Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Course Structure and Syllabus

of

Second Year Engineering

in

Computer Engineering

Prepared by:- Board of Studies in Computer Engineering

Recommended by:- Academic Council of D. J. Sanghvi College of Engineering

Approved by:- Governing Body of D. J. Sanghvi College of Engineering

Revision: 4 (2025)

With effect from the Academic Year: 2025-2026

Scheme for Second Year Undergraduate Program in Computer Engineering (Autonomous) (DJS23 Scheme)

SEMESTER III

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment			Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tutorial (hrs)	Total Credits	Duration (hrs)	Theory	Oral	Pract.	Oral & Practical	SEE Total (A)	TT	Term Work Total	Total (B)			
1	DJS23CPC201	Data Structures	3			3	2	60				60	40		40	100	3	4
	DJS23CPC201L	Data Structures Laboratory		2		1					25	25		25	25	50	1	
2	DJS23CPC202	Database Management System	3			3	2	60				60	40		40	100	3	4
	DJS23CPC202L	Database Management System Laboratory		2		1					25	25		25	25	50	1	
3	DJS23CPC203	Computer Networks	2			2	2	60				60	40		40	100	2	2
	DJS23CPC203L	Python Programming Laboratory		2		1					25	25		25	25	50	1	1
4	DJS23CMD201	Computational Mathematics	3			3	2	60				60	40		40	100	3	3
5	DJS23XOE211	Product Life Cycle Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	3
	DJS23XOE212	Management Information System	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE213	Operations Research	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE214	Personal Finance Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE215	Public Systems and Policies	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE216	Fundamentals of Biomedical Instruments	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE217	IPR and Patenting	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE218	Entrepreneurship and Startup Ecosystem	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
6	DJS23XSC201P	Innovative Product Development I	--	2	--	1	--	--		--	--	--	--	25	25	25	1	1
7	DJS23XHS231L	Design Thinking Laboratory		2		1								25	25	25	1	1
8	DJS23XHS232	Universal Human Values	2			2	2	60				60	40		40	100	2	3
	DJS23XHS232T	Universal Human Values Tutorial			1	1								25	25	25	1	
9	DJS23XEL201L	Community Engagement Service		2		1								25	25	25	1	1
		Total	16	10	1	23	12	360			75	435	240	175	415	850	23	23

Prepared by Checked by Head of the Department Principal

Scheme for Second Year Undergraduate Program in Computer Engineering (Autonomous) (DJS23 Scheme)

SEMESTER IV

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment			Aggregate (A+B)	Credits Earned	
			Theory (hrs)	Practical (hrs)	Tutorial (hrs)	Total Credits	Duration (hrs)	Theory	Oral	Pract.	Oral & Practical	SEE Total (A)	TT	Term Work Total	Total (B)			
1	DJS23CPC251	Operating Systems	3			3	2	60				60	40		40	100	3	4
	DJS23CPC251L	Operating Systems Laboratory		2		1					25	25		25	25	50	1	
2	DJS23CPC252	Analysis of Algorithms	3			3	2	60				60	40		40	100	3	4
	DJS23CPC252L	Analysis of Algorithms Laboratory		2		1					25	25		25	25	50	1	
3	DJS23CPC253	Artificial Intelligence	3			3	2	60				60	40		40	100	3	4
	DJS23CPC253L	Artificial Intelligence Laboratory		2		1					25	25		25	25	50	1	
4	DJS23CMD251	Algebraic Number Theory	2			2	2	60				60	40		40	100	2	2
5	DJS23XOE261	Project Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	3
	DJS23XOE262	Cyber Security, Policies and Laws	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE263	Advanced Operations Research	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE264	Corporate Finance Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE265	Corporate Social Responsibility	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE266	Bioinformatics	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE267	Human Resource Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE268	Digital Marketing Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
	DJS23XOE269	Logistics and Supply Chain Management	3	--	--	3	2	60	--	--	--	60	40	--	40	100	3	
6	DJS23XSC251P	Innovative Product Development II	--	2	--	1	--	--		--	--	--	--	25	25	25	1	1
7	DJS23XHS281T	Professional and Business Communication Tutorial			2	2								50	50	50	2	2
8	DJS23XHS282	Economics and Financial Management	2			2	2	60				60	40		40	100	2	2
Total			16	8	2	22	12	360			75	435	240	150	390	825	22	22

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Continuous Assessment (A):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 40 % syllabus)	15	45
	b. Term Test 2 (on next 40 % syllabus)	15	45
	c. Assignment / course project / group discussion / presentation / quiz/ any other.	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Semester End Assessment (B):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	60	2
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	As per the scheme	2

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Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: III**

Course: Data Structures (DJS23CPC201)

Course: Data Structures Laboratory (DJS23CPC201L)

Pre-requisite:

1. C Programming

Objectives:

The objective of the course is

1. To introduce and familiarize students with linear and non-linear data structures, their use in fundamental algorithms and design & implementation of these data structures.
2. To introduce students to the basics of algorithms and time complexity.
3. To familiarize students with various sorting and searching techniques, and their comparison.

Outcomes: On completion of the course, the learner will be able to:

1. Assimilate the concept of various linear and non-linear data structures.
2. Solve the problem using appropriate data structure.
3. Implement appropriate searching and sorting algorithms for a given problem.

Data Structures (DJS23CPC201)		
Unit	**Description**	**Duration**
1	**Data Structures:** Introduction, need of Data Structures, Types of Data Structures, Abstract Data Types (ADT), Algorithms and Asymptotic notations.	02
2	**Linear Data Structures** – LIST: List as an ADT, Array-based implementation, Linked List implementation, singly linked lists, circularly linked lists, doubly linked lists, All operations (Insertion, Deletion, Merge, Traversal, etc.) and their analysis, Applications of linked lists - (Polynomial Addition).	08
3	**Linear Data Structure – STACK**: Stack as an ADT, Operations, Array and Linked List representation of Stack, Applications – Reversing data, Conversion of Infix to prefix and postfix expression, Evaluation of postfix and prefix expressions, balanced parenthesis, etc. **Linear Data Structure – QUEUE**: Queue as an ADT, Operations, Implementation of Linear Queue, Circular and Priority Queue using arrays and Linked List, DEQueue, Applications – Queue Simulation.	10
4	**Non-Linear Data Structure** – TREES: Tree Terminologies, Tree as an ADT, Binary Tree - Operations, Tree Traversals, Binary Search Tree (BST) - Operations, Expression Trees **Height Balanced Tree**: Creation of AVL Tree, **Heap**- Operations on heap, Heap Sort **Applications** - Huffman coding **Introduction to B tree**- Insertion, Deletion	10
5	**Non-Linear Data Structure** – GRAPHS: Graph Terminologies, Types of Graphs, Representation of Graph using arrays and Linked List,	04

	Breadth-First Search (BFS), Depth–First Search (DFS), Applications of Graphs -Topological sorting.	
6	**Searching-** Linear Search, Binary Search and Fibonacci search. **Sorting**: Selection Sort, Insertion Sort, Radix Sort, Merge Sort, Quick Sort. **Hashing**: Hash Functions, Overflow handling, Collision & Collision Resolution Techniques, Linear hashing, Hashing with chaining, Separate Chaining, Open Addressing.	08
	Total	**42**

Data Structures Laboratory (DJS23CPC201L)	
Exp.	**Suggested experiments (Any 10)**
1	Implementation of Linked List using menu driven approach.
2	Implementation of different operations on linked list –copy, concatenate, split, reverse, count no. of nodes etc.
3	Implementation of polynomials operations (addition, subtraction) using Linked List.
4	Implementation of stack using menu driven approach.
5	Implementation of Infix to Postfix conversion
6	Implementation of prefix and postfix evaluation using menu driven approach.
7	Implementation of parenthesis checker using stack.
8	Implementation of Linear queue using menu driven approach.
9	Implementation of circular queue using menu driven approach.
10	Implementation of double ended queue using menu driven approach
11	Implementation of Priority queue program using array and Linked list.
12	Implementation of Binary Tree using menu driven approach
13	Implementation of Binary Tree Traversal.
14	Implementation of Binary Tree Traversal.
15	Implementation of BST using following operations – create, delete, display.
16	Implementation of various operations on tree like – copying tree, mirroring a tree, counting the number of nodes in the tree, counting only leaf nodes in the tree.
17	Implementation of Graph traversal using menu driven program (DFS & BFS).
18	Implementations of Selection sort, Radix sort using menu driven.
19	Implementation of Heap & Heap Sort using menu driven program.
20	Implementation of Merge Sort, Quick Sort using menu driven Program
21	Implementation of searching methods (Index Sequential, Fibonacci search, Binary Search) using menu driven program.

22	Implementation of hashing functions with different collision resolution techniques

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Batchwise laboratory work of minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Batchwise tutorial sessions are to be conducted on topics which would help the learner to identify/analyze the problem and to apply problem solving techniques learnt.

Books Recommended:

Textbooks:

1. Reema Thareja, "Data Structures using C", 3rd Edition, Oxford, 2023.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, W. H. Freeman and Company, 2008.
3. R. F. Gilberg and B. A. Forouzan, "Data Structures – A Pseudocode Approach with C", 2nd Edition, Cengage Learning, 2007.

Reference Books:

1. Tanenbaum, Langsam, Augenstein, "Data Structures using C", Pearson, Second edition 2015.
2. Kruse, Leung, Tondo, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2013.
3. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Addison-Wesley, 2010.

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Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: III**

Course: Database Management System (DJS23CPC202)

Course: Database Management System Laboratory (DJS23CPC202L)

Prerequisite: Computer Basics, Foundation of Computing Technologies

Course Objectives: The course intends to introduce the students to the management of database systems, with an emphasis on how to design, organize, maintain and retrieve information efficiently and effectively from a database.

Course outcomes: On successful completion of this course, learner will be able to:

1. Design an optimized database.
2. Construct SQL queries to perform operations on the database.
3. Demonstrate appropriate transaction management and recovery techniques for a given problem.
4. Apply indexing mechanisms for efficient retrieval of information from database.

Database Management System (DJS23CPC202)		
Unit	**Description**	**Duration**
1	**Introduction to DBMS** **Entity–Relationship Model:** Relationship constraints: Cardinality and Participation **Extended Entity-Relationship (EER) Model:** Generalization, Specialization and Aggregation **Relational Model:** Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER and EER Model to the Relational Model **Relational Algebra** – Unary and Set operations, Relational Algebra Queries	06
2	**Structured Query Language (SQL):** Overview of SQL, Data Definition Commands, Data Manipulation commands, Integrity constraints – key constraints, Domain Constraints, Referential integrity, check constraints, Data Control commands, Transaction Control Commands, Set and String operations, aggregate function – group by, having, Views in SQL, joins, Nested and complex queries, Triggers, Security and authorization in SQL.	10
3	**Relational–Database Design:** Pitfalls in Relational-Database designs, Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF	08

4	**Transaction Management and Recovery:** Transaction Concept, ACID properties, Transaction States, Implementation of atomicity and durability, Concurrent Executions, Serializability, Concurrency Control Protocols: Lock-based, Deadlock Handling **Recovery System:** Failure classification, Log based recovery, Shadow Paging	08
5	**Indexing Mechanism:** Hashing techniques, Types of Indexes: Single Level Ordered Indexes, Multilevel Indexes, Overview of B-Trees and B+ Trees	04
6	**NoSQL Databases:** Introduction to unstructured data, Overview of NoSQL databases – Key-value store, Document database, Column-oriented database, Graph database, Overview of MongoDB	06
	Total	**42**

Database Management System Laboratory (DJS23CPC202L)

List of Laboratory Experiments:

1. Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) /Extended Entity-Relationship (EER) Model.
2. Map the ER/EER to relational schema.
3. To implement DDL and DML commands with integrity constraints.
4. To access & modify Data using basic SQL.
5. To implement Joins and Views.
6. To implement Subqueries.
7. To implement triggers.
8. Examine the consistency of database using concurrency control technique (Locks)
9. To implement B-trees/B+ trees.
10. Perform CRUD operations in MongoDB.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Batchwise laboratory work of minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Textbooks:

1. Korth, Silberchatz, Sudarshan, —Database System Concepts, 7th Edition, McGraw – Hill, 2019.
2. Elmasri and Navathe, —Fundamentals of Database Systems, 7th Edition, Pearson education, 2016.

3. Peter Rob and Carlos Coronel, —Database Systems Design, Implementation and Management, Thomson Learning, 5th Revised Edition, 2002.
4. G. K. Gupta —Database Management Systems, 3rd Edition, McGraw – Hill, 2018.
5. Andreas Meier, Michael Kaufmann, "SQL & NoSQL Databases", Springer, 2019.
6. Xun (Brian) Wu, Sudarshan Kadambi, Devram Kandhare, Aaron Ploetz — Seven NoSQL Databases in a Week, Packt Publishing Limited, 2018
7. NoSQL with MongoDB in 24 Hours, Sams Teach Yourself, Pearson Education, 2015

Reference Books:

1. Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2012.
2. Sharaman Shah, —Oracle for Professional, Shroff Publishers & Distributers Private Limited, 1st Edition, 2008
3. Raghu Ramakrishnan and Johannes Gehrke, — Database Management Systems, 3rd Edition, McGraw – Hill, 2014.
4. Patrick Dalton, "Microsoft SQL Server Black Book", Coriolis Group,U.S., 11th Edition, 1997.
5. Lynn Beighley, "Head First SQL", O'Reilly Media, 1st Edition, 2007.
6. Gaurav Vaish —Getting started with NoSQL, Packt Publishing Limited, 2013.
7. Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, "MongoDB in Action", 2ed: Covers MongoDB Version 3.0, Harper Business, 2016

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Program: Computer Engineering **S.Y B. Tech.** **Semester: III**

Course: Computer Networks (DJS23CPC203)

Prerequisite: Digital Logic

Objectives:

To get familiar with contemporary issues and challenges of various protocol designing in layered architecture and performance analysis of routing and transport layer protocols for various applications.

Outcomes: On completion of the course, learner will be able to:

1. Demonstrate the concepts of data communication at physical layer and compare ISO - OSI model & TCP/IP model.
2. Demonstrate the working of networking protocols at data link layer.
3. Design of network using given IP addressing and subnetting / supernetting schemes
4. Understand different transport layer protocols and various congestion control algorithms.
5. Explore various protocols at application layer.
6. Understand the key concepts, components, and protocols of Wireless Sensor Networks (WSN) and Software Defined Networking (SDN).

Computer Networks (DJS23CPC203)		
Unit	**Description**	**Duration**
1	**Introduction to Networking:** Introduction to computer network, network application, network software and hardware components, Network topology, design issues for the layers. Reference models: Layer details of OSI, TCP/IP models.	03
2	**Physical Layer:** Frequency Spectrum, Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media: Bluetooth (Piconet, Scatternet and Protocol stack), Infra, Radio Waves, Microwaves	03
3	**Data Link Layer:** Design Issues: Framing, Error Control: Error Detection and Correction (Hamming Code, CRC, Checksum), Flow Control: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Medium Access Control Sublayer: Channel Allocation problem, Multiple Access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CA, CSMA/CD).	06
4	**Network Layer:** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (Classful and Classless),IPv4 Protocol,IPv6 Protocol Network Address Translation (NAT) Routing algorithms : Link state routing, Distance Vector Routing Protocols - ARP,RARP, ICMP, IGMP Congestion control algorithms: Open loop	08

	congestion control, Closed loop congestion control, Token & Leaky bucket algorithms.	
5	**Transport Layer:** The Transport Service, Port Addressing, Transport service primitives, Berkeley Sockets, Connection management (Handshake, Teardown), UDP, TCP, TCP Congestion Control: Slow Start. **Application Layer:** DNS, HTTPS, SMTP, Telnet, FTP.	04
6	**Introduction to Modern Networking Paradigms:** Introduction to WSN, WSN Architecture, Types of WSN, Challenges in WSN. Introduction to SDN, SDN Architecture, Key Concepts in SDN (Introduction to flow-based forwarding and an overview of the OpenFlow protocol.)	04
	Total	**28**

Books Recommended:

Text Books

1. Andrew S. Tanenbaum, David J. Wetherall, - Computer Networks, Pearson Education, 6th edition 2021
2. Behrouz A. Forouzan, -Data Communications and Networkingl, TMH ,5th edition 2017
3. Oliver C Ibe - Fundamentals of Data Communication Networks, Wiley Publications ,1st edition 2017.
4. James F. Kurose, Keith W. Ross, -Computer Networking, A Top-Down Approach Featuring the Internetl, Pearson Education, 6th edition 2017.

Reference Books

1. S.Keshav,- An Engineering Approach To Computer Networking, Pearson Education, 3rd edition 2010.
2. Natalia Olifer& Victor Olifer,- Computer Networks: Principles, Technologies & Protocols for Network Design, Wiley India, 2011.
3. Larry L.Peterson, Bruce S. Davie,- Computer Networks: A Systems Approach, Second Edition (The Morgan Kaufmann Series in Networking),2012.
4. Anna Hac, Wireless Sensor Network Designs, John Wiley & Sons, December 2003, 391 pages
5. Paul Goransson, Chuck Black, Software Defined Networks: A Comprehensive Approach, Morgan Kaufmann, 2014.

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Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: III**

Course: Python Programming Laboratory (DJS23CPC203L)

Pre-requisite:

1. C Programming
2. Data Structures

Objectives:

1. To learn the basic and OOP concepts of Python.
2. To study various advanced python concepts like inheritance, exception handling, modules etc.
3. Learn to develop GUI based standalone and web application.

Outcomes: On completion of the course, the learner will be able to:

1. Understand basic and object-oriented concepts, data structure implementation in python.
2. Apply file, directory handling and text processing concepts in python.
3. Apply database connectivity using python.
4. Develop python-based application using Tkinter.

Python Programming Laboratory (DJS23CPC203L)		
Unit	**Description**	**Duration**
1	**Python Basics, Control Structures and Data Structures** Introduction to Python, Types of IDE (Anaconda/PyCharm) Identifiers, Variables, Operators, Data Types, Conditions, Loops **Data Structures in Python** • **Strings**: Introduction, functions, and operations on Strings, Application Programs on Strings. • **Arrays**: Application Programs on Arrays. • **List**: Introduction, functions and operations on List, Application Programs on Lists • **Tuple**: Introduction, functions, and operations on Tuple • **Dictionaries**: Introduction, functions and operations on Dictionaries, Application Programs on Dictionaries. • **Sets**: Introduction, functions, and operations on Sets, Applications on Sets	04
2	**Functions, Modules and Collections** • **Functions**: Defining and Invoking functions, Scope, Parameter types Recursive functions, Built in Functions such as enumeration, zip, sorted, map, filter and Applications • **Modules** in Python, creating custom modules and calling them • **Lambda functions**	06

	• **Collections,** Iterators, Generators, Decorators, OrderedDict, defaultdict etc. • Recursion and Memoization • Functional Libraries (functools, itertools)	
3	• **Working with Text and DatabasesFile I/O operations**: Reading and Writing data from various formats, • **Regular Expressions,** Identifiers, Quantifiers. Application Programs on Regular Expressions • **Working with Databases**: Databases and Data Science, SQLite database and Insert, Update, Delete, Retrieve operations • **Exception Handling**: Need for Exception handling, Raising exceptions • Network Programming with Sockets	06
4	**Object Oriented Programming using Python** • Need for Static members, Static functions • Need for Encapsulation and Abstraction, Private Attributes • Getter, and Setter Methods– Python Implementation • Inheritance: Need for Inheritance, Kinds of Inheritance • Polymorphism Abstract methods, Overloading and Overriding	04
5	**Web Development with Python** • Web Frameworks (Flask, Django) • RESTful API Development • Authentication and Authorization • Asynchronous Programming with Python	04
6	**Exploratory Data Analysis and Visualization** • Data Manipulation and Exploratory Data Analysis with Numpy, Pandas • Matplotlib and Seaborn libraries for Visualization • Machine Learning with scikit-learn • Data Scraping with BeautifulSoup and Scrapy • GUI programming using Tkinter	04
	Total	**28**

Python Programming Laboratory (DJS23CLPC303)	
Exp.	**Suggested experiments**
1	Write python programs to understand Expressions, Variables, Quotes, Basic Math operations.
2	Write python programs to demonstrate applications of different decision-making statements.
3	Write a Python program to implement Basic String Operations & String Methods.
4	Write a Python program to implement functions of List, Tuples, and Dictionaries.
5	Write a Python program to implement Arrays (1D, 2D) applications.

6	Write a Python program to implement Functions and Recursion.
7	Write a Python program to implement Programs based on Lambda, Map, and Reduce Functions
8	Write a Python program to implement program to implement concept of Function decorators.
9	Write python programs to implement Classes & objects, Constructors.
10	Write python programs to implement Inheritance & Polymorphism.
11	Write python programs to implement Exception handling.
12	Write python programs to understand different File handling operations with exception handling.
13	Write python programs to implement database connectivity and DDL and DML commands in Python using SQLite.
14	Write python programs to understand GUI designing (Programs based on GUI designing using Tkinter
15	Implement different Machine learning packages like numpy, pandas and matplotlib.
16	Build a simple web application using Flask or Django framework.
17	Implement a RESTful API for a specific use case (e.g., a blog API).

Batchwise laboratory work of minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books:

1. Dr. R. Nageswara Rao, "Core Python Programming", 3rd Edition, Dreamtech Press, 2021.
2. Mark Lutz, "Learning Python", 5th Edition, Oreilly Publication, 2013.
3. E Balagurusamy, "Introduction to computing and problem-solving using Python", McGraw Hill Education, 2018
4. Reema Thareja, "Python Programming: Using Problem Solving Approach", 2nd Edition, Oxford, 2017

Reference Books:

1. Martin C Brown, "Python: The Complete Reference", 1st Edition, Mc Graw Hill, 2018.
2. Zed A. Shaw, "Learn Python the Hard Way", 3rd Edition, Addison-Wesley Publication, 2014.
3. Laura Cassell, Alan Gauld, "Python Projects", Wrox Publication, 2015.

Online References:

1. The Joy of Computing https://onlinecourses.nptel.ac.in/noc24_cs57/
2. Programming in Python https://onlinecourses.swayam2.ac.in/cec22_cs20/

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Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: III**

Course: Computational Mathematics (DJS23CMD201)

Pre-requisite: Knowledge of

1. Calculus
2. Descriptive Statistics
3. Basics of probability

Objectives:

1. This course's objective is to introduce students to the concepts of Eigenvalues and Eigenvectors of Matrices.
2. This course's objective is to introduce students to the concepts of probability, and test of hypothesis.
3. The course also familiarizes students with different methods of solving Linear Programming problems.

Outcomes: On completion of the course, the learner will be able to:

1. Apply the concepts of eigenvalue, eigenvectors, and diagonalization to engineering problems.
2. Apply the concept of probability distribution to engineering problems.
3. Draw conclusions on population based on large and small samples taken and hence apply it to understand data science problems.
4. Apply nonparametric test and perform Analysis of Variance on the population to analyze data.
5. Apply the concept of Optimization to the engineering problems.

Computational Mathematics (DJS23CMD201)		
Unit	**Description**	**Duration**
1	**Matrices:** 1.1 Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof). 1.2 Similar matrices, diagonalizable of matrix. 1.3 Functions of square matrix. 1.4 Matrix decomposition, Singular Value Decomposition of a matrix (SVD).	08
2	**Probability:** 2.1 Random Variables: Discrete & Continuous random variables, expectation, Variance. 2.2 Probability Density Function & Cumulative Density Function. 2.3 Moments, Moment Generating Function. 2.4 Probability distribution: Binomial distribution, Poisson distribution and Normal distribution.	08

3	**Sampling Theory:** **Test of Hypothesis- Large Sample Test:** 3.1 Test of Hypothesis, Level of significance, Critical region, One Tailed and Two Tailed test, Interval Estimation of population parameters. 3.2 Test of significant for Large Samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples. **Test of Hypothesis- Small Sample Test:** 3.3 Test of significant for small samples: Student's t-distribution and its properties. 3.4 Test for significance of the difference between sample mean and population mean, Test for significance of the difference between the means of two samples, paired t-test.	08
4	**Test of Hypothesis- Chi Square Distribution and ANOVA:** 4.1 Test of goodness of fit. 4.2 Test of independence of attributes-Contingency table. 4.3 Association of attributes and Yate's correction. 4.4 Analysis of Variance(F-Test): One way classification, Two-way classification (short-cut method).	06
5	**Optimization Techniques:** 5.1 Types of solution, Standard and Canonical form of LPP, Basic and feasible solutions. 5.2 Simplex method, Big –M method (method of penalty). 5.3 Duality of Linear Programming Problem. 5.4 Dual simplex method. 5.5 Non-Linear Programming: -Problems with equality constraints and inequality constraints (No formulation, No Graphical method).	12
	Total	**42**

Books Recommended:

Textbooks:

1. Matrices, by A. R. Vasishtha, Krishna Prakashan, Edition 2023.
2. Fundamentals Of Mathematical Statistics by S. C. Gupta, V. K. Kapoor, Sultan Chand & Sons 12th Edition, 2020.
3. Probability, Statistics and Random Processes by T. Veerarajan, Mc Graw Hill publication, 3rd Edition, 2020.
4. Operation Research by Hira & Gupta,,S Chand.

Reference Books:

1. Higher Engineering Mathematics by Dr. B. S. Grewal, Khanna Publication, 42nd Edition.
2. Probability and Statistics for Engineering, Dr. J Ravichandran, Wiley-India, Edition 2019.
3. Probability & Statistics with reliability by Kishor s. Trivedi, Wiley India, 2016.
4. Operations Research by S.D. Sharma KedarNath, Ram Nath& Co. Meerat.
5. Engineering optimization (Theory and Practice) by SingiresuS.Rao, New Age International publication

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Product Life Cycle Management (DJS23XOE211)

Pre-requisite:

1. Basic Management knowledge

Objectives:

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management & PLM strategies.
3. To give insights into new product development program and guidelines for designing and developing a product.
4. To familiarize the students with Virtual Product Development.
5. To acquaint students with the need of Environmental aspects in PLM & its implementation.

Outcomes: On completion of the course, the learner will be able to:

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Acquire knowledge in applying virtual product development tools.
4. Acquire knowledge in implementation of Environmental aspects in PLM.

Product Life Cycle Management (DJS23XOE211)		
Unit	**Description**	**Duration**
1	**Introduction to Product Lifecycle Management (PLM):** Product Lifecycle management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications. **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM.	**08**
2	**Product Design and Development:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase.	**08**
3.	**Methodological Evolution of Product Design:**	**10**

	Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering, Life Cycle Approach, Characteristic Features of Life Cycle Approach. The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process. New Product Development (NPD) and Strategies, Product Configuration and Variant Management. **Integration of Environmental Aspects in Product Design:** Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design, Tools and techniques for integrated design, Implementation of international standards.	
4	**Product Data Management (PDM):** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation. **Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.	08
5	**Engineering Methods for product Duration design & evaluation:** Durability of Products and Components, Design for Fatigue, Infinite Life Approach, Design for Finite Life. **Product Recovery Planning & Analysis:** Approach to the Recovery Problem, Method for Recovery Cycles Planning, Calculation Models for Recovery Cycles Planning, Basic procedure, Determinant Factors for Recovery, Effective Component Reusability, Recovery Fractions, Extension of Useful Life.	08
	Total	**42**

Books Recommended:

Textbooks:

1. John Stark, — Product Lifecycle Management: Paradigm for 21st Century Product Realisationl, Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, Antonino Risitano, — Product Design for the environment-A life cycle approachl, Taylor & Francis 2006, ISBN: 0849327229

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, — Product Life Cycle Managementl, Springer, Dreamtech, ISBN: 3540257314
2. Michael Grieve, — Product Lifecycle Management: Driving the next generation of lean thinkingl, Tata McGraw Hill, 2006, ISBN: 0070636265

3. François Villeneuve, Luc Mathieu, Max Giordano —Product Life-Cycle Management: Geometric Variations. (2010). United Kingdom: Wiley.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

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Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Management Information System (DJS23XOE212)

Pre-requisite:

Nil

Objectives:

1. The course is blend of management and technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. Identify the basic steps in systems development.

Outcomes: On completion of the course, the learner will be able to:

1. Explain the fundamental concepts of the management information systems used in business.
2. Describe IT infrastructure and its components and its current trends.
3. Use the tools and technologies for accessing information from databases to improve business performance and decision making
4. Identify and explain the security and ethical challenges in MIS along with the measures to be taken
5. Select a suitable social computing platform for the given requirements that integrates AI and IoT.
6. Explain the processes involved in the information system within the organization includes information acquisition and enterprise and global management technologies.

Management Information Systems (DJS23XOE212)		
Unit	**Description**	**Duration**
1	**Foundation Concepts** • Definition and scope of Management Information Systems (MIS) in business, • Functional area information system, • The components of information systems, • Impact of IT on organizations and society, • Business Process – BPR and BPI. • Business Pressure, Organizational responses. • Competitive Advantage and Strategic IS's.	04
2	**Information Technology Infrastructure** • Overview of IT infrastructure, • Hardware and software, • Computer systems: End user and enterprise, • Computing computer peripherals: Input, output, and storage technologies, • Application software: End user applications,	07

	• System software: Computer system management, • Data resource management: Technical foundations of database management, Managing data resources, Big data, Data warehouse and data marts, Knowledge management, • Networks: The networked enterprise (wired and wireless), Pervasive computing, Cloud computing models,	
3	**MIS Tools and applications for Decision making** • ERP and ERP support of business • Business intelligence (BI): Managers and Decision Making. • Decision Support System (DSS): types, components, Data mining. • Executive information system. • Role of AI in decision making. • Role of predictive analytics and data visualization in business	10
4	**Security and Ethical Challenges** • Information security fundamentals • Key principles of information security • Common threats and vulnerabilities in MIS • Security measures and controls • Access control mechanisms: authentication, authorization, and accounting (AAA) • Encryption techniques and cryptographic protocols • Ethical, and societal challenges of IT • Legal and regulatory framework • Privacy Policies	08
5	**Social Computing (SC)** • Web 2.0 and 3.0: static and dynamic platform, integration with AI and IoT • SC in business-shopping: leveraging social media platforms, Social listening and sentiment analysis • Social computing in Customer Relationship Management (CRM) • Marketing, operational and analytic CRM • E-business and E-commerce – B2B B2C, E-commerce platforms and payment gateways • Mobile commerce: growth trends, mobile wallets, contactless payments, shopping apps and platforms	07
6	**Information System within Organization** • Acquiring Information Systems and Applications: Various System development life cycle models • Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT • Business processes and information systems	06
	Total	**42**

Books Recommended:

Textbooks:

1. A. K. Gupta, "Management Information System", S. Chand Limited, 2010.
2. K. K. Ghosh, Saini Das, and S. Mukherjee, "Management Information System", Management, IIT, Kharagpur, 2021.

Reference Books:

1. J. A. O'Brien, G. Marakas, "Management Information Systems", McGraw-Hill Companies, Incorporated, 2006.
2. K. Rainer, B. Prince, "Management Information Systems", Wiley, 2016.

Web References

- Management Information System (https://nptel.ac.in/courses/110105148)
- Management Information System (https://archive.nptel.ac.in/courses/110/105/110105148/)

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks
2) Term Test 2 (on next 40 % syllabus) – 15 marks
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by | Checked by | Head of the Department | Principal

Program: Open Elective for all Programs **S.Y B. Tech. Semester: III**

Course: Operations Research (DJS23XOE213)

Pre-requisite: Knowledge of

1. Mathematics.
2. Probability

Objectives:

1. Formulate a real-world problem as a linear programming problem and able to solve.
2. Understand the optimisation tools that are needed to solve linear programming problems.

Outcomes: On completion of the course, learner will be able to:

1. Formulate the real-world optimisation problem into a Linear Programming Problem (LPP) and analyse the solution obtained using LPP optimisation models.
2. Solve Linear Programming Problems using transportation and assignment models.
3. Apply Decision Theory to determine the optimal course of action when a number of alternatives are available, and their consequences cannot be forecast with certainty and uncertainty.
4. Apply Game Theory for decision making under conflicting situations where there are one or more opponents (players).
5. To breaking down a large problem into smaller sub problems and solved recursively or iteratively using Dynamic Programming models.

Operation Research (DJS23XOE213)		
Unit	**Description**	**Duration**
1	**Introduction to Operations Research:** Introduction, Structure of the Mathematical Model, Limitations of Operations Research. **Linear Programming:** Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method, Penalty Cost Method or Big M-method, Two Phase Method.	12
2	**Transportation Problem:** Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: MODI method. **Assignment Problem:** Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and	10

	m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem	
3	**Decision Theory:** Steps in Decision Theory approach, Decision-making Environment, Decision making under condition of certainty, Decision making under condition of uncertainty, Decision making under condition of risk, Maximum likelihood criterion.	07
4	**Game Theory**: Competitive games, rectangular game, saddle point, minimax/maximin method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	06
5	**Dynamic programming**: Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stagecoach/Shortest Path, cargo loading and Reliability problems.	07
	Total	**42**

Books Recommended:

Textbooks:

1. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
2. Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.

Reference Books:

1. Operations Research: Introduction to Models and Methods, Boucherie, R. J., Tijms, H. and Braaksma, A., 2021.
2. Introduction to Operations Research: Hiller, F. S. and Liebermann, G. J., McGraw-Hill Higher Education, 2010.
3. Operations Research: Principles and Practice: Ravindran, A., Phillips, D. T. and Solberg, J. J., Wiley India Pvt. Limited, 2009.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks
2) Term Test 2 (on next 40 % syllabus) – 15 marks
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Personal Finance Management (DJS23XOE214)

Pre-requisite:

1. Nil

Objectives:

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familiarize the students with microfinance for accelerating the expansion of local microbusinesses.

Outcomes: On completion of the course, learner will be able to:

1. Understand the Indian financial system.
2. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
3. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
4. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
5. Understand how Microfinance can help in financial inclusion.

Personal Finance Management (DJS23XOE214)		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System**: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion. **Introduction to Personal Finance** Personal Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.	08
2	**Personal Financial Management** **Loans:** Home, Car, Education, Personal, Loan against property and Jewel loan. **Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. **Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning.	08
3	**Income Tax** **Income Tax Act Basics**- Introduction to Income Tax Act, 1961 **Heads of Income and Computation of Total Income and Tax Liability**- Heads of Income and Computation of Total Income under	09

	various heads, Clubbing Provisions, Set off and carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. **Tax Management, Administrative Procedures and ICDS** - TDS, TCS and Advance Tax Administrative Procedures, ICDS.	
4	**Goods and Services Tax** GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. **Levy and Collection of GST** Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services	09
5	**Introduction to Micro – finance** Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinances, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self-Help Groups (SHGs). **Models in Microfinance** - Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges. **Institutional Mechanism** Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs	08
	Total	**42**

Books Recommended:

Textbooks:

1. Banking and Financial Sector Reforms in India, by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance, by K.M. Bhattacharya O.P. Agarwal, Himalaya Publishing House.
4. Agricultural Finance and Management, by S. Subba Reddy, P. Raghu Ram.
5. The Indian Financial System and Development, by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition.

6. Income Tax Management, Simple Way of Tax Management, Tax Planning and Tax Saving, By Sanjay Kumar Satapathy.
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra, Educreation Publishing.
9. Introduction to Microfinance, By Todd A Watkins, World Scientific Publishing Company

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks
2) Term Test 2 (on next 40 % syllabus) – 15 marks
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Public Systems and Policies (DJS23XOE215)

Pre-requisite:

1. Basic Knowledge of Social science and Current affairs

Objectives:

1. To explain public policy and its operations with special focus on policy relating to Government finance.
2. To analyze and evaluate the impact of public policy on firms and the economy at large.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the importance of public systems in a fast-changing environment in the global context.
2. Analyse the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
3. Explain public policy and its operations with special focus on policy relating to Government finance.
4. Make policies and know about the happenings in the world, in the nation and those in their locality.
5. Analyze and evaluate the impact of public policy on firms and the economy at large and work under various fields as policymakers.

Public Systems and Policies (DJS23XOE215)		
Unit	**Description**	**Duration**
1	**Introduction and Overview of Public Systems:** Ideology of Public Systems: Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.	10
2	**Public Sector in the Economics Accounts:** Public Sector in the circular flow; Public Sector in the National Income Accounts.	07
3	**Public Choice and Fiscal Politics:** Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.	08
4	**Introduction and Overview of Public Policy:** Markets and Government; Social goods and Market failure, public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.	10

5	**Case Studies in Expenditure Policy: Public Services** A) National Defense B) Highways C) Outdoor Recreation D) Education	07
	Total	**42**

Books Recommended:

Reference Books:

1. Charles J, Wheelan, "Introduction to Public Policy", W.W. Norton & Company, New York, 2011.
2. Thomas R, Dye, "Understanding Public Policy", Prentice Hall, 2008.
3. Anderson, James E, "Public Policy-Making: An Introduction", Boston, 2011.
4. Avasthi & Maheshwari, "Public Administration", Lakshmi Narain Agarwal, 2008.
5. Mohit Bhattacharya, "New Horizons of Public Administration", Jawahar Publishers, New Delhi, 2011
6. Nicholas Henry, "Public Administration and Public Affairs", Prentice Hall of India, New Delhi, 2017.
7. Harvey S Rosen and Ted Gayer, "Public Finance" 10th Edition, McGraw-Hill Education, 2013.
8. Richard A Musgrave and Peggy B Musgrave, "Public Finance in Theory and Practice", 5th Edition, Mcgraw Hill Book, 2017.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks
2) Term Test 2 (on next 40 % syllabus) – 15 marks
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Fundamentals of Biomedical Instruments (DJS23XOE216)

Pre-requisite:

1. Basic knowledge of Human Anatomy
2. Basic knowledge of Electronics

Objectives:

1. To understand the basic principles and working of various medical instruments.
2. To familiarize the learners with the various medical imaging modalities, their operating principles, instrumentation and clinical applications.

Outcomes: On completion of the course, the learner will be able to:

1. Associate & describe the different physiological processes taking place within the human body.
2. Identify the use of biomaterials and apply principles of various transducers & sensors.
3. Demonstrate the working principle of various medical instruments.
4. Demonstrate principles used in imaging modalities and analysis.
5. Identify different processes used in telemetry and telemedicine.

Fundamentals of Biomedical Instruments (DJS23XOE216)		
Unit	**Description**	**Duration**
1	**Basic Human Physiology** • **Cell:** Electrical activity of excitable cells (Structure and functions of cell. Polarization and depolarization of cell) • **Cardiovascular System**: Heart, Conductive tissues of heart, Cardiac cycle, Heart Valves, System and Pulmonary Circulation, Transmission of Cardiac Impulse, Blood Pressure, ECG (Einthoven's Triangle, Various leads and Waveforms). • **Muscle Physiology**: Muscle physiology and aspects of skin resistance. Generation of EMG • **Nervous System**: Different parts, their functions. Reflex actions and reflex arc, Function of Sympathetic and Parasympathetic nervous system. Generation of EEG	06
2	**Biomaterial, Transducers and Sensors:** • **Biomaterials used in fabrication of biodevices and implants**: Polymeric, Composite biomaterials, Metallic biomaterials, and Ceramic biomaterials. • Biopotential electrodes: Electrode tissue interface, Electrode electrolyte interface Electrodes used for ECG, EEG & EMG. • Transducers & sensors: temperature transducer, pulse sensor, glucose sensor, respiration sensor • Introduction of biomaterials, Classification of biomaterials	10
3	**Overview of Medical Instruments**	08

	• Classification, application and specifications of **diagnostic, therapeutic and clinical laboratory equipment** • Method of operation of these Bio Medical Instruments • ECG , EEG,EMG	
4	**Imaging Modalities and Analysis:** • Radio graphic techniques, Computer Tomography, • MRI, PET, SPECT • Ultrasonography • Endoscopy • Thermography, Retinal Imaging • Imaging application in Biometric systems • Analysis of digital images	10
5	**Telemetry & Telemedicine:** • Introduction to Biotelemetry • Physiological parameters compliant to biotelemetry • Components of Biotelemetry system • Applications of telemetry in medical field (ECG, EEG & EMG)	08
	Total	**42**

Books Recommended:

Textbooks:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi,2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, New Delhi, 2 Edition, 2003.
4. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, NewYork, 1998.
5. Biomaterials Science - An Introduction to Materials in Medicine. B.D. Ratner, A.S. Hoffmann, F. J. Schoen, J. E. Lemons, Academic Press, 1997.

Reference Books:

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, Third Edition, Boca Raton, CRC Press LLC, 2006.
3. Curry, T. S., Dowdey, J. E., & Murry, R. C. (1990). Christensen's physics of diagnostic radiology. Lippincott Williams & Wilkins.
4. Biomaterials: An Introduction, Joon Park, R. S. Lakes, Springer Science & Business Media

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.

2) Term Test 2 (on next 40 % syllabus) – 15 marks.

3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: IPR and Patenting (DJS23XOE217)

Pre-requisite:

- NIL

Objectives:

1. To promote the knowledge of intellectual property laws of India and international treaties.
2. To encourage innovation.

Outcomes: On completion of the course, the learner will be able to:

1. Map a given project/ idea to a suitable intellectual property rights.
2. Explain the fundamentals of the patents, copyrights, and design registrations.
3. Draft applications to protect various intellectual property rights.
4. Communicate with national and/or international intellectual property organisations.

IPR & Patenting (DJS23XOE217)		
Unit	**Description**	**Duration**
1	**Introduction to Intellectual Property Rights (IPR):** • Concept & meaning of IP and IPR. • General principles of intellectual property rights. • Need for intellectual property. • Categories of IPR instruments - Patents, Trademarks, Copyrights, Industrial. Designs, Plant variety protection, Trade secrets, Geographical Indications etc. • Ownership, assignment, licenses, infringement, validity period. • International treaties on IPR.	**06**
2	**Copyright and Design** 1. The Indian Copyright Act, 1957. 2. Meaning of copyrights and rights of copyrighted works. 3. Types of copyright. 4. Process of filing a copyright application. 5. Introduction to Designs Law – Definitions. 6. Registration of designs and procedure.	**09**
3	**Basics of Patents** • The Indian Patent Act and The Indian Patent Rules. • Conditions of patentability. • Patentable and non-patentable inventions. • Types of patent applications and patent specification. • Inventors and Applicants.	**09**

	• Category of applicants - natural person, small entity, startup and others. • Patent databases and prior-art search. • International Patent Classification code.	
4	**Patent Application Drafting** • Patent application drafting: ○ Application. ○ Specification. ○ Claims drafting: ▪ Independent and dependent claims drafting. ▪ Process patent and product patent claims. ○ Abstract. ○ Drawings. ○ Declaration as to inventorship. ○ Statement and undertaking. • Drafting response to communications from patent office. ○ Reading and understanding examination reports. ○ Drafting response.	**09**
5	**Procedure for Filing a Patent Application, Timelines and Fees** • Application for grant of patent. • Forms and Fees. • Request for (early) publication and / or (early) examination. • Patent examination and hearing. • Pre-grant and post-grant opposition.	**09**
	Total	**42**

Books Recommended:

Textbooks:

1. A Durafe and D Toradmalle, "Intellectual Property Rights", Wiley, 2020.
2. H Rockman, "Intellectual property law for engineers, scientists, and entrepreneurs", Wiley-IEEE Press, 2020.

Reference Books:

1. Bare Act, "The Patents Act, 1970 with The Patents Rules, 2003", Universal, 2023.
2. Bare Act, "The Copyright Act, 1957", Universal and LexisNexis, 2021.
3. Bare Act, "The Designs ACT, 2000", Commercial Law Publishers (India) Pvt. Ltd. 2021

Online Resources:

1. W. Fisher, "Maps of Intellectual Property" https://cyber.harvard.edu/people/tfisher/IP/IPMaps.htm
2. World Intellectual Property Organisation courses https://www.wipo.int/academy/en/

3. Prof. Feroz Ali, "Patent Drafting for Beginners", https://onlinecourses.nptel.ac.in/noc24_hs59/preview

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks
2) Term Test 2 (on next 40 % syllabus) – 15 marks
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by | Checked by | Head of the Department | Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: III**

Course: Entrepreneurship and Startup Ecosystem (DJS23XOE218)

Pre-requisite:

Nil

Objectives:

1. To foster an entreprencurial mindset.
2. To guide participants in building effective Business Models.
3. To educate participants regarding Intellectual property and Fundraising for Innovative Ventures.

Outcomes: On completion of the course, the learner will be able to:

1. Effectively Navigate the Global Startup Landscape:
2. Cultivate an Entrepreneurial Mindset.
3. Create Effective Business Models.
4. Understand the significance of Intellectual Property rights.
5. Master Fundraising Strategies

Unit	Description	Duration
1	**Understanding the Entrepreneurial Ecosystem** • Introduction to Entrepreneurship and Startups • Role of Entrepreneurship in economy • Global and Local Entrepreneurial Landscapes • Role of Incubators and Accelerators • Case Studies of Successful Startups	**08**
2	**Developing a Startup Mindset** • Cultivating an Entrepreneurial Mindset • Market Analysis and Segmentation • Opportunity Recognition • Innovation and Idea Generation • Feasibility Analysis of Business Ideas • Role of innovation in Entrepreneurship • Fostering creativity • Practical Exercises and Workshops on Creative Problem Solving	**08**

3	**Business Model Development** • Introduction to Business Models • Lean Startup Methodology • Prototyping and Minimum Viable Product (MVP) • Financial Projections and Budgeting • Various forms of Business Ownership • Compliance and Legal Regulations • Operations and Supply Chain Management • Human Resource Management • Developing a marketing Strategy • Managing Growth Challenges	10
4	**Technological Innovation and Intellectual Property** • Technology and Entreprencurship • Intellectual Property Basics (Patents, Trademarks, Copyrights) • Patent Search and Analysis • Strategies for Protecting Intellectual Property • Ethical Considerations in Technology and Innovation	08
5	**Fundraising and Investment Strategies** • Fundraising Options for Startups • Angel Investors and Venture Capital • Crowdfunding Platforms • Financial Modelling for Startups • Crafting an Effective Pitch	08
	Total	42

Books Recommended:

1. Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, John Wiley & Sons, Jul2010.
2. Peter Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Virgin Books, 2015.
3. Alejandro Cremades, The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know" by, John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.
4. Christensen, Clayton M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Boston, MA: Harvard Business School Press, 1997.

5. Brad Feld and Jason Mendelson, Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist, Wiley; 4th edition, 1 October 2019.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by | Checked by | Head of the Department | Principal

Program: Computer Engineering										Semester: III
Course: Innovative Product Development I										Course Code: DJ523XSC201P
Teaching Scheme (Hours/week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				–			–	–	–	–
				Laboratory Examination			Semester review		Average	25
–	2	–	1	Oral	Practical	Oral & Practical	Review 1	Review 2		
				–	–	–	25	25	25	

Course Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Course Outcome:

Learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyze the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare them to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity logbook is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The design solution is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department.
- Efforts are to be made by the students to try and publish a technical paper, at a suitable publication (National /International), approved by the department research committee/ Head of the department.
- The focus should be on self-learning, the capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, the focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.

Review/Progress monitoring committee may consider the following points during the assessment.

The tentative rubrics that can be followed can be as follows:

Review 1:

i. Literature Review (Algorithms, Techniques, Methodologies) / Product Review (Review of atleast 5 technical papers).
ii. Presentation Quality
iii. Contribution as a team member and Punctuality

Review 2:

i. Analysis of Literature Review
ii. Problem Statement and proposed solution
iii. System Process flow Diagram
iv. Presentation Quality
v. Contribution as a team member and Punctuality
vi. Project Documentation

Prepared by Checked by Head of the Department Principal

Program: Common to all Programs. **Group A / B S.Y B. Tech. Semester: III & IV**

Course: Design Thinking Laboratory (DJS23XHS231L)

Pre-requisite:

1. Understanding of product/ process/ software/ service development life cycle.
2. Knowledge of agile frameworks (or any similar iterative framework) would be an added advantage but will not be mandatory.

Course Objectives:

1. To instill an innovative mindset in students to solve the digital-age business, societal, and wicked types of problems using design thinking methods and tools, and its application.
2. To equip students with techniques to empathize with users, and ideate innovative and sustainable solutions for real-world problems through an iterative approach to design.

Course Outcomes: On completion of the course, the learner will be able to:

1. Understand the importance of a Human-Centric design approach for developing a solution.
2. Generate innovative ideas to design sustainable solutions for real-world problems.
3. Apply design thinking principles to solve real-world problems

Design Thinking Laboratory (DJS23XHS231L)		
Unit	**Syllabus Content**	**Duration**
1	**Introduction to Design Thinking** • Understanding the fundamentals of design thinking. • Exploring the history and evolution of design thinking. • The importance of empathy in the design thinking process. • Conduct market & industry research by observing and contextualizing various macro & micro trends. • Case Study - conduct their research on how Design Thinking helped solve some of the biggest and most critical problems of our time.	06
2	**Empathize Phase** • Techniques for conducting user research and gathering insights. • Creating user personas and empathy maps. • Practicing active listening and observation skills. • To apply various empathizing techniques to the problem statement selected. • Use walk-a-mile immersion and heuristic reviews to first empathize with end users and then to build an empathy map and customer journey map.	04
3	**Define Phase** • Defining problem statements and reframing challenges. • Tools for synthesizing research findings. • Developing a clear and actionable problem statement. • Start building from Persona map and conduct interviews/ Gemba walk to plot user's journeys from start to end. • Define the problem space using the HMW statement. Now highlight areas of opportunities in the journey map and enlist potential channels/touchpoints as well as stakeholders for proposed solution interventions.	04
4	**Ideate Phase**	04

	• Generating creative ideas through brainstorming sessions. • Techniques for divergent and convergent thinking. • Prototyping and experimenting with ideas. • Apply suitable ideation technique to quickly generate diverse ideas that could be applied to target problem space – either partially or in full. • Brain Writing – Build on each other's ideas and constructively & creatively develop better ideas using SCAMPER technique.	
5	**Prototype and Validation** • Introduction to prototyping tools and techniques. • Rapid prototyping methods. • Testing prototypes with users and gathering feedback. • Refining solutions based on user insights. • Develop user storyboard to layout solution proposition in visual and easily explainable form. Run a quick peer validation. • peer-validated the storyboard. • Build an interactive digital prototype using any digital rapid prototyping platform and seek user validation.	**06**
6	**Design Thinking for Strategic Innovation:** • Types of innovations, strategic innovation. • Features of strategic innovation. • Design thinking and strategic innovation. • Practices of integrating design thinking in strategic innovation.	**04**
	Total	**26**

List of Experiments:

- Below is a list of assignments/ activities/ experiments that would be carried out by students as a mini project in groups consisting of 3-4 students.
- Problem statement for these assignments/ activities/ experiments will be provided by facilitator/ instructor/ faculty to the groups/ teams/ batches within each class.
- This list of experiments will help students learn various design thinking methods and practice the corresponding tools available.

Sr. No.	Name of the Experiment
1	To conduct market and industry research and analyze case studies demonstrating the application of design thinking. (Increased understanding of how design thinking has been applied to solve critical problems in various contexts.)
2	To exercise empathizing techniques to understand the needs and pain points of a target audience.
3	Developing empathy maps and customer journey maps based on collected insights.
4	To exercise different tools and techniques (such as affinity diagrams, journey mapping, and user story mapping) for synthesizing research findings.
5	Develop user personas to represent different user archetypes and their needs concerning the problem at hand.
6	To practice the SCAMPER technique, Brainstorming, and brain-writing as a collaborative ideation technique to create multiple creative ideas/ solutions for the problem at hand.
7	Create a mind map to generate a wide range of solutions to a problem at hand.

8	To explore different prototyping tools and platforms, such as Adobe XD, Figma, Sketch, and InVision.
9	To Conduct rapid prototyping sessions to build low-fidelity / High fidelity prototypes based on the ideas generated in the Ideation phase and iterate based on feedback received.
10	Develop a plan for implementing the final solution, considering factors like scalability and feasibility.
11	• Conduct usability testing to gather feedback on prototypes. • Use A/B testing to compare different versions of a solution and determine which performs better.

***Note** – A minimum of five experiments from the above-suggested list or any other assignment based on the syllabus will be included, which would help the learner to apply the concept. The mini-project is mandatory.*

Books Recommended

Text books:

1. I. Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", Wiley, 2013.
2. M. Lewrick, P. Link, and L. Leifer, "The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems", Wiley, 2018.
3. T. Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2010.
4. K. T. Ulrich and S. D. Eppinger, "Product Design and Development", McGraw-Hill Hill Education, 6th Edition, 2016.
5. C. J. Meadows and C. Parikh, "The Design Thinking Workbook: Essential Skills for Creativity and Business Growth", Emerald Publishing, 2022.

Reference books:

1. T. Kelley and D. Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", HarperCollins Publisher, 2013.
2. T. Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", HarperCollins, 2013.
3. J. Knapp, J. Zeratsky, and B. Kowitz, "Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days", Simon & Schuster, 2016.
4. Chakrabarti, "Engineering Design Synthesis: Understanding, Approaches and Tools", Springer, 2002.
5. K. Otto, and K. Wood, "Product Design", Prentice Hall, 2000.

Online Reference:

1. **Design and Innovation:**
   a. https://openstax.org/books/entrepreneurship/pages/4-suggested-resources
2. **Overview of Design Thinking:**
   a. https://www.interaction-design.org/literature/topics/design-thinking
   b. 10 Models for Design Thinking: In 2004, business consultants Hasso… | by Libby Hoffman | Medium

c. https://www.tcgen.com/design-thinking/#What_is_Design_Thinking_and_How_Does_it_Relate_to_Product_Development

3. **Understand, observe and define the problem:**
   a. https://www.nngroup.com/articles/empathy-mapping/
   b. https://uxdesign.cc/the-purpose-of-a-journey-map-and-how-can-it-galvanize-action-9a628b7ae6e
4. **Ideation and prototyping:**
   a. https://www.interaction-design.org/literature/topics/prototyping
   b. https://www.uxmatters.com/mt/archives/2019/01/prototyping-user-experience.php
5. **Testing and implementation:**
   a. https://www.nngroup.com/articles/usability-testing-101/
   b. https://www.interaction-design.org/literature/article/test-your-prototypes-how-to-gather-feedback-and-maximise-learning
6. **Design thinking in various sectors:**
   a. https://www.tutorialspoint.com/design_thinking/design_thinking_quick_guide.htm

Web References:

1. Creative Engineering Design (https://nptel.ac.in/courses/107108010)
2. Understanding Creativity and Creative Writing (https://nptel.ac.in/courses/109101017)
3. Understanding Design Thinking & People Centred Design (https://nptel.ac.in/courses/109104109)
4. Design Thinking - A Primer (https://nptel.ac.in/courses/110106124)
5. Product Engineering and Design Thinking (https://nptel.ac.in/courses/112105316)

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks

Shall comprise of:

Assignments (minimum 05): 15 marks

Mini Project (individual or in a group of 3-4 students): 10 marks

Prepared by | Checked by | Head of the Department | Principal

Program: Common to all Programs. **Group A / B** **S.Y B. Tech.** **Semester: III / IV**

Course: Universal Human Values (DJS23XHS232)

Course: Universal Human Values Tutorial (DJS23XHS232T)

Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Outcomes: On completion of the course, the learner will be able to:

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society
4. Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

Universal Human Values (DJS23XHS232)		
Unit	**Description**	**Duration**
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct	05

	priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	
2	**Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Self-regulation and health.	06
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** Understanding harmony in the Family- the basic unit of human interaction, understanding values in human-human relationship; meaning of Justice and program for its fulfilment. Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family). Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family!	09
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence	05
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations	04
	Total	**28**

Tutorials: (Term work)

Term work shall consist of minimum 5 activities based on activities conducted.

The tutorials could be conducted as per the following topics: -

Activity No 1	Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.
Activity No 2	Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.
Activity No 3	Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.
Activity No 4	Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
Activity No 5	Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

The final certification and acceptance of term work will be subject to satisfactory performance of activities and upon fulfilling minimum passing criteria in the term work.

Books Recommended:

Textbooks:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
6. Small is Beautiful - E. F Schumacher. 6. Slow is Beautiful - Cecile Andrews.
7. Economy of Permanence - J C Kumarappa.
8. Bharat Mein Angreji Raj – PanditSunderlal.
9. Rediscovering India - by Dharampal.
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad.
12. Vivekananda - Romain Rolland. (English)
13. Gandhi - Romain Rolland. (English)

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Common to all Programs. **Group A / B** **S.Y B.Tech.** **Semester: III**

Course: Community Engagement Service (DJS23XEL201L)

Pre-requisite:

1. Fundamentals of core branch
2. Communication Skills

Objectives:

1. To sensitise the student / learner into recognising community level problems & challenges and give them an opportunity to engage in activities for solving the same.

Outcomes: On completion of the course, the learner will be able to:

1. Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Witness diversity in communities and cultures and demonstrate change in approach / attitude as, an evidence of unconditional acceptance.
4. Recognise, experience and value, effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

Unit	Description
1	**Open Activities** • Participation in: blood donation camps organizer / donor, day-long tree plantation or afforestation / seed dispersal / cleanliness (water bodies, surrounding etc.) drives. • Literacy drives for children / youth / adults. One day hand holding activities in work-shop conduct for under privilege kids in the areas of – basic science, math, technical skill demonstration and building.
2	**Technical (Program core related)** • Cyber-crime, security awareness and vulnerabilities – sensitization, information dissemination and awareness sessions in indicated focus areas. Promotion and Sensitization for Sustainable living – focusing on solar power, water recycling, e-waste responsible disposal, waste recycling etc. in indicated focus areas. Focus areas: residential societies, schools, under-privileged areas, governments /private offices, and similar other establishments. **OR** **Field Survey**

	• Reporting on proactively conducted survey in the areas of resource management for – water, vegetables, electricity, crops etc.

Activities to be performed
Among the listed activities students are expected to complete one open activity mandatorily, and one technical (program core) OR field survey activity. The activities mentioned are exemplary in nature and any other additional activity of similar nature too can be undertaken by the learners, provided it is approved and endorsed by the faculty mentor / head of the department.

Suggested Activities

1. Undertaking cyber safety / security awareness sensitization drive / program especially for un-initiated students / individuals in schools / colleges / residential complex / offices etc. Typical suggested tabulation.

Participant No.	Name	Age	School/ College/ Residence/ Office	Email	Contact Number	Awareness Level	Remarks

2. Energy / Power assessment for establishments (societies, schools, colleges, residential complex, shops etc.) involving computing power devices ratings, power consumption over operating period, calculating energy cost from tariff card / rates for every group of appliances / devices or equipment. Typical suggested tabulation pattern.

Device/Appliance Group	Number of appliances / devices	Power Rating (kW)	Operating Hours (h/day)	Energy Consumption (kWh/day)	Tariff Rate (Rs. / kWh)	Energy Cost (Rs.)
Lighting Fixtures						
Ceiling Fans						
Air Conditioner (AC)						
Security Systems						
Water Pump						

3. Traffic light monitoring viz-e-viz average traffic density on road. Analysing the data and commenting on results. Evaluating and comparing impact on road repairs related lane blockage and proportional recommendation for lights timing variations. Typical suggested tabulation pattern.

Sr. No.	Timestamp	Traffic Density	Traffic Light Status	Road Repair Status	Remarks

4. Help compute green footprint of select number of household (per member) - say 10 houses of 3+ members. This is for evaluating dependence upon non green energy sources and habits and changes in lifestyle for attempts at their reductions. Learners are encouraged to use typically available online carbon-footprint calculators. The table herewith maybe used for reference calculations.

House No.	House hold Name	Number of Members	Energy Usage (kWh)	Water Usage (liters)	Waste Production (kg)	Transportation Habits	Green Footprint

5. Compulsion of having a borewell for non-potable water supply in city residential complexes is a modern-day rule. Increased pace of re-development, as well as number of occupants in given area, has resulted in increased number of borewells being dug within and outside city limits.
Reduced yield, quality and quantity of water adds to the recurring maintenance cost of borewells, especially in the city areas. Poor water recharge systems along-with depleting open soil cover area in wake of wall-to-wall of concrete carpet aggravate the problem. Study, analyse and report a residential society's – capacity of water requirement, present day borewells in action, approximate yield, maintenance cost and frequency, borewell flushing iterations in wake of redevelopment in neighborhood. A typical tabulation mechanism for inferences can be as below:

Borewell	Location	Depth (ft)	Yield (Liters/Day)	Water Quality	Maintenance Cost (Rs.)	Remarks No.

6. Detection of Adulteration in food / fruits / vegetables / milk / mava /saffron etc. or contamination of potable drinking water.
Ex. Adulteration in fruits could be apple waxing, injecting chemicals in watermelon, pomegranate etc. to give it a bright red color, artificial ripening of mangos etc.
For a given activity, samples from more than one area, specifically from mofussil /interiors / 'gaothans' etc, may be obtained, to evaluate sample purity or extent of adulteration. Learners are encouraged to use online resources provided by 'Food Safety and Standards Authority of India' (*fssai*), for handholding in requisite procedures.
YouTube link:
Food Safety and Standards Authority of India: goo.gl/Y8Lzbu
Ex. 1 Milk Adulteration:

https://www.youtube.com/watch?v=pbnmeRUBxKk

Ex.2 Watermelon Adulteration:

https://www.youtube.com/watch?v=yrLAj7oJies

Product	Adulterant	Testing Method	Result	Remarks

Certificates and Formats:

Activity Endorsement Certificate

Date:

Community engagement service is a mandatory course, of two credits, introduced at second year of engineering under the autonomous structure of the institute.

Course objective: To sensitise the student / learner into recognising social problems & challenges and give them an opportunity to engage in activities for solving the same.

Course outcomes:

1. Knowledge application: Applies knowledge understandings acquired from one's academic study/ field/ discipline for community level education, information dissemination by participation and engagement in community welfare activities.
2. Commitment for cause: Identify and experience commitment for community engagement activities that reinforce sense of belongingness and gratitude towards societal cause.
3. Diversity: Witness diversity in communities and cultures and demonstrate change in approach / attitude as an evidence of unconditional acceptance.
4. Team: Recognise, experience and value effectiveness of working in a team, demonstrating co-existence of the roles - sincere worker and effective leader.

This is to certify that Mr./Ms. _____bearing SAP ID _____ is a student of S.Y. B.Tech., _____ branch of engineering. He / She is a bonafide student of SVKM's Dwarkadas J. Sanghvi College of Engineering, Mumbai. He / She is reliable, sincere, hardworking and capable of conducting

_____

_____activity in your premises. We request you to kindly allow for the conduction of the activity and we also solicit your earnest co-operation in the same.

Signature

Name of Department Head:

Disclaimer

(This form must be read, signed, and submitted prior to the beginning of the community service activity.)

Student Details	**Activity Details**
Name	
SAPID	Date
Program	Time
Class/Div	Address

I, the undersigned _____ accept the following terms and conditions unconditionally:

1. I accept and understand that the community activity identification and selection has been done willingly by me.
2. I undertake to convey that, I am apparently in good health and well-being, and suffer no physical impairment that would or should prevent my participation in the activity.
3. I undertake to bear all related expenses and risk of travel related to the activity and shall not hold any personnel from the institute responsible with regards to claims and / or loss in the process of conduct of activity.
4. I undertake that my parents or legal/local guardians are aware of said activity and agree to above mentioned terms and conditions.

Student's name & signature: _____

Parent or Guardian's name & signature: _____

Guidelines for Assessment of the work

- The review/progress monitoring committee shall be constituted by the Head of the Department. The progress of selected/assigned activities is to be evaluated on a continuous basis, holding at-least one review in the semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Each group needs to submit following forms to respective supervisor after conducting both the activities,
  - o Activity Conduction Report
  - o Participant Feedback (online / offline)
  - o Participant Attendance (online / offline)
  - o Survey Report
  - o Participation certification

Forms for Technical Activity:

1. Activity Conduction Report

Sr. No.	Name of the Activity	
1	Date of Activity	
2	Activity type Open / Technical	
3	Activity objectives	
4	Place of Activity	
5	SAP id and Names of students	
6	Name of the Association	
7	Activity description	
8	No. of participants	
9	Photos (Geo tagged)	

2. Participant feedback (online / offline):

Sr. No.	Indicators	Scale: 1 (Lowest) to 5 (Highest)
1	The objectives of the training were clearly defined.	
2	The content was organized and easy to follow.	
3	This training experience will be useful to me.	
4	The trainer was knowledgeable about the training topics.	
5	The training objectives were met	

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 25 marks, distribution as herewith:

1. Rubric for Open Ended Activity (10 marks)

- Participation certificate/proof

2. Rubric for Technical Activity (15 marks)

Sr. No.	Performance Indicators (Maximum marks per indicator are given in bracket)	Marks
1	Pre-requisite documents (permission letter, presentation material, permission letters, etc.) [05 marks]	
2	Participant Feedback [05 marks]	
3	Participant attendance [05 marks]	
	TOTAL	

OR

3. Rubric for Field Survey Activity:

Sr. No.	Performance Indicators (Maximum 03 marks per indicator)	Marks
1	Topic selection	
2	Survey preparation	
3	Field work	
4	Analysis	
5	Report writing	
	TOTAL	

Prepared by Checked by Head of the Department Principal

Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: IV**

Course: Operating Systems (DJS23CPC251)

Course: Operating Systems Laboratory (DJS23CPC251L)

Pre-requisite:

1. Digital Electronics
2. Foundation of Computing Technologies

Objectives:

The objective of this course is to familiarize students with the functionality of an Operating System, its basic components & interaction among them. The course will also expose students to analyze and evaluate different policies for scheduling, deadlocks, memory management, synchronization, file management & I/O and implement these policies using a suitable programming language.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the basic functionalities of an Operating System.
2. Understand process management principles and apply methods for process scheduling, concurrency control, and deadlock management.
3. Understand memory management principles and apply them to optimize memory utilization.
4. Apply and analyze different techniques of file and I/O management
5. Understand the functionalities of advanced operating systems.

Operating Systems (DJS23CPC251)		
Unit	**Description**	**Duration**
1	**Overview of Operating System**: Operating System Objectives, basic functions and services, Evolution of operating system, Operating System structures (monolithic, microkernel), System calls	04
2	**Process Management and Synchronization** Concept of a Process, Process States, Process Control Block, Threads: Definition and Types, Concept of Multithreading, Scheduling: Types of Scheduling: Preemptive and Non-preemptive, Scheduling algorithms and their performance evaluation: FCFS, SJF, SRTF, Priority based, Round Robin Concurrency: Principles of Concurrency, Inter-Process Communication, Process/Thread Synchronization. Mutual Exclusion: Requirements, Hardware and Software Support, Semaphores and Mutex, Monitors, Classical synchronization problems: Producer and Consumer problem, Readers/Writers Problem	10
3	**Deadlock**: Principles of deadlock, Conditions for deadlock, Resource Allocation Graph, Deadlock Prevention, Deadlock Avoidance: Banker's	08

	Algorithm for Single & Multiple Resources, Deadlock Detection and Recovery. Dining Philosophers Problem.	
4	**Memory Management:** Memory Management Requirements, Memory Partitioning: Fixed Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Next Fit, Relocation, Paging, Segmentation. Virtual Memory: Demand Paging, Structure of Page Tables, Page Replacement Strategies: FIFO, Optimal, LRU, LFU, Thrashing.	08
5	**File System and I/O Management:** File Management: Overview, File Organization and Access, Secondary Storage Management: File Allocation Methods Input /Output Management I/O Management and Disk Scheduling: I/O Devices, I/O Buffering, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C-LOOK.	08
6	**Advanced Operating Systems:** Overview of NOS, DOS, Multiprocessor OS, RTOS, Cloud OS Mobile OS: Architecture, design issues, Application development using Android	04
	Total	**42**

Operating Systems Laboratory (DJS23CPC251L)	
Exp.	**Suggested experiments**
1	Explore the internal commands of linux and Write shell scripts to do the following: Display top 10 processes in descending order Display processes with highest memory usage. Display current logged in user and logname. Display current shell, home directory, operating system type, current path setting, current working directory. Display OS version, release number, kernel version. Illustrate the use of sort, grep, awk, etc.
2	System calls for file manipulation.
3	CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
4	There is a service counter which has a limited waiting queue outside it. It works as follows: • The counter remains open till the waiting queue is not empty • If the queue is already full, the new customer simply leaves • If the queue becomes empty, the outlet doors will be closed (service personnel sleep) • Whenever a customer arrives at the closed outlet, he/she needs to wake the person at the counter with a wake-up call

	Implement the above-described problem using semaphores or mutexes along with threads. Also show how it works, if there are 2 service personnel, and a single queue. Try to simulate all possible events that can take place, in the above scenario.
5	Implement Banker's Algorithm for deadlock avoidance
6	Implement Placement algorithms (Best, First, Worst fit)
7	Implement various page replacement policies (LRU, FIFO, Optimal)
8	Implement File allocation techniques (Sequential, Indexed, Linked)
9	Implement disk scheduling algorithm FCFS, SSTF, SCAN, CSCAN etc.
10	Using the CPU-OS simulator analyze and synthesize the following: a. Process Scheduling algorithms. b. Thread creation and synchronization. c. Deadlock prevention and avoidance
11	Building a scheduler in XV6
12	Application development using Android.

Batchwise laboratory work of minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books:

1. Abraham Silberschatz, Greg Gagne, Peter Baer Galvin, "Operating System Concepts", 10th Edition, Wiley, 2021.
2. Tanenbaum, "Modern Operating System", 4th Edition, Pearson Education, 2014
3. William Stallings, "Operating Systems: Internal and Design Principles", 9th Edition, Pearson, 2018.
4. Randal. K. Michael, "Mastering Shell Scripting", 2nd Edition, Wiley Publication, 2008.

Reference Books:

1. A Tanenbaum, "Operating System Design and Implementation", 3rd Edition, Pearson, January 2015.
2. Phillip A. Laplante, Seppo J. Ovaska, "Real Time Systems Design and Analysis", 4th Edition, Wiley-IEEE Press, Dec 2011.
3. Naresh Chauhan, "Principles of Operating Systems", 1st Edition, Oxford University Press, 2014

Prepared by Checked by Head of the Department Principal

Program: B. Tech. in Computer Engineering **S.Y B. Tech. Semester: IV**

Course: Analysis of Algorithms (DJS23CPC252)

Course: Analysis of Algorithms Laboratory (DJS23CPC252L)

Pre-requisite:

1. Data Structures
2. Programming in C

Objectives: The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving. To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

Outcomes: On completion of the course, the learner will be able to:

1. Analyse the performance of algorithms using asymptotic analysis.
2. Solve the problem using appropriate algorithmic design techniques.
3. Able to prove that certain problems are NP-Complete.

Analysis of Algorithms (DJS23CPC252)		
Unit	**Description**	**Duration**
1	**Introduction to analysis of algorithms**: Introduction, Asymptotic notations (Big-Oh, small-oh, Big Omega, Theta notations). Analysis of Selection Sort, Insertion Sort, **Recurrences**: Recursion Tree Method, Substitution method, Master's theorem. **Problem Solving using divide and conquer algorithm** - Max-Min problem, Strassen's Matrix Multiplication.	08
2	**Greedy Method**: Introduction, control abstraction Problem solving using - fractional knapsack problem, job sequencing with deadline, **Minimum Spanning trees** (Kruskal's algorithm, Prim's algorithm) **Graphs**: Single source shortest path (Dijkstra's algorithm),	06
3	**Dynamic Programming**: Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack (table and set method), Multistage graphs, All pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Matrix Chain Multiplication, Travelling salesperson problem, Longest Common Subsequence (LCS).	10
4	**Backtracking**: Introduction, Basics of backtracking, N–queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles Generating permutation, Analysis of all algorithms.	06

5	**String Matching Algorithms:** Introduction, The naive string-matching algorithm, The Rabin Karp algorithm, String matching with finite automata, The Knuth Morris Pratt algorithm	06
6	**Basics of Computational Complexity:** Complexity classes: The class P and NP, Polynomial reduction, NP Completeness Problem, NP-Hard Problems, NP Completeness problem using Travelling Salesman problem (TSP), Approximation algorithm using TSP	06
	Total	**42**

Analysis of Algorithms Laboratory (DJS23CPC252L)

Exp.	Suggested experiments
1	Implementation of Min Max algorithm.
2	Implementation of Strassen's Matrix Multiplication.
3	Fractional Knapsack implementation using greedy approach
4	Implementation of job sequencing with deadline using greedy approach
5	Implementation of Kruskal's/ Prim's algorithm using greedy approach
6	Implementation of Single source shortest path (Dijkstra's algorithm)
7	Implementation of Bellman Ford algorithm using Dynamic programming
8	Implementation of Longest Common Subsequence algorithm using Dynamic programming
9	Implementation of Travelling Salesperson problem using Dynamic programming
10	Implementation of multistage graphs/ all pair shortest path using dynamic programming
11	Implementation of N-queen problem using Backtracking
12	Implementation of Knuth Morris Pratt string matching algorithm
13	Implementation of sum of subset problem using Backtracking

Batchwise laboratory work of minimum 10 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Batchwise tutorial sessions are to be conducted on topics which would help the learner to identify/analyze the problem and to apply problem solving techniques learnt.

Books Recommended:

Text Books:

1. T.H.Coreman , C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", 4th Edition, The MIT Press, 2022.
2. Ellis Horowitz , Sartaj Sahni, S. Rajsekaran. "Fundamentals of computer algorithms" University Press, 2008.

Reference Books:

1. Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani, "Algorithms", Tata McGraw- Hill Edition, 2023.
2. John Kleinberg, Eva Tardos, "Algorithm Design", Pearson, 2005.
3. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication, 2014.

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T.Y B.Tech. Semester: IV

Program: Computer Engineering

Course: Artificial Intelligence (DJS23CPC253)

Course: Artificial Intelligence Laboratory (DJS23CPC253L)

Pre-requisite:

Knowledge of

1. Programming Language
2. Algorithms

Objectives:

1. To understand AI fundamentals, agent architectures, environment properties and problem solving techniques.
2. To learn knowledge representation, planning and techniques to deal with uncertain and incomplete information.

Outcomes: On completion of the course, the learner will be able to:

1. Provide the basic ideas and techniques underlying the design of AI agents.
2. Apply the knowledge of various search techniques for problem solving.
3. Apply knowledge representation and planning techniques, and use suitable approaches to manage uncertain and incomplete information in AI systems.
4. Explain the fundamental concepts of different learning paradigms and explore advanced AI techniques

Artificial Intelligence (DJS23CPC253)		
Unit	**Description**	**Duration**
1	**Introduction to Artificial Intelligence:** Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI **Agents and Environments:** Concept of rationality, Nature of environment, Structure of Agents, Types of Agents, PEAS representation for an Agent	**06**
2	**Problem Solving:** Problem Solving Agent, Formulating Problems, Example Problems. **Search Methods:** **Uninformed Search:** Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID) **Informed Search:** Greedy Best First Search, A* Search, Memory bounded heuristic Search. **Local Search Algorithms and Optimization Problems:** Hill Climbing search, Simulated Annealing, Genetic algorithms, Ant Colony Optimization **Adversarial Search:** Game Playing, The Minimax algorithm, Alpha-Beta Pruning	**12**
	Knowledge Representation and Reasoning: Knowledge based Agents, The Wumpus World, Propositional Logic, First Order Logic, Inference in	

3	FOL, Conjunctive Normal Form, Forward Chaining, Backward Chaining, Unification, Resolution, Logic Programming (PROLOG), Semantic networks **Uncertain Knowledge and Reasoning:** Representing knowledge in an uncertain domain, The semantics of Bayesian Belief Network, Inference in Belief Network	**08**
4	**Planning:** The planning problem, Planning with state space search, Planning graphs, Partial order planning, Hierarchical planning	**04**
5	**Learning:** Types of Learning, Inductive Learning **Artificial Neural Networks:** McCulloh Pitts Model, Perceptron, Feed Forward Network, Backpropagation Algorithm, Self-Organizing Map	**08**
6	**Expert System:** Introduction, Phases in building Expert Systems, ES Architecture, Case Study on MYCIN Rule based system **Advanced topic:** Introduction to Generative AI, Explainable AI,	**04**
	Total	**42**

Artificial Intelligence Laboratory (DJS23CPC253L)	
Suggested List of Experiments	
LAB	**Explanation of Activity**
Lab 1	Select a problem statement relevant to AI. i) Identify the problem ii) PEAS Description iii) Problem formulation
Lab 2	Identify and analyze Uninformed Search Algorithm to solve the problem. Implement BFS/DFS search algorithms to reach goal state.
Lab 3	Implement DFID search algorithms to reach goal state.
Lab 4	Identify and analyze Informed Search Algorithm to solve the problem. Implement A* search algorithm to reach goal state
Lab 5	Program to implement Local Search algorithm: Hill Climbing search
Lab 6	Program on Genetic Algorithm to solve a optimization problem in AI.
Lab 7	Program to implement learning: Perceptron Learning / Backpropagation Algorithm.
Lab 8	The laboratory will emphasize the use of PROLOG. (For example, Program to implement Family Tree in Prolog)
Lab 9	Implementation on any AI game: Wumpus world, Tic-tac-toe, 8-Queens Problem
Lab 10	Case study of an AI Application.

Batchwise laboratory work of minimum 8 experiments from the above suggested list or any other experiment based on syllabus will be included, which would help the learner to apply the concept learnt.

Books Recommended:

Text Books

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" 3rd Edition, Pearson Education, 2010.
2. George F Luger, "Artificial Intelligence" 6th Edition, Pearson Education, 2021.
3. Deepak Khemani, "A First Course in Artificial Intelligence", 6th Reprint, McGraw Hill Education, 2018.
4. Saroj Kaushik, "Artificial Intelligence", 1st Edition, Cengage Learning, 2010

Reference Books

1. AP Engelbrecht, "Computational Intelligence", 3rd Edition, Wiley–Blackwell, 2021.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence" 3rd Edition, McGraw Hill Education, 2017.
3. Ivan Bratko, "PROLOG Programming for Artificial Intelligence", 4th Edition, Addison-Wesley, 2011.
4. Hagan, Demuth, Beale, "Neural Network Design", 2nd Edition, Martin Hagan, 2014.
5. Ronald J. Martin, "The Age of Artificial Intelligence", Independently Published, 2023.

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Program: B. Tech. in Computer Engineering **S.Y B.Tech.** **Semester: IV**

Course: Algebraic Number Theory (DJS23CMD251)

Pre-requisite:

Computational Mathematics

Objectives:

1. To provide a foundation in sets, logic, proof techniques, relations, functions, and combinatorics for applications in computer science and formal systems.
2. To develop an understanding of number theory, group theory, rings, fields, and Boolean algebra for computational algorithms.
3. To apply graph theory and automata theory in the context of secure communication and computational modeling.

Outcomes: On completion of the course, the learner will be able to:

1. Analyze and apply set theory, logic, relations, and functions to construct formal mathematical arguments and solve discrete problems.
2. Apply number theory and modular arithmetic techniques in advanced computational algorithms.
3. Understand different algebraic structures and its applications in various security systems.
4. Understand graph theory and apply these concepts to solve real world problems.

Algebraic Number Theory (DJS23CMD251)		
Unit	**Description**	**Duration**
1	**Set Theory and Mathematical Logic:** Sets and Operations: Union, Intersection, Difference, Complement, Power Sets, Cartesian Product, Inclusion-Exclusion Principle Propositional Logic: Syntax, Semantics, Truth Tables, Logical Equivalence Predicate Logic: Quantifiers, Validity, Rules of Inference and Logical Arguments, Proof by Mathematical Induction.	04
2	**Relations, Lattices and Functions:** Relations: Reflexive, Symmetric, Transitive, Equivalence Relations, Partial Orders, Hasse Diagrams, Lattice, Types of Lattice Functions: Injective, Surjective, Bijective, Inverses, Composition of Functions, Pigeonhole Principle.	06
3	**Number Theory and Modular Arithmetic:** Number Theory: Divisibility, Prime Numbers, Greatest Common Divisor (GCD), Least Common Multiple (LCM), Euclidean Algorithm, Extended Euclidean Algorithm, Modular Arithmetic: Modular Operations, Modular Exponentiation, Modular Inverse, Fermat's Little Theorem, Euler's Theorem, Euler's Totient Function, Chinese Remainder Theorem. Primality Testing and Primitive Roots.	06

4	**Algebraic Structures:** Algebraic Structures: Semigroups, Monoids, Groups, Binary Operations, Group codes, Cyclic Groups, Abelian Groups, Group Homomorphisms, Group Isomorphisms. Rings and Fields: Commutative Rings, Integral Domains, Finite Fields: Galois Fields (GF(p), GF(2^n)), Polynomial Rings, Polynomial Irreducibility	06
5	**Graph Theory and Automata:** Graph Theory: Graphs, Degrees, Paths, Cycles, Connected Components, Graph Representations: Adjacency Matrices, Incidence Matrices, Euler's and Hamiltonian Graphs.	06
	Total	**28**

Books Recommended:

Text Books:

1. Eric Lehman, F. Thomson Leighton, and Albert R. Meyer, Mathematics for Computer Science, Pearson, 2021, 2nd Edition.
2. Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw-Hill, 2021, 9th Edition.
3. Niven, Zuckerman, and Montgomery, An Introduction to the Theory of Numbers, John Wiley & Sons, 2020, 7th Edition.
4. David S. Dummit and Richard M. Foote, Abstract Algebra, Wiley, 2021, 4th Edition.
5. Richard J. Trudeau, Introduction to Graph Theory, Dover Publications, 2021, 2nd Edition.

Reference Books:

1. G. V. Kumbhojkar, Discrete Structures and Graph Theory, 2nd Edition, 2021, P. Jamnadas LLP.
2. Johannes A. Buchmann, Introduction to Cryptography: Principles and Applications, Springer, 2021, 3rd Edition.
3. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson, 2021, 9th Edition.
4. John M. Harris, Jeffry L. Hirst, and Michael J. Mossinghoff, Combinatorics and Graph Theory, Springer, 2021, 2nd Edition.
5. Michael Artin, Algebra, Pearson, 2021, 4th Edition.
6. Michael Sipser, Introduction to the Theory of Computation, Cengage Learning, 2021, 4th Edition.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Project Management (DJS23XOE261)

Pre-requisite:

1. Basic concepts of Management.

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: On completion of the course, the learner will be able to:

1. Explain project management life cycle and the various project phases as well as the role of project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use Earned value technique and determine & predict status of the project. Capture lessons learned during project phases and document them for future reference.
5. Differentiate between traditional waterfall approach and agile scrum methodology for software development projects.

Project Management (DJS23XOE261)		
Unit	**Description**	**Duration**
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical). Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	08
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	08
3	**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques,	09

	PERT, CPM. Crashing project time & Resource loading and levelling (Only Theory). Project Stakeholders and Communication plan. **Risk Management in projects:** Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability, and impact matrix. Risk response strategies for positive and negative risks.	
4	**Monitoring and Controlling Projects**: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit, Project Contracting: Project procurement management, contracting and outsourcing. **Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	09
5	**Agile project management:** Agile principle, Agile Manifesto, Agile process framework, Characteristics of Agile Approaches and Scrum, Benefits of Agile project management, Implementing Agile project management. **Agile Project Planning:** Comparison of Agile Project Management with Traditional Waterfall Approach, Project Planning with Scrum, Scrum Artifacts Supporting Project Planning , Scrum Events for Project Planning. Scheduling with scrum, Techniques for scrum scheduling-Poker estimation. **Agile Tools for Tracking Project Progress:** Task Boards, Burnup and Burndown Charts.	08
	Total	**42**

Books Recommended:

Text Books:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 11th Edition, Wiley India.
2. Project Management: The Managerial Process, 8th edition, Erik Larson, Clifford Gray, McGraw Hill Education.
3. Agile Project Management, Jim Highsmith, Pearson Education, Low Price Edition, India.

Reference Books:

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 7th Ed, Project Management Institute PA, USA.

2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.
5. Agile Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers U.S.A.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

4) Term Test 1 (based on 40 % syllabus) – 15 marks.
5) Term Test 2 (on next 40 % syllabus) – 15 marks.
6) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Cyber Security, Policies and Laws (DJS23XOE262)

Pre-requisite:

1. Fundamentals of Computers.

Objectives:

1. Familiarize with the provisions and implications of the Digital Personal and Data Protection Act, the obligations of data fiduciaries, the rights and duties of data principals, and mechanisms for resolving breaches.
2. Equip individuals and organizations with the knowledge and tools to create secure cyber ecosystems, strengthen regulatory frameworks, and develop incident response plans.

Outcomes: On completion of the course, the learner will be able to:

1. Understand and describe the major types of cybercrime and navigate legal frameworks and regulations concerning digital personal and data protection.
2. Implement strategies for cybersecurity outlined in the National Cyber Security Policy.
3. Apply appropriate law enforcement strategies to both, prevent and control cybercrime.
4. Comprehend regulations and strategies pertaining to AI (Artificial Intelligence) and large language models.

Cyber Security, Policies and Laws (DJS23XOE262)		
Unit	**Description**	**Duration**
1	**Cyber Crime:** Definition and Origin of the Word, Cyber Crime and Information Security, who are Cyber Criminals, Classification of Cybercrimes, E-mail Spoofing, Spamming, Cyber Defamation, Internet Time Theft, Salami Attack, Salami technique Data Diddling, Forgery, Newsgroup Spam, Online Frauds, Pornographic Offenders, Email Bombing, Password Sniffing, Credit Card Frauds.	08
2	**Cyber Offenses:** How Criminals plan them, Categories of Cyber Crimes, How Criminal Plans the Attack: Active Attacks, Passive Attacks, Social Engineering, Classification of Social Engineering, Cyber Stalking: types of Stalkers, Cyber Cafe and Cyber Crimes, Botnets, Attack Vectors, Cyber Crime and Cloud Computing.	08
3	**Indian IT Act** Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments Security aspect in Cyber-Law, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, Security Standards: SOX, GLBA, HIPAA, NIST Cyber Security Framework (CSF).	09

4	**India's Digital Personal and Data Protection Act (2023)** Preliminary, Obligations of Data Fiduciary, Rights and Duties of Data Principal, Special Provisions, Data Protection Board of India, Powers, Functions and Procedure to Be Followed by Board, Appeal and Alternate Dispute Resolution, Penalties and Adjudication.	08
5	**India's AI Regulation and Strategy** Privacy, Security and Artificial Intelligence, Differential Privacy, Security in AI. National Artificial Intelligence Strategy, Principles for Responsible AI, Information Technology (Intermediary Guidelines and Digital Media Ethics Code-2021), Draft National Data Governance Framework Policy (NDGFP), Rules against Deepfakes, Due diligence advisory for AI, AI regulations framework (June 2024).	09
	Total	**42**

Books Recommended:

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunit Belapur, Wiley-2011.
2. Understanding Cybersecurity Management in Decentralized Finance: Challenges, Strategies, and Trends by Gurdip Kaur, Springer-2023.

Reference Books:

1. The Information Technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
2. Izzat Alsmadi , The NICE Cyber Security Framework: Cyber Security Intelligence and Analytics, Springer-2023.

References (Web Resources):

1. Digital Personal Data Protection Act 2023.pdf (meity.gov.in)
2. National Cyber Security Policy (draft v1 (meity.gov.in)
3. CISO_Roles_Responsibilities.pdf
4. Standards (bis.gov.in)
5. AI, Machine Learning & Big Data Laws & Regulations | India (globallegalinsights.com)

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15,marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by | Checked by | Head of the Department | Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Advanced Operations Research (DJS23XOE263)

Pre-requisite:

1. Operation Research
2. Mathematics (Calculus)

Objectives:

1. To develop an ability to analyse the structure and mathematical model of various complex system occurring in manufacturing system, service system, and business applications.
2. To develop knowledge of the mathematical structure of linear and nonlinear optimization models.
3. To develop an understanding of the techniques used to solve linear and nonlinear optimization models using their mathematical structure.
4. To develop an understanding of the use of modelling languages for expressing and solving optimization models.

Outcomes: On completion of the course, learner will be able to:

1. Apply Duality theory to solve linear programming problem and analyse optimum solution.
2. Construct linear integer programming models and apply the O.R. algorithms and techniques to solve linear integer programming problems.
3. Determine best satisfying solution under a varying quantity of resources and priorities of the goals.
4. Set up decision models and solve nonlinear programming- unconstrained optimization problems.
5. Set up decision models and solve nonlinear programming- constrained optimization problems.

Advanced Operations Research (DJS23XOE263)		
1	**Dual Linear Programs** Primal, dual, and duality theory - The dual simplex method -The primal-dual algorithm-Duality applications. Post optimization problems: Sensitivity analysis	06
2	**Integer Programming** Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.	06
3	**Goal Programming** Concept of Goal Programming, GP model formulations, Graphical method of GP, The simplex method of GP, Application areas of GP.	12
4	**Nonlinear Programming- Unconstrained optimization** Minimization and maximization of convex functions- Local & Global optimum- Convergence-Speed of convergence. one-dimensional	12

	unconstrained optimization – Newton's method – Golden-section search method , multidimensional unconstrained optimization –Gradient method – steepest ascent (descent) method – Newton's method	
5	**Nonlinear Programming- Constrained optimization** Constrained optimization with equality and inequality constraints. Constrained optimization: Lagrangian method - Sufficiency conditions - Kuhn-Tucker optimality conditions Rate of convergence - Engineering Applications Quadratic programming problems-convex programming problems	06
	Total	**42**

Books Recommended:

Text Books:

1. Operations Research, Gupta, P. K. and Hira, D. S., S. Chand Publications, 2014.
2. Operations research: Principles and applications, Srinivasan, G., Prentice Hallof India, 2007.
3. Non-Linear Programming-A Basic Introduction, Nita H. Shah, Poonam Prakash Mishra, CRC Press, 2020.

Reference Books:

1. Introduction to Operations Research, Frederick S. Hillier & Gerald J. Lieberman, McGraw-Hill: Boston MA; 8th. (International) Edition, 2005.
2. Operations Research – Principle and Practice Ravindran, Philips and Soleberg, Second Edition, John Wiley, and sons, 2007.
3. Operations Research - An Introduction: Taha, H. A., Pearson Education, 2022.
4. Operations Research: models and methods, Paul A. Jensen, Jonathan F. Bard, Wiley Publications, 2003
5. Optimization Techniques in Operation Research, C. B Gupta, I.K. International Publishing House Pvt. Limited, 2008.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Corporate Finance Management (DJS23XOE264)

Pre-requisite:

1. Nil

Objectives:

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
3. Knowledge about sources of finance, capital structure, dividend policy.

Outcomes: On completion of the course, learner will be able to:

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance and working capital management.
4. Take Investment and finance decisions.
5. Take dividend decisions.

Corporate Finance Management (DJS23XOE264)		
Unit	**Description**	**Duration**
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market. Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges.	09
2	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	09
3	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance-investment Decision, Financing Decision, and Dividend Decision.:	08

	Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	
4	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	08
5	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure **Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches — Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	08
	Total	**42**

Books Recommended:

Textbooks:

1. Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.
2. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
3. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Reference Books:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.

3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Corporate Social Responsibility (DJS23XOE265)

Objectives:

1. To make students understand the concept, theories and application of CSR for the Development of the Society.

Outcomes: On completion of the course, the learner will be able to:

1. Upon completion of this course, students will be able to analyse and critique the ethical dimensions of Corporate Social Responsibility initiatives, demonstrating a comprehensive understanding of CSR principles and their ethical underpinnings.
2. Upon completion of this course, students will demonstrate an understanding of the legislative frameworks shaping Corporate Social Responsibility both in India and globally, alongside recognizing the key drivers fostering CSR practices within the Indian context.
3. Upon completion of this course, students will be able to identify and discuss the significance of social responsibility and community engagement initiatives, demonstrating an understanding of their impact on both businesses and society.

Corporate Social Responsibility (DJS23XOE265)		
Unit	**Description**	**Duration**
1	**Introduction to Corporate Social Responsibility (CSR)** - Understanding the concept of CSR - Historical evolution and development of CSR - Importance and benefits of CSR for businesses and society - Stakeholder theory and its relevance to CSR	07
2	**Ethical Foundations of CSR** - Ethical theories relevant to CSR (Utilitarianism, Deontology, Virtue Ethics) - Ethical decision-making frameworks in business - Corporate governance and ethics - Ethical issues in supply chain management	09
3	**CSR-Legislation in India and the World** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India	09
4	**The Drivers of CSR in India** Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP)	09

5	**Social Responsibility and Community Engagement** - Social issues and challenges in contemporary society - Corporate philanthropy and community development initiatives - Stakcholder engagement strategies - Corporate volunteering and employee engagement programs - CSR as a strategic business tool vital for sustainable development	08
	Total	**42**

Books Recommended:

Text Books:

1. Andrew Crane, Dirk Matten, "Corporate Social Responsibility: Definition, Core Issues, and Recent Developments" Oxford University Press.
2. O. C. Ferrell, John Fraedrich, Linda Ferrell, "Business Ethics: Ethical Decision Making & Cases", Cengage Learning
3. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
4. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015

Reference Books:

1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Bioinformatics (DJS23XOE266)

Course Objectives:

1. To provide an overview of bioinformatics and its significance in modern biological research.
2. To enable students to apply bioinformatics methods in practical scenarios for biological data analysis and interpretation.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. Understand the structure and function of cells, organelles, and biomolecules.
2. Understand the types of data stored in bioinformatics databases and their relevance to biological research.
3. Explore genomic databases and understand the structure and content of protein databases.
4. Understand system biology concepts and molecular evolution.
5. Apply knowledge of cellular and molecular biology concepts to analyze a biological problem.

Bioinformatics (DJS23XOE266)		
Unit	**Description**	**Duration**
1	**Module 1: Foundations of Molecular and Cellular Biology** **Introduction to molecular biology:** DNA, RNA, proteins, and their roles in cellular processes **Cell structure and function:** Organelles, membrane structure, and cellular transport **Cell cycle regulation:** phases of the cell cycle, checkpoints, and cell cycle control mechanisms	08
2	**Module 2: Genetics and Genomics** **Mendelian genetics:** Inheritance patterns, Punnett squares, and genetic crosses **Chromosome structure and organization:** karyotyping, gene mapping, and genetic linkage **Introduction to genomics:** genome structure, organization, and variation Techniques in molecular genetics: PCR, DNA sequencing, and gene cloning	09

3	**Module 3: Genomic and Protein Databases** Types of genomic databases such as GenBank, Ensemble, and UCSC Genome Browser, Understand the structure and content of protein databases such as UniProt and Protein Data Bank (PDB), Searching, Retrieving, and Analysing Genomic and Protein data from online databases.	09
4	**Module 4: Systems Biology** **Introduction to Systems Biology**: Modeling biological systems and network analysis, Bioinformatics tools for systems biology and modeling complex biological processes. **Principles of molecular evolution**: Mutation, Selection, and genetic drift. **Phylogenetic analysis**: Tree construction, sequence alignment, and molecular clock.	09
5	**Module 5: Applications and Case Studies** Applications of Bioinformatics in Medicine, Agriculture, and Biotechnology, Case Studies (Integrating Cellular and Molecular Biology with Bioinformatics) and Research Examples, Ethical and Legal Issues in Bioinformatics, Future Trends and Emerging Technologies in Bioinformatics.	07
	Total	**42**

Books Recommended:

Textbooks:

1. Bioinformatics For Dummies", Jean-Michel Claverie and Cedric Notredame, For Dummies. (2019)
2. Bioinformatics Algorithms: An Active Learning Approach" by Phillip Compeau and Pavel Pevzner, Active Learning Publishers (2019)

Reference Books:

1. Introduction to Bioinformatics, Arthur Lesk, Biologist & Bioinformatics Expert, 2019
2. Introduction to Biomedical Data Science, Robert Hoyt, Informatics Education, 2019
3. Python for Biologists: A Complete Programming Course for Beginners, Martin Jones, Oxford University Press, 2013
4. An Introduction to Bioinformatics Algorithms, Neil C. Jones, and Pavel A. Pevzne, MIT Press,2004.
5. Exploring Bioinformatics: A Project-Based Approach, Caroline St. Clair, and Jonathan E. Visick, Jones & Bartlett Learning, 2014.

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by | Checked by | Head of the Department | Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Human Resource Management (DJS23XOE267)

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations
3. To familiarize the students about the importance of the labour relations in the organization.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the changing environment of the HRM and the role of the HR managers.
2. Understand the recruitment process and the application of the IT.
3. Understand the importance of the training and development.
4. Understand about the pay plans, performance appraisal and compensation.
5. Understand the importance of the labour relation, the employee security and collective bargaining.

Human Resource Management (DJS23XOE267)		
Unit	**Description**	**Duration**
1	**Human Resource Function** Human Resource Philosophy – Changing environments of HRM – Strategic human resource management – Using HRM to attain competitive advantage – Trends in HRM – Organisation of HR departments – Line and staff functions – Role of HR Managers.	08
2	**Recruitment & Placement** Job analysis: Methods - IT and computerised skill inventory - Writing job specification - HR and the responsive organisation. Recruitment and selection process: Employment planning and forecasting - Building employee commitment: Promotion from within - Sources, Developing and Using application forms - IT and recruiting on the internet. Employee Testing & selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.	10
3	**Training & Development** Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet.	08

	Developing Managers: Management Development - The responsive managers - On-the-job and off the-job Development techniques using HR to build a responsive organisation. Performance appraisal: Methods - Problem and solutions - MBO approach - The appraisal interviews - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers.	
4	**Compensation & Managing Quality** Establishing Pay plans: Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation - pricing managerial and professional jobs - Computerised job evaluation. Pay for performance and Financial incentives: Money and motivation - incentives for operations employees and executives - Organisation wide incentive plans - Practices in Indian organisations. Benefits and services : Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits -retirement benefits and other welfare measures to build employee commitment.	08
5	**Labour relations and employee security** Industrial relation and collective bargaining: Trade unions - Collective bargaining - future of trade unionism. Discipline administration - grievances handling - managing dismissals and separation. Labour Welfare: Importance & Implications of labour legislations - Employee health - Auditing HR functions, Future of HRM function.	08
	Total	**42**

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Digital Marketing Management (DJS23XOE268)

Objectives:

1. Explain the evolution and technology of digital marketing, including underlying frameworks.
2. Understand digital business strategy and emerging business structures.
3. Cover digital marketing planning, operations setup, and implementation of search campaigns, alongside emerging concepts like Big Data, IoT, SMB, B2B marketing, and SoLoMo.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

Digital Marketing Management (DJS23XOE268)		
Unit	**Description**	**Duration**
1	**Introduction to Digital Marketing** Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing. **Digital Marketing Framework** Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework **Digital Marketing Models Creation** Factors impacting digital marketplace, value chain digitization, business models. **The Consumer for Digital Marketing** Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC)	08
2	**Digital marketing Strategy Development** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review. **Digital Marketing Strategy Definition** Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing	11

	models, managing promotional channels and developing the extended Ps- People, process, programs and performance. **Digital marketing Strategy Roadmap** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.	
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing. **Digital Marketing Operations Setup** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.	**08**
4	**Digital marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing. **Digital marketing Execution Elements** Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like ecommerce, internal & external and consumer specific challenges.	**08**
5	**Digital Business – Present and Future** Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape. Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing.	**07**
	Total	**42**

Books Recommended:

Text Books:

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,2017
2. Digital Marketing by Seema Gupta- McGraw Hill Education, 2022

Reference Books:

1. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5th edition, Taylor & Francis, 2017
2. Digital Marketing: Strategy, Implementation and Practice- 6th edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited,2019
3. Digital marketing by Vandana Ahuja, Oxford University Press, 2015
4. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons, 2016

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

Program: Open Elective for all Programs **S.Y B.Tech.** **Semester: IV**

Course: Logistics and Supply Chain Management (DJS23XOE269)

Pre-requisite:

1. Latest trend of information technology in retail industry and logistic applications.

Objectives:

1. To develop advanced strategic thinking skills in supply chain management and logistics to effectively analyse and optimize supply networks.
2. To attain proficiency in leveraging cutting-edge tools and technologies to enhance supply chain efficiency and supply chain transformation.
3. Design and implement collaborative supply chain and sourcing strategies to promote information sharing and optimise coordination.

Outcomes: On completion of the course, learner will be able to:

1. Develop a sound understanding of the important role of supply chain management in today's business environment.
2. Develop criteria and standards to achieve improved business performance by integrating and optimizing the total logistics and supply-chain process.
3. Summarize the value of focusing on information business logistics systems which drives improved accuracy and decision-making at all levels of management.
4. Become familiar with current supply chain information technology management trends.
5. Use available technologies to enhance work performance and support supply chain functions, processes, transactions, and communications.

Logistics and Supply Chain Management (DJS23XOE269)		
Module	**Description**	**Hours**
1	**Introduction** What Is Supply Chain Management? The Development Chain, Global Optimization, Managing Uncertainty and Risk, The Complexity in Supply Chain Management, Key Issues in Supply Chain Management	05
2	**Network Planning** Introduction, Network Design- Data Collection, Data Aggregation, Transportation Rates, Mileage Estimation, Warehouse Costs, Warehouse Capacities, Potential Warehouse Locations, Service Level Requirements, Future Demand, Model and Data Validation, Solution Techniques, Key Features of a Network Configuration Supply Chain Planning; Inventory Positioning and Logistics Coordination -Strategic Safety Stock.	07
3	**The Value of Information** Introduction, The Bullwhip Effect-Quantifying the Bullwhip Effect, The Impact of Centralized Information on the Bullwhip Effect, Methods for	09

Program: Common to all Programs. **Group A / B** **S.Y B. Tech.** **Semester: III / IV**

Course: Economics and Financial Management (DJS23XHS282)

Pre-requisite: Knowledge of

1. Economics and Finance domain current affairs.

Objectives:

1. To describe the relationships among variables to analyse economic issues.
2. To Explain the function of the market and prices as an allocative mechanism.
3. To identify key macroeconomic indicators and measures of economic change, growth, and development
4. To understand basic concepts of financial management and their application in investment and financing decisions
5. To explore the relationship between Financial Management and Financial Statements.

Outcomes: On completion of the course, learner will be able to:

1. Analyse individual decision making, how prices and quantities are determined in product and factor markets, microeconomic and macroeconomic outcomes
2. Analyse the performance and functioning of government, RBI, markets, and institutions in the context of social and economic problems.
3. Analyse the current economic status of India at global levels and provision in budget to address economic issues at national level.
4. Describe an understanding of the overall role and importance of the finance function.
5. Analyse financial performance and make appropriate inferences.

Economics and Financial Management (DJS23XHS282)		
Unit	**Syllabus Content**	**Hours**
1	**Introduction to Economics** Fundamentals of Economics, Definition and scope of economics, the nature of the economic problem, finite resources and unlimited wants, definitions of the factors of production and their rewards, definition of opportunity cost, the influence of opportunity cost on decision making. **Microeconomics and Macroeconomics** The role of markets in allocating resources, the market system, introduction to the price mechanism, Demand, Supply and Price determination, Price elasticity of demand and supply (PED).	06
2	**Role of Government and RBI** Money, Banking, Households, Firms, economies and diseconomies of scale, Market Structure, Fiscal Policy, Monetary Policy, Economic Growth, causes and consequences of recession, causes of economic growth, measurement of economic growth inflation and deflation, living standards, indicators of living standards	05
3	**Government Policies** Last 20 years Journey of Indian Economy, Measures taken to grow Indian Economy, Meaning of India is the world's fifth-largest economy by nominal GDP and the third-largest by purchasing power parity (PPP), On a per capita	05

	income basis, India ranked 139th by GDP (nominal) and 127th by GDP (PPP) (Data reference year 2023), Comparison of top 5 largest economies in world, Discuss key points of India latest union budget and its impact on Indian economy and citizens, Meaning of Initiatives like Make in India, Digital India, Skill India etc. and expected impact on Indian Economy	
4	**Overview of Financial Management** Fundamentals of financial management, principles and functions of the financial management, Strategy, methods, and techniques of the financial management, Overview of financial instruments, financial markets, financial Institutions	04
5	**Overview of Financial Statements** Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios;	08
	Total	**28**

Books Recommended:

Text books:

1. Datt & Sundharam's Indian Economy by Gaurav Datt & Biswajit Nag, S. Chand Publications, 73rd Edition,2024
2. Fundamentals of Financial Management by Prasanna Chandra, McGraw Hill Publications, 7th Edition, 2020

Reference Books:

1. Public Economics: The Macroeconomic Perspective by Burkhard Heer, Springer International Publications,2019
2. Indian Economy: Economic Ideas, Development, and Financial Reforms by Raj Kumar Sen, Deep & Deep Publications, 2008
3. Indian Economy: Performance and Policies by Dr. V. C. Sinha, SBPD Publications,2021
4. Financial Management by C. Paramasivan, T. Subramanian, New Age Publications,2009
5. Financial Management Practices in India by Sandeep Goel, Taylor & Francis Publications,2016

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

Prepared by Checked by Head of the Department Principal

	Coping with the Bullwhip Effect, Information Sharing and Incentives, Effective Forecasts, Information for the Coordination of Systems, Locating Desired Products, Lead-Time Reduction, Information and Supply Chain Trade-offs-Conflicting Objectives in the Supply Chain, Designing the Supply Chain for Conflicting Goals ,Decreasing Marginal Value of Information.	
4	**Supply Chain Integration** Introduction, Push, Pull, and Push-Pull Systems-Push-Based Supply Chain, Pull-Based Supply Chain, Push-Pull Supply Chain ,Identifying the Appropriate Supply Chain Strategy, Implementing a Push-Pull Strategy The Impact of Lead Time Demand-Driven Strategies The Impact of the Internet on Supply Chain Strategies-what is E-Business, the Grocery Industry , the Book Industry , the Retail Industry and Impact on Transportation and Fulfillment.	09
5	**Information Technology and Business Process** Introduction, The Importance of Business Processes, Goals of Supply Chain IT, Supply Chain Management System Components, Decision-Support Systems, IT for Supply Chain Excellence, Sales and Operations Planning Integrating Supply Chain Information Technology. Implementation of ERP and Decision Support System.	06
6	**Technology Standards** Introduction, IT Standards, Information Technology Infrastructure-Interface Devices, System Architecture and Electronic Commerce. Service-Oriented Architecture (SOA)-Technology Base: IBM and Microsoft and ERP Vendor Platform: SAP and Oracle. Radio Frequency Identification (RFID)- applications, point of sale data, business benefits and supply chain efficiency.	06
	Total	**42**

Books Recommended:

Text Books:

1. Sunil Chopra, Peter Meindl "Supply Chain Management-Strategy, Planning, and Operation", Pearson Publications 2016
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain-Concepts, Strategies, and Case Studies", McGraw-Hill/Irwin 2008

Reference Books:

1. Ian Sadler, "Logistics and Supply Chain Integration", SAGE Publications, 2007

2. Donald Waters, "Supply Chain Management - An Introduction to Logistics", Bloomsbury Publishing, 2019
3. Dimitris Folinas, "E-Logistics and E-Supply Chain Management-Applications for Evolving Business, IGI Global publications, 2013
4. Martin Christopher, "Logistics & Supply Chain Management", Pearson Education publications, 2016

Evaluation Scheme:

Continuous Assessment (A):

Will consist of following three components:

1) Term Test 1 (based on 40 % syllabus) – 15 marks.
2) Term Test 2 (on next 40 % syllabus) – 15 marks.
3) Assignment / course project / group discussion / presentation / quiz – 10 marks

Total summing up to 40 marks.

Semester End Examination (B):

Theory:

Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 60 marks.

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Program: Computer Engineering									Semester: IV
Course: Innovative Product Development II									Course Code: DJS23XSC251P
Teaching Scheme (Hours/week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.
				–			–	–	–
				Laboratory Examination			Semester review		Average
–	2	–	1	Oral	Practical	Oral & Practical	Review 1	Review 2	25
				–	–	–	25	25	25

Course Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value-added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualize and create a successful product.

Course Outcome:

Learner will be able to:

1. Identify the requirement for a product based on societal/research needs.
2. Apply knowledge and skills required to solve a societal need by conceptualizing a product, especially while working in a team.
3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.
4. Draw proper inferences through theoretical/ experimental/simulations and analyze the impact of the proposed method of design and development of the product.
5. Develop interpersonal skills, while working as a member of the team or as the leader.
6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare them to be successful entrepreneurs.
7. Demonstrate product/project management principles during the design and development work and excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualization of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity logbook is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The design solution is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department.
- Efforts are to be made by the students to try and publish a technical paper, at a suitable publication (National /International), approved by the department research committee/ Head of the department.
- The focus should be on self-learning, the capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, the focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.

Review/Progress monitoring committee may consider the following points during the assessment.

The tentative rubrics that can be followed can be as follows:

Review 1:

iv. Literature Review (Algorithms, Techniques, Methodologies) / Product Review (Review of atleast 5 technical papers).
v. Presentation Quality
vi. Contribution as a team member and Punctuality

Review 2:

vii. Analysis of Literature Review
viii. Problem Statement and proposed solution
ix. System Process flow Diagram
x. Presentation Quality
xi. Contribution as a team member and Punctuality
xii. Project Documentation

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal Examiners.

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Program: Common to all Programs. **Group A / B S.Y B. Tech. Semester: III & IV**

Course: Professional and Business Communication Tutorial (DJS23XHS281T)

Objectives:

1. To inculcate professional and ethical attitude at the workplace
2. To enhance communication and interpersonal skills
3. To develop effective employability skills
4. To hone written skills for technical documentation

Outcomes: On completion of the course, the learner will be able to:

1. Apply group discussion techniques in professional situations
2. Use employability skills to optimize career opportunities
3. Employ storytelling techniques for effective presentation
4. Prepare technical documents using appropriate style, format, and language
5. Analyze the concept of professional ethics
6. Demonstrate interpersonal skills in professional and personal situations

Professional and Business Communication (DJS23XHS281T)		
The course is designed to equip students with essential skills, crucial for navigating the contemporary job market successfully and fostering a positive work environment through effective communication and collaboration. The assignments comprise of a combination of interactive activities, discussions, case studies and real-world simulations, to help students, not only to ace job interviews and professional interactions, but also to contribute positively to the ethical and productive functioning of any organization. For the project work, students must prepare and present a well-researched and persuasive business proposal, in groups, integrating the skills and knowledge acquired throughout the course.		
Unit	**Description of Tutorial Activities**	**No of Assignments**
1	**Group Discussion:** Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD **Activity:** *The students will be divided into groups of 8-12 and each group will be given a topic/case to discuss within a given time frame. Each student will submit a write-up on their observations of the GD.*	1
2	**Employment Skills** **Resume Writing:** Types of resumes, structure, content, and formatting of resume **Activity:** *The students will prepare and submit their individual resume according to the professional requirements.* **Interview Skills:** Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview	2

	Activity: *The students will submit a write-up on the FAQs and participate in mock interviews*	
3	**Corporate Story Telling:** Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate. **Activity:** *The students will be divided into groups of 8-12 and asked to give a team presentation using storytelling technique and submit the hardcopy of the ppt.*	1
4	**Technical Writing and Documentation** **Business Proposal Writing:** Types of business proposals, format of proposal, language and style, presentation of proposal **Meeting Documentation:** Planning layout of meetings, observing meeting decorum, drafting notice, agenda, and minutes of meeting **Activity:** *The students will be divided into groups of 8-12 and each group will conduct a mock meeting based on an agenda and submit a writeup of the meeting documentation.*	1
5	**Professional Ethics:** Effective work habits, accountability, integrity, and excellence **Activity:** *The students will be divided into groups of 8-12 and each group will analyse a case involving an ethical issue and submit the writeup.*	1
6	**Interpersonal Skills** **Team Building:** Difference between group and team, importance of teamwork, strategies to be a good team player **Activity:** *The students will be divided into groups of 8-12 and each group will be assigned a task to be accomplished as a team, for which they will submit the writeup.* **Leadership:** Types of leadership, leadership styles, case studies **Activity:** *Each student will submit a writeup involving a leader they admire, analysing various aspects of his leadership style.* **Time Management:** Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals **Activity:** *Each student will submit a writeup about a case involving time management.*	2

Batch-wise tutorial work of minimum eight assignments from the above suggested list or any other assignments based on the syllabus will be included, which would help the learner to apply the concepts learnt.

Books Recommended:

1. Fred Luthans, *"Organizational Behavior"*, McGraw Hill, edition
2. Lesiker and Petit, *"Report Writing for Business"*, McGraw Hill, edition

3. Huckin and Olsen, *"Technical Writing and Professional Communication"*, McGraw Hill
4. Wallace and Masters, *"Personal Development for Life and Work"*, Thomson Learning, 12th edition
5. Heta Murphy, *"Effective Business Communication"*, Mc Graw Hill, edition
6. Sharma R.C. and Krishna Mohan, *"Business Correspondence and Report Writing"*, Tata McGraw-Hill Education
7. Ghosh, B. N., *"Managing Soft Skills for Personality Development"*, Tata McGraw Hill. Lehman,
8. Bell, Smith, "Management Communication" Wiley India Edition, 3rd edition.
9. Dr. Alex, K.," Soft Skills", S Chand and Company
10. Subramaniam, R., "Professional Ethics" Oxford University Press.
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact" Penguin Random House India Pvt. Ltd.

Evaluation Scheme:

Continuous Assessment (A):

Term Work: - 50 marks.

Term Work shall comprise of:

Minimum 8 assignments: 25 marks.

Business Proposal presentation: 25 marks.

GD : 10 Marks

Prepared by 23/12 Checked by Head of the Department Principal