~jmarty/courses/kurose/KuroseCh1-2.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data_Communications_and_Networking_By_Behrouz_A.Forouzan.pdf
3. http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf
4. https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf

MOOCs Courses link:

- nptel.ac.in/courses/106/105/106105183
- nptel.ac.in/courses/106/105/106105080
- nptel.ac.in/courses/106/105/106105081
- nptel.ac.in/courses/106/106/106106091
- nptel.ac.in/courses/106/105/106105031
- https://www.mooc-list.com/tags/computer-networking
- https://www.coursera.org/courses?query=computer%20network

Program	B. Tech. I.T.				Semester			IV
Course	Computer Networks Technology Laboratory				Code			BIT24PC02
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
2	-	4	-	-	50	-	50	100

Prior knowledge of:

1. Basic Mathematics
2. Fundamentals of communication

is essential

Course Objectives:

1. To learn computer network topologies, hardware, software and types of network
2. To develop an understanding of various protocols, modern technologies and applications
3. To learn modern tools for network traffic analysis
4. To learn network programming.

Course Outcomes:

After learning the course, the students will be able to:

1. Analyze the requirements of network types, topology and transmission media(Assignment No 1,2,3)
2. Demonstrate error control, flow control techniques and protocols and analyse them (Ass. No.4)
3. Demonstrate the subnet formation with IP allocation mechanism and apply various routing algorithms (Ass. No.5)
4. Implement client-server applications using sockets (Ass. No.6,7)
5. Demonstrate the configuration and working of various servers and networking protocols using Packet tracer simulator and analyze all the packets captured (Ass. No.8)
6. Analyze the working of application layer protocols (Ass. No.9)

Guidelines:

Continuous assessment of laboratory work should be based on parameters such as timely completion, performance, innovation, efficient codes, and punctuality. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and write-up of each assignment.

Note:

Practical examination will be based on concepts implemented in assignments.

Detailed Syllabus

Assignment No.	Suggested List of Assignments (All assignments are compulsory)
1.	Demonstrate the different types of topologies and types of transmission media by using a packet tracer tool.
2.	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility and demonstrating the PING packets captured traces using Wireshark Packet Analyzer Tool.
3.	Setup a WAN which contains wired as well as wireless LAN by using a packet tracer tool. Demonstrate transfer of a packet from LAN 1 (wired LAN) to LAN2 (Wireless LAN).
4.	Write a program for error detection and correction for 7/8 bits ASCII codes using Hamming Codes or CRC.
5.	Use packet Tracer tool for configuration of 3 router network using one of the following protocol RIP/OSPF/BGP.

6.	Write a program using TCP/UDP Sockets to enable file transfer (Script, Text, Audio and Video one file each) between two machines.
7.	Install and configure DHCP server.
8.	Capture packets using Wireshark, write the exact packet capture filter expressions to accomplish the following and save the output in file: 1. Capture all TCP traffic to/from Facebook, during the time when you log in to your Facebook account 2. Capture all HTTP traffic to/from Facebook, when you log in to your Facebook account 3. Write a DISPLAY filter expression to count all TCP packets (captured under item #1) that have the flags SYN, PSH, and RST set. Show the fraction of packets that had each flag set. 4. Count how many TCP packets you received from / sent to Face book, and how many of each were also HTTP packets.
9.	Study and Analyse the performance of HTTP, HTTPS and FTP protocol using Packet tracer tool.

Reference Books:

1. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
2. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.
3. S. Tanenbaum : "Computer, Networks", PHI Publication, 4th edition, ISBN: 8178087855.
4. Behrouz A. Forouzan,”TCP-IP protocol suite “, Tata McGraw Hill Edition, 2nd edition,2003, ISBN: 978007060004.

E-resources:

1. Wireshark packet analyser
2. NS3.0/CISCO network simulator

Program	B. Tech. I.T.				Semester			IV
Course	Database Management System				Code			BIT24PC03
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior knowledge of:

1. Fundamentals of Data Structures and Files
2. Set Theory

is essential

Course Objectives:

1. To understand systematic database design approaches.
2. To learn the concepts of transaction processing and concurrency control.
3. To understand database architectures and applications.

Course Outcomes:

After learning the course, the students will be able to:

1. Explain the basic concepts of databases.
2. Design ER and EER modeling to represent entities, relationships, and constraints.
3. Apply relational database techniques for applications.
4. Apply transaction management and concurrency control techniques within a database management system.

Detailed Syllabus

Unit	Description	Duration (Hrs)
1.	**Introduction To Database Concepts** Introduction, Purpose of Database Systems, Database Languages, Database System Structure, Data Models, Database and Application Architecture, Database Users and Administrators.	5
2.	**Conceptual Database Design** Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process: Entity-Relationship Model, Extended E-R Features, converting ER and EER diagram into tables.	8
3.	**Relational Database Design** Relational Algebra, Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints; Database Design: Features of Good Relational Designs, SQL for relational database design.1NF, 2NF, Functional Dependency, 3NF, BCNF.	9
4.	**Database Transactions** Properties of Transactions, Transaction Management, Commit Protocols, Concept of Schedule, Serializability, Concurrency Controls, Deadlocks, Recovery methods: Shadow-Paging and Log-Based Recovery.	8
	Total	**30**

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., Database System Concepts, 7th edition, McGraw Hill,2019
2. Connally T, Begg C., Database Systems: A Practical Approach to Design, Implementation, and Management, 6th edition, Pearson Education, 2021

Reference Books:

1. Ramakrishnan Raghu, Gehrke Johannes . *Database management systems*. 3rd Edition, McGraw Hill , 2011

E-resources:

1. https://nptel.ac.in/courses/106105175

Program	B. Tech. I.T.				Semester			IV
Course	Database Management System Laboratory				Code			BIT24PC04
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
2	-	4	-	-	50	-	50	100

Prior knowledge of:

1. Logic and Set Theory.
2. Computer Programming and Problem Solving

is essential

Course Objectives:

1. To know design standards for database management systems.
2. To apply SQL commands to database management systems.
3. To apply No SQL commands to a database management system.

Course Outcomes:

After learning the course, the students will be able to:

1. Construct the database schema using concepts of ER, EER diagrams.
2. Apply SQL commands for various database applications.
3. Apply No SQL commands for various database applications,
4. Create a mini project using database management concepts.

Guidelines:

Continuous assessment of laboratory work should be based on parameters such as timely completion, performance, innovation, efficient codes, and punctuality. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and write-up of each assignment.

Note:

- Instructor should ensure all the important topics must be covered through assignments.
- Instructor should maintain the progress report of mini project.
- Practical examination will be based on concepts implemented in assignments.
- Mini Project in this course should facilitate the Project Based Learning among students

Detailed Syllabus

Assignment No.	Suggested List of Assignments
1.	**ER Modeling and Normalization:** a. Consider case studies and formulate a problem statement for application to be developed. b. Propose a conceptual design using ER features (Identifying entities, relationships between entities, attributes, keys, cardinalities, generalization, specialization etc.). c. Convert the ER diagram into relational tables and normalize relational data model.
2.	**SQL Queries-** Use Create, Select, Update, Delete with operators, functions, and set operator: a. Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, Index and different constraints etc. b. Write at least 10 SQL queries on the suitable database application using SQL DML Statements.
3.	**SQL Queries-** All types of **Join, Sub-Query and View**: a. Write at least 10 SQL queries for suitable database application using SQL DML

	statements using joins and subqueries. b. Write queries using group by and having clause.
4.	Write code to implement **Procedure and Function.**
5.	Write **cursor** code using control structures and exception handling.
6.	Write all types of **Database Triggers** for suitable application.
No SQL	
7.	**No SQL**: Design and Develop Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators, joins etc.).
8.	**No SQL**: Aggregation and Indexing: Design and Develop Queries using aggregation and indexing with suitable example using Mongo DB.

Mini Project

Using the database concepts covered , develop an application with following details:

1. Follow the same problem statement designed in Assignment 1.
2. Develop application considering: Front End : Java/Python or any other language
   Backend: MongoDB/ MySQL /Oracle.

Students should develop applications in group of 2-4 students and submit the Project Report which will consist of documentation related to different phases of Software Development.

Reference Books:

1. Bayross Ivan, *SQL, PL/SQL: The Programming Language of Oracle*, 4th Edition, BPB Publications, Reprint 2022.
2. Bradshaw Shannon, Brazil Eoin, Chodorow Kristina, *MongoDB:The Definitive Guide: Powerful and Scalable Data Storage*. 3rd Edition, Oreilly, 2019

E-resources:

1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013847905398898688555847_shared/overview
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_24062681407488140000_shared/overview

Program	B. Tech. I.T.				Semester			IV
Course	Community Engagement Project				Code			BIT24EL01
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	TW	OR	PR	Total
2	-	4	-	-	100	-	-	100

Course Objectives:

1. Understand the needs of diverse sectors such as education, agriculture, environment, health, and community development etc
2. Design and implement solutions to address identified problems using available platforms.
3. To evaluate the impact of their solutions on the community and the environment.

Course Outcomes:

After learning the course, the students will be able to:

1. Identify the societal/community needs
2. Apply the knowledge, values, and relevant skills to solve the identified problem.
3. Develop the prototype/product in line with the social responsibility and ethics
4. Demonstrate communication skills through project reports, presentations, and interactions with community members, team members, and mentor.

Guidelines:

The purpose of the Community Engagement Project is to involve students in community development, service activities and apply the experience to personal and academic development. Refer to collaborative efforts that involve engineers working with local communities, addressing specific needs, solving their problems, improving living conditions, empowering communities, promoting collaboration, imbibing interdisciplinary approaches, and creating lasting impact and sustainability.

1. A group of 3-4 students can form a team. Students are required to identify real-life problems under the guidance of a mentor.
2. Fieldwork: The problem chosen will be relevant to societal needs, and students will undergo field visits under the guidance of the mentor to identify the community requirements.
3. After identifying and defining the problem, the plan of activities and methodology will be framed.
4. The project's outcome will be evaluated in terms of technical, economical, societal, environmental, political, and demographic feasibility and implementation.
5. Students are required to submit an authorization letter from the relevant authority, which may include representatives from the industry, community, or non-governmental organizations (NGOs).
6. It is mandatory to prepare a project report with plagiarism below 20%.
7. Each team member will prepare his/her contribution in one to two pages, highlighting the contribution majorly with a brief abstract of the total work and add it to the project report.

Evaluation Criteria

Sr. No.	Criteria	Marks
1.	Identification of project topic: The project demonstrates a significant positive impact on the community, addressing identified needs effectively	20
2.	Sustainability: The project demonstrates a clear plan for environmental sustainability	10
3.	Timely project completion	20
4.	Project report	20
5.	Project presentation and demo (Synopsis, Report, Video, Flyer, Poster)	30
	Total	**100**

Suggested List projects:

Environmental Projects:

- Urban Gardening
- Waste Management Awareness Campaigns
- River Cleanup Initiatives
- Tree Plantation Drives
- Solar Panel Installation in Low-Income Areas
- Smart Green Transportation
- Environmental Education Platform
- Community Garden Automation
- Sustainable Community Development Dashboard
- Sewage engineering
- Public health engineering
- Eco-Friendly Community Center Design
- Beach Cleanup Events
- Composting Initiatives
- Air Quality Monitoring System
- Smart Waste Management
- Water Quality Monitoring and Management
- Smart Irrigation System
- Forest Fire Detection and Prevention
- Noise Pollution Monitoring
- Green Building Monitoring
- Stormwater Management Projects etc.

Agriculture projects: Crop estimation, quality monitoring, crop information

Healthcare projects: Prediction of Diabetes, Cancer, Trauma Management and CRC Training, etc.

Smart City/Smart Home Requirement and Automation

Transportation optimization

Educational Initiatives:

- Technical Awareness Sessions such as Eureka- Increasing the literacy line:
- Educational Software Development
- Library Renovation Projects
- Science Fair Mentoring
- Coding Bootcamp for Youth
- Robotics Workshops for Kids etc.
- Open Source Contributions
- Digital Transformation Initiatives
- Data Analytics and Data Visualization
- Software Development Projects
- Network Design and Implementation
- IoT (Internet of Things) Projects
- Field Survey and Data Collection

E-resources:

https://www.javaassignmenthelp.com/blog/community-service-project-ideas-for-engineering-students/

Program:	B. Tech. I.T.							Semester: IV	
Course:	Professional Development Training (Offered by AS&H)							Code:	BSH24AE05
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks				
	Lecture	Practical	Tutorial	Others	Practical			SA	Total
					FA1	FA2	TW		
02	--	04	--	-	--	--	100	--	100

Prior knowledge of: Basic Mathematics & English

Course Objectives:

This course aims at enabling students:

1. To enhance the logical reasoning skills of the students and improve the problem-solving abilities.
2. To improve the overall professional development of students.

Course Outcomes:

After learning the course, the students will be able to:

1. 1. Apply mathematical concepts to solve diverse numerical problems encountered in engineering, spanning arithmetic, algebra, geometry, and statistics.
2. Employ deductive reasoning, interpret data, and discern patterns to navigate complex logical puzzles and analytical challenges typical of engineering aptitude tests and professional scenarios.
3. Identify grammatical nuances, enhancing their verbal and written communication prowess essential for effective engineering discourse.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Numerical Ability-I** HCF & LCM and Number System, Geometry, Ages, Allegations and Mixtures, Averages, Clocks and Calendars, Equations, Percentages, Profit and Loss, Ratios and Proportion, Series and Progressions, Time, Speed and Distance, Time and Work.	18
II	**Numerical Ability-II** Permutations and Combinations, Probability, Mean, Median, Mode, Standard Deviation, and Variance, Data Interpretation, Graphical Data Interpretation, Pie Charts, Tabular Data Interpretation, Simple Arithmetic Operations, Interest and Compound Interest, Linear equations, Quadratic equations, Triplets, Trigonometry	12
III	**Logical Reasoning** Clocks and Calendar, Direction sense, Family tree, Syllogism, Seating arrangement, Team formation, Coding and Decoding, Number Series and Letter Series, Ranking and Arrangements, Game-Based Aptitude.	12

IV	**Verbal Ability & Reading Comprehension** Subject-Verb Agreement, Articles and Other Determiners, Prepositions, Tenses, Parts of Speech, Active and Passive Voice, Direct and Indirect Speech, Conjunctions, Sentence Selection, Contextual Vocabulary, Error Spotting and Sentence Correction, Sentence Completion, Synonyms and Antonyms, Reading Comprehension, Jumble words & sentences. SMART Goal Setting & Career Road-map, Resume Writing & Linked-in Profile Building, Mock Interviews. Programming Language: Problem-solving & coding practice, Mock coding interviews	18
	Total	**60**

Text Books:

1. Arun Sharma, Quantitative Aptitude, 2016, 7th Edition, McGraw Hill Education Pvt. Ltd.
2. ETHNUS, Aptimithra, 2013, 1stEdition, McGraw-Hill Education Pvt.Ltd

Reference Books:

1. R S Aggarwal, Quantitative Aptitude For Competitive Examinations, 2017, 3rd Edition, S. Chand Publishing, Delhi.
2. M. Tyra, Quicker Maths, 2018, 5th edition, 2018, BSC publishing company Pvt. Ltd

PCCOE "Knowledge Brings Freedom"

Program:	B. Tech. IT						Semester : IV	
Course:	Business Finance for Engineers						Code:	BIT24EM01
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-		-	10	10	30	50

Prior knowledge of:

1. Basic mathematical skills, analytical reasoning, and fundamental computer skills.

is essential

Course Objectives:

1. Inculcate the knowledge of the core concepts of business finance and its importance
2. Improve the time-value and financial concepts in the current competitive business scenario.

Course Outcomes :

After learning the course, the students will be able to:

1. Explain the concept of Business Finance and financial planning.
2. Apply financial and funding concepts to support IT startup and tech venture decisions.
3. Analyze financial markets and the role of financial institutions in Business Development.
4. Describe the role of Financial System in Business.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**IT Business Finance:** Concept and importance of Business Finance in IT companies, Role of finance in software project management & IT services, Objectives, scope, and functions of financial management, Finance Function, Business finance v/s corporate finance, Source of Finance. Financial structure of IT companies (CapEx, OpEx, Cloud costs), Sources of finance for tech startups and software firms, Introduction to financial planning for tech enterprises Types of financial plan.	7
II	**Capitalization and Venture Financing in the IT Sector:** Introduction to capitalization, Amount of Capitalization, Over Capitalization, Under Capitalization, Venture Capital - Meaning of Venture Capital, Method of Venture Financing ,Venture Capital Funds, Stages of venture funding for IT startups (Seed, Series A, etc.) , Polices and Procedures adopted by Venture Capitalists, Venture Capital in India, Guidelines for Venture Funds.	7
III	**Financial Markets & Instruments for IT Professionals:** Institutions and Instruments: Introductions to Financial Markets: Nature, Functions and Types of Financial markets, Different Financial Instruments, Sources of financing: Shares, Debentures, Term Loans, Retained Earnings, Public Deposits, Bonds, Trade Credit, Mutual Funds - Definition, Types of Mutual Funds, Significance of Mutual Funds. Case studies on financial markets impacting IT firms.	8

IV	**Constituents of the Financial System and Regulatory Institutions:** Classification: Fund Based, Non-Fund Based and Modern Services, Hire Purchasing, Leasing: Lease Financing - Essential Elements of Leasing, Types of Leases, Merits and Demerits of Lease Financing, Merchant Banking - Role; Functions of Merchant Banking, Factoring. Debt management, Portfolio Management. RBI - Organization, objectives, role and functions, monetary policy of RBI, NABARD, SEBI - Organization and Objectives	8
	Total	**30**

Text Books:

1. Byers, Thomas H., Dorf, Richard C., & Nelson, Andrew J. (2020). Technology Ventures: From Idea to Enterprise, 5th Edition, McGraw-Hill Education.
2. Khan, M.Y. Indian Financial System, 11th Edition, McGraw-Hill Education, 2021
3. Srivastava, R.M. Essentials of Business Finance, 8th Edition, Himalaya Publishing House, 2016.

Reference Books:

1. Gordon, E. & Natarajan, K. Financial Markets and Institutions, Himalaya Publishing House.
2. Khan and Jain, Financial Management, Tata McGraw Hill, 2008
3. Singh, Preeti. Investment Management. Himalaya Publishing House,
4. Kale, N.G. Business Organization. Manisha Publications.

E-sources:

1. https://www.youtube.com/watch?v=TgF2XvjquUU&list=PLLy_2iUCG87CXY2B6fPex1SOIqxzzD5Wj
2. https://www.youtube.com/watch?v=CCQwz_Gwo6o
3. https://www.youtube.com/watch?v=OT5RdoJAkhY&list=PLPjSqITyvDeUTeAOGhip_ubjN3y8oqT13

Program:	B. Tech. I.T.				Semester:			IV
Course:	Constitution of India				Code:			BSH24VE02
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	25	25	-	50

Course Objectives:

1. To introduce students to the fundamental principles, philosophy, and key features of the Indian Constitution.
2. To familiarize students with the structure and functioning of government and key constitutional provisions.
3. To enable students to apply constitutional values, rights, and duties in understanding contemporary issues and responsible citizenship.

Course Outcomes:

After learning the course, the students will be able to,

1. Explain the fundamental principles and key features of the Indian Constitution, including Preamble, Rights, Duties, and DPSP.
2. Describe the structure and functioning of the Executive, Legislature, and Judiciary, including the law-making process.
3. Illustrate constitutional provisions such as amendments, writs, and citizen mechanisms to address rights and governance issues.
4. Apply constitutional values to evaluate contemporary issues and challenges in civic and professional contexts.

Unit	Description	Duration [Hrs]
I	**Foundations of the Indian Constitution** • Introduction to the Indian Constitution: brief historical background, making of the Constitution, and its significance • The Preamble: ideals, philosophy, and interpretation • Salient features of the Indian Constitution: sovereignty, secularism, democracy, federalism, and rule of law • Fundamental Rights and Fundamental Duties: concepts and relevance in contemporary society • Directive Principles of State Policy (DPSP): objectives and role in governance • Relationship between Fundamental Rights, Duties, and DPSP	7
II	**Structure and Functioning of Government** • Union Executive: President, Vice-President, Prime Minister, and Council of Ministers—roles and functions • Parliament: composition and functioning of Lok Sabha and Rajya Sabha • Legislative process: stages of law-making (bill to act) • Judiciary: structure, independence, and concept of judicial review • Federalism: Centre–State relations and distribution of powers • State Government: role of Governor and State Legislature (overview)	8
III	**Constitutional Mechanisms and Citizen Interface** • Amendment process of the Constitution and basic structure doctrine • Constitutional bodies: Election Commission of India and Comptroller and Auditor General—roles and functions	7

	• Emergency provisions: national, state, and financial emergencies • Constitutional remedies: writs and judicial remedies for protection of rights • Public Interest Litigation (PIL): concept and significance • Introduction to citizen-centric mechanisms: Right to Information (RTI)	
IV	**Constitution in Contemporary Context** • Judicial activism and its role in safeguarding constitutional values • Contemporary constitutional issues: freedom of speech, right to privacy, gender justice, and environmental protection • Challenges to constitutional governance: secularism, federalism, and social justice • Recent constitutional developments and amendments • Basic comparative perspective: Indian Constitution and selected global practices • Case Studies with help of artificial intelligence	8

Text Books:

1. E 1. Durga Das Basu, ―Introduction to the Constitution of India ―, Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, ― Our Constitution: An Introduction to India‘s Constitution and constitutional Law‖, NBT, 5th edition, 2014, ISBN-9781107034624

Reference Books:

1. Maciver and Page, ―Society: An Introduction Analysis ―, Laxmi Publications, 4th edition, 2007, ISBN 100333916166
2. PM Bhakshi, ―The constitution of India‖, Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375
3. Indian Constitution by Subhash C. Kashyap, National Book Trust, New Delhi.
4. Constitution of India and Professional Ethics, Dr. G. B. Reddy & Mohd. Suhaib, Dreamtech Press.

e-sources:

1. https://www.legislative.gov.in/constitution-of-india
2. **https://legalaffairs.nalsar.ac.in/**

"Knowledge Brings Freedom"

Open Elective Mathematics

Program:	B. Tech. I.T.					**Semester:** IV		
Course:	**Applied Mathematics** (Suggested for Mechanical branch)					**Code:**	BSH24OE01	
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	2	--	--	--	10	10	30	50

Prior knowledge of: Univariate Calculus, Multivariate Calculus

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Statistical techniques and Probability theory for Data Analysis.
2. Partial differential equations applied to mechanical engineering problems such as mechanical vibrations and heat transfer.
3. Laplace Transform and Inverse Laplace Transform applied to solve linear differential equations.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply descriptive statistical techniques to numerical data.
2. Draw inferences from data using probability theory and hypothesis testing.
3. Solve wave, heat and Laplace equations using separation method.
4. Find Laplace and Inverse Laplace Transform for piecewise continuous function and solution of linear differential equations.

Detailed Syllabus

Unit	**Description**	**Duration [Hrs]**
I	Statistics: Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.	7
II	Probability Distributions: Probability, Theorems on Probability, Mathematical Expectation, Binomial, Poisson, and Normal Distributions. Hypothesis Test: z-test, t-test, Chi-Square test, ANOVA Test.	8
III	Applications of Partial Differential Equations: Solution to One dimensional Wave, Heat and Transport equation, Two-dimensional heat flow equation using Method of separation of variables.	7
IV	Laplace Transform: Introduction, Laplace Transform of some standard and special functions, Region of convergence and Properties, properties and theorems of Laplace Transformation. Inverse Laplace Transform, Application of Laplace Transform to solve LDE.	8
Total		30

Text Books: T**ext Books:**

1. Peter O'Neil, "Advanced Engineering Mathematics", Thomson Learning, 7 Edition, ISBN 13:9781337274524.
2. B.V. Ramana , "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.

Reference Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics” Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365.
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13:9788174091955.
3. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320.
4. H.K. Das, “Advanced Engineering Mathematics”, S Chand & Company Ltd, 22 edition, ISBN 9352533836.

e-resources: NPTEL Course lectures links:

1. https://nptel.ac.in/courses/111/105/111105038/ (P.D.E)
2. https://onlinecourses.nptel.ac.in/noc20_ma13/ (Advanced Engineering Mathematics)

Program:	B. Tech. I.T.						**Semester: IV**	
Course:	**Computational Techniques (**Suggested for E&TC branch)						**Code:**	BSH24OE02
Credits	**Teaching Scheme (Hrs./Week)**				**Evaluation Scheme and Marks**			
	Lecture	**Practical**	**Tutorial**	**Other**	**FA**		**SA**	**Total**
					FA1	**FA2**		
2	2	-	-	-	10	10	30	50

Prior knowledge of:

1. Univariate Calculus
2. Multivariate Calculus is essential

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Statistical techniques, Probability theory and hypothesis techniques.
2. Numerical techniques to approximate solutions for interpolation, integration and ordinary differential equations.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply descriptive statistical techniques to numerical data.
2. Analyze random phenomena using probability theory and distributions.
3. Draw inferences from data using hypothesis testing.
4. Find approximate solutions for interpolation, integration and ordinary differential equations.

Detailed Syllabus

Unit	**Description**	**Duration [Hrs]**
I	**Statistics:** Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.	7
II	**Probability Distributions:** Probability, Theorems on Probability, Random Variable, Probability mass function, Mathematical Expectation, Probability distributions: Binomial, Poisson, and Normal.	8
III	**Sampling Distribution:** Introduction and Types, Population vs Sample **Hypothesis Tests:** Level of significance, Confidence interval, p-Test, z-test, t-test, Chi-Square test, ANOVA Test.	7
IV	**Numerical Methods:** **Interpolation:** Finite Differences, Newton's and Lagrange's interpolation formula. **Numerical Integration:** Trapezoidal and Simpson's rule **Ordinary differential equations:** Euler's, Modified Euler's and Runge-Kutta fourth order methods	8
	Total	**30**

Text Books:

1. Peter V. Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13:9781337274524.
2. B.V. Ramana , "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13:9780486492797.
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13:9788174091955.
3. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320
4. H. K. Das, “Advanced Engineering Mathematics”, S Chand & Company Ltd., 22 edition, ISBN 9352533836.

e-resources:

NPTEL Course lectures links:

1. Probability Theory for Data Science - Course (nptel.ac.in) (Statistics, Probability and Hypothesis testing)
2. Numerical methods - Course (nptel.ac.in) (Numerical Methods)

Program:	B. Tech. I.T.						Semester: III	
Course:	**Applied Mathematics** (Suggested for Civil branch)						Code:	BSH24OE03
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior knowledge of:

1.Univariate Calculus

2. Multivariate Calculus is essential

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Statistical techniques, Probability theory, and Hypothesis techniques.
2. Higher level mathematics and their applications in Civil Engineering.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply descriptive statistical techniques to numerical data.
2. Draw inferences from data using probability theory and hypothesis testing.
3. Find approximate solutions for interpolation, integration and ordinary differential equations.
4. Examine the vector fields using concepts of vector differentiation and Integration.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Statistics:** Measures of Variability, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.	7
II	**Probability Distributions:** Probability, Theorems on Probability, Mathematical Expectation, Binomial, Poisson and Normal Distribution. **Hypothesis Test:** z-test, t-test, Chi-Square test, ANOVA Test.	8
III	**Numerical Methods:** **Interpolation:** Finite Differences, Newton's and Lagrange's interpolation formula **Numerical Integration:** Trapezoidal and Simpson's rule. **Ordinary differential equations:** Euler's, Modified Euler's and Runge-Kutta fourth order methods.	7
IV	**Vector Differentiation:** Introduction, Vector differential operators, Gradient, Divergent, Curl, Directional Derivatives, Solenoidal and Irrotational fields, Scalar Potential. **Vector Integration and Applications:** Introduction toLine, Surface and Volume Integration of Vectors, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem.	8
	Total	**30**

Text Books:

1. Peter V. Neil, “Advanced Engineering Mathematics”, Thomson Learning ,7 Edition, ISBN 13:9781337274524.
2. B.V. Ramana , “Higher Engineering Mathematics”, Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13: 9780486492797
2. S.R.K. Iyengar, Rajendra K. Jain, “Advanced Engineering Mathematics”, Alpha Science International, Ltd,4
3. Edition, ISBN 13: 9781842658468
4. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13: .9788174091955
5. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320

e-resources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/105/111105090/(Probability)
   https://onlinecourses.nptel.ac.in/noc20_ma13/(Advanced Engineering Mathematics)
2. **V-lab (IIT-Bombay) link: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php**

Program:	B. Tech.						Semester: IV	
Course:	Computational Techniques (Suggested for Comp/Comp-RL/IT branch)						Code:	BSH24OE07
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	2	-	-	0	10	10	30	50

Prior knowledge of:

1. Univariate Calculus
2. Multivariate Calculus

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Statistical techniques, Probability theory and hypothesis techniques.
2. Different mathematical approaches for optimization.

Course Outcomes:

After learning the course, the students should be able to:

1. Apply descriptive statistical techniques to numerical data.
2. Analyze random phenomena using probability theory and distributions.
3. Draw inferences from data using hypothesis testing.
4. Apply optimization techniques in transportation and assignment problems.

Detailed Syllabus

Unit	Description	Duration [Hrs]
I	**Statistics:** Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting (line, parabola & exponential curves), Correlation and Linear Regression.	7
II	**Probability Distributions:** Probability, Theorems on Probability, Random Variable, Probability mass function, Mathematical Expectation, Probability distributions: Binomial, Poisson, and Normal.	8
III	**Sampling Distribution:** Introduction and Types, Population vs Sample **Hypothesis Tests:** Level of significance, Confidence interval, p-Test, z-test, t-test, Chi-Square test, ANOVA Test.	7
IV	**Transportation Problems:** Introduction, Mathematical model of transportation problem, Methods of finding initial solutions: North-west Corner rule, least cost method, VOGEL"s approximation method, Optimality of initial solution using MODI Method. **Assignment Problems:** Introduction, Mathematical model of Assignment problem, solutions to Assignment problems using Hungarian method.	8
	Total	**30**

Text Books:

1. Peter O'Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13:9781337274524.
2. B.V. Ramana , "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.

Reference Books:

1. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13:9780486492797.
2. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13:9788174091955.
3. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320
4. H.K. Das, “Advanced Engineering Mathematics”, S Chand & Company Ltd, 22 edition, ISBN 9352533836

e-sources:

NPTEL Course lectures links:

Probability Theory for Data Science - Course (nptel.ac.in) (Statistics, Probability and Hypothesis testing)

https://nptel.ac.in/courses/110/106/110106059/(Transportation&AssignmentsProblems)

Program:	B. Tech. I.T.						Semester: IV	
Course:	**Mathematical Optimization (**Suggested for AI & ML branch)						Code:	BSH24OE08
Credits	Teaching Scheme (Hrs./Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	-	10	10	30	50

Prior knowledge of:

1. Univariate Calculus
2. Multivariate Calculus

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Different mathematical approaches for optimization.
2. Commonly used tools and techniques in network analysis

Course Outcomes:

After learning the course, the students should be able to:

1. Solve Linear Programming Problems using graphical and simplex methods.
2. Apply optimization techniques in transportation and assignment problems.
3. Analyze project networks using Critical Path Method and Project Evaluation & Review Techniques.
4. Apply numerical methods for optimal solutions of constrained, unconstrained linear and nonlinear programming problems.

Detailed Syllabus

Unit		Duration [Hrs]
I	**Linear Programming (LP):** Introduction, formulation of Linear Programming problems, Graphical solution method, multiple optimal solutions, Unbounded solutions, Infeasible solutions, Simplex Method.	**8**
II	**Transportation Problems:** Introduction, Mathematical model of transportation problem, methods of finding initial solutions: North-west Corner rule, Least cost method, VOGEL‟s approximation method, Optimality of initial solution using MODI Method. **Assignment Problems:** Introduction, Mathematical model of Assignment problem, solutions to Assignment problems using Hungarian method.	**7**
III	**Network Analysis:** Network Diagram, Project Management: PERT and CPM, Critical path analysis, Project scheduling with uncertain activity time, and Project time-cost	**8**
IV	**Unconstrained optimization:** One-dimensional search methods, Gradient-based methods, Conjugate direction and quasi-Newton methods, **Constrained Optimization:** Lagrange theorem	**7**
	Total	**30**

Text Books:

1 .Rao S. S., Engineering Optimization Theory and Practice, Willy Eastern Ltd.4th Edition, ISBN: 978-0-470- 18352-6

2.Taha Hamdy ,Operation Research: An Introduction, Pearson Education, 9thEdition, ISBN:0134444019

Reference Books:

1. Sharma S.D .Operation Research, Kedarnath Ramnath & Co.Edition, ISBN:9380803389
2. Peter. O' Neil,"Advanced Engineering Mathematics,"Thomson Learning,7 Edition, ISBN13: 9781337274524
3. Hira Gupta," Operation Research,"S.Chand Publication, ISBN(13):9788121909686.
4. Sharma J.K."Operations Research-Theory and Applications," Trinity Press,6 Edition ISBN:9789385935145

E-resources:

NPTEL Course lectures links:

1. https://nptel.ac.in/courses/111/102/111102012/(LPP) https://nptel.ac.in/courses/110/106/110106059/(Transportation&AssignmentsProblems)

Vision and Mission of Information Technology Department

Department Vision

To become a front-runner in the western region in preparing Information Technology engineers with academic excellence and research skills empowering their roles in technology and society.

Department Mission

1. To equip students with the skills and knowledge through a dynamic learning environment
2. To collaborate with industries to nurture proficient Information Technology Engineers
3. To cultivate a spirit of research, innovation, and entrepreneurship to address community and business challenges.
4. To imbibe work ethics and leadership skills through co-curricular and extracurricular activities.