Dr. N.G.P. ARTS AND SCIENCE COLLEGE
(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore
Approved by Government of Tamilnadu and Accredited by NAAC with 'A++'
Grade (3rdCycle)
Dr. N.G.P.- Kalapatti Road, Coimbatore-641048, Tamilnadu, India
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REGULATIONS 2024-25 for Post Graduate Programme

(Outcome Based Education model with Choice Based Credit System)

M.Sc. Computer Science Degree

(For the students admitted during the academic year 2024-25 and onwards)

Programme: M.Sc. Computer Science

Eligibility

Candidates for admission to the first year course leading to the Degree of Master of Science (COMPUTER SCIENCE) will be required to possess a pass in B.Sc. Computer Science / B.C.A. /B.Sc. Computer Technology / B.Sc. Information Technology /B.Sc. Information Sciences/B.Sc. Information Systems/ B.Sc. Software Systems/B.Sc. Software Sciences / B.Sc. Applied Sciences (Computer Science/Computer Technology) / B.Sc. Electronics of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the M.Sc. Computer Science Examination of this College after the programme of study of two academic years.

Programme Objectives

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To embrace future developments and professional relevance in Computer Science.
2. To attain agility in advanced programming languages and software building for wide area of applications.
3. To explore with applications of Internet Technologies in the related profession with social and ethical responsibilities.
4. To handle the current techniques, skills and tools necessary for computing practice.
5. To engage in research-oriented activities and life-long learning for continuing professional development.

PROGRAMME OUTCOMES

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	The ability to identify and analyze the requirements of Computer Science problems.
PO2	The understanding of professional and ethical responsibility in the field of computer science and to communicate effectively.
PO3	The ability to implement algorithms and paradigms with modern software tools.
PO4	The ability to function effectively on multi-disciplinary projects and problems.
PO5	The ability to recognize and respond towards research areas of computer science and the need for lifelong learning.

TOTAL CREDIT DISTRIBUTION

Part	Subjects	No. of Papers	Credit	Semester No.
III	Core	11	9X4=36 2X5=10	I to III
	Core Practical	6	12	I to III
	Extra Departmental Course (EDC)	1	5	II
	Discipline Specific Elective (DSE)	3	3 x 5=15	I to III
	Internship	1	2	III
	Project Work	1	12	IV
TOTAL CREDITS			**92**	

CURRICULUM - PROGRAMME NAME – M.Sc. Computer Science (2024 Batch)

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
24CSP1CA	Core - I	Advanced Data Structures	4	-	-	4	48	3	25	75	100	4
24CSP1CB	Core - II	Advanced Java	4	-	-	4	48	3	25	75	100	4
24CSP1CC	Core - III	Information Security	5	-	-	5	60	3	25	75	100	5
24CSP1CD	Core - IV	Software Project Management	4	-	-	4	48	3	25	75	100	4
24CSP1CP	Core Practical I	Advanced Data Structures	-	-	4	4	48	3	40	60	100	2
24CSP1CQ	Core Practical II	Advanced Java	-	-	4	4	48	3	40	60	100	2
24CSP1DA	DSE -I	Digital Image Processing	5	-	-	5	60	3	25	75	100	5
24CSP1DB		Advanced Data Mining										
24CSP1DC		Computer Communication Networks										
Total			22		8	30	360				700	26

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Total	Week		CIA	ESE	Total	
						Second Semester						
24CSP2CA	Core - V	Advanced Python Programming	4	-	-	4	48	3	25	75	100	4
24CSP2CB	Core - VI	Modern Database Management Systems	4	-	-	4	48	3	25	75	100	4
24CSP2CC	Core - VII	Neural Networks and Fuzzy Logic	4	-	-	4	48	3	25	75	100	4
24MTP2ED	EDC	Advanced Operations Research	5	-	-	5	60	3	25	75	100	5
24CSP2CP	Core Practical - III	Advanced Python Programming	-	-	4	4	48	3	40	60	100	2
24CSP2CQ	Core Practical - IV	Modern Database Management Systems	-	-	4	4	48	3	40	60	100	2
24CSP2DA	DSE -II	Deep Learning	5	-	-	5	60	3	25	75	100	5
24CSP2DB		Predictive Analytics										
24CSP2DC		Advanced Networks										
			22	-	08	30	360				700	26

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Total	Week		CIA	ESE	Total	
Third Semester												
24CSP3CA	Core - VIII	Data Science Essentials	4	-	-	4	48	3	25	75	100	4
24CSP3CB	Core - IX	Advanced Operating Systems	4	-	-	4	48	3	25	75	100	4
24CSP3CC	Core - X	Distributed Computing	4	-	-	4	48	3	25	75	100	4
24CSP3CD	Core - XI	Research Methodology	5	-	-	5	60	3	25	75	100	5
24CSP3CP	Core Practical - V	Data Science Essentials	-	-	4	4	48	3	40	60	100	2
24CSP3CQ	Core Practical - VI	Advanced Operating Systems	-	-	4	4	48	3	40	60	100	2
24CSP3TA	IT	Internship	-	-	-			3	40	60	100	2
24CSP3DA	DSE -III	Natural Language Processing	5	-	-	5	60	3	25	75	100	5
24CSP3DB		Business Analytics										
24CSP3DC		Network Security										
Total			**22**		**08**	**30**	**360**				**800**	**28**

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Total	Week		CIA	ESE	Total	
Fourth Semester												
24CSP4CV	Core	Project and Viva voce	-	-	-	-	-	3	80	120	200	12
Total											200	12
*Grand Total											2400	92

Theory   :CIA 25   : ESE 75

Practical/ IT   : CIA 40   : ESE 60

Project   : CIA 100   : ESE 100

*Total Credits does not exceed 92 credits

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I, II and III

Semester I (Elective I)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24CSP1DA	Digital Image Processing
2.	24CSP1DB	Advanced Data Mining
3.	24CSP1DC	Computer Communication Networks

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24CSP2DA	Deep Learning
2.	24CSP2DB	Predictive Analytics
3.	24CSP2DC	Advanced Networks

Semester III (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	24CSP3DA	Natural Language Processing
2.	24CSP3DB	Business Analytics
3.	24CSP3DC	Network Security

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

Semester III

S. No.	Course Code	Name of the Course
1	24CSPSSA	IPR and Entrepreneurship
2	24CSPSSB	Organizational Behavior

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M.Sc Computer Science (Students admitted during the AY 2024-25)

SEMESTER I							
CORE I: ADVANCED DATA STRUCTURES							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1CA	ADVANCED DATA STRUCTURES	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - Operations of elementary data structures - The Tree data structure and Hashing for a specified application. - Various priority queues and disjoint sets
Prerequisite	Knowledge on Data Structures

Course Outcomes (Cos)		
CO No	Course Outcomes (COs) Statement	Bloom's Tax anomy Knowledge Level
CO1	Understand the operations of data structures Stack, Queues and Linked List.	K1
CO2	The functionalities and applications of Tree data structures.	K2
CO3	Demonstrate Hash functions and applications	K3
CO4	Apply the operations of Priority Queues and Heaps.	K4
CO5	Applying knowledge about disjoint sets.	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓		✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓		✓

24CSP1CA – CORE: ADVANCED DATA STRUCTURES

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Elementary Data Structures** Abstract Data Types (ADTs) - The List ADT - Simple Array Implementation of Lists - Simple Linked Lists - Implementation of list-Applications of Lists - Doubly Linked List - Circular Linked List - The Stack ADT - Stack Model - Implementation of Stacks - Applications - Queue ADT - Queue Model - Array Implementation of Queues - Applications of Queues	10	Text Book
II	**Trees** Trees - Tree Traversals with an Application - Binary Trees - Implementation - The Search Tree ADT—Binary Search Trees - AVL Trees: Single Rotation - Double Rotation - Splay Trees - B-Trees - Red-Black Trees - Sets and Maps in the Standard Library - Sets - Maps - Implementation of set and map	9	Reference Book
III	**Hashing** Hash Functions - Separate Chaining - Hash Tables without Linked Lists - Linear Probing - Quadratic Probing - Double Hashing – Rehashing	9	Text Book
IV	**Priority Queues** Binary Heap - Structure Property - Heap-Order Property - Basic Heap Operations - Other Heap Operations - Applications of Priority Queues - The Selection Problem - Heaps - Skew Heaps - Binomial Queues	10	Reference Book
V	**The Disjoint Sets** Equivalence Relations - The Dynamic Equivalence Problem - Smart Union Algorithms - Path Compression - Worst Case for Union-by-Rank and Path Compression - Slowly Growing Functions - An Analysis by Recursive Decomposition **Case Study:** Data structures used in Web graph and Google maps	10	You Tube Videos

Text book	1.	Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Edition, 2014, Pearson
Reference Books	1.	S.Sahni,2018,"Data structures, Algorithms and Applications in C++, 2nd edition, University Press (India) Pvt.Ltd.
	2.	Lipschutz, 2016,"Data Structures", 3rd Edition, Tata McGraw Hills
	3.	Michael T.Goodrich, R.Tamassia andMount,2017."Data structures and Algorithms in C++", 3rd Edition, Wiley student edition, John Wiley and Sons.
	4.	R.G. Dromey, 2016, "How to solve it by Computers", 8th Edition, Pearson Education.

Journal and Magazines	Data Structures	SpringerLink
E-Resources and Website	Advanced Data Structures - GeeksforGeeks

Learning Methods	Chalk and Talk / Assignment / Seminar
Focus of the Course	Skill Development / Employability

SEMESTER I CORE II: ADVANCED JAVA							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1CB	ADVANCED JAVA	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand
	• Advanced Java concepts to develop applications
	• The Concepts of Java Beans and Swing
	• Database Connectivity using JDBC and Embedded SQL
Prerequisite	Knowledge on Java

Course Outcomes (Cos)		
CO.No	Course Outcomes (COs) Statement	Bloom's Tax anomy Knowledge Level
CO1	Understand about Java beans and Swing	K2
CO2	Understand the life cycle of Java Servlet	K2
CO3	Develop and apply events in JSP and RMI	K3
CO4	Learn the architecture and design of Enterprise Java Bean	K2
CO5	Design applications implementing Database Connectivity using JDBC and Embedded SQL.	K5

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		
CO2	✓	✓	✓		
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓	✓	✓

24CSP1CB – CORE: ADVANCED JAVA

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Java Beans and Swing** Introduction: Advantages – Design patterns for Properties – Events – Methods and Design Patterns - Java Beans API – Swing : Introduction – Swing Is Built on the AWT - Two Key features of Swing – MVC Connections – Components and Containers – The Swing Packages – Simple Swing Applications - Exploring Swing	10	Text Book
II	**Java Servlet** Introduction: Background - The life cycle of a Servlet – Using Tomcat for Servlet development – A Simple Servlet – The Javax. Servlet Packages – Reading Servlet Parameters – The javax. servlet. http packages – Handling Http request and responses – cookies - Session Tracking	10	Reference Book
III	**Java Server Pages, Remote Method Invocation** Java Server Pages- Introduction - Tags: Variable Objects - Request String: Parsing Other Information - User Session - Cookies- Session 10objects. Java Remote method Invocation: Remote Interface- Passing Objects- RMI Process - Server side- Client side	8	Text Book
IV	**Enterprise Java Bean** Enterprise Java Beans :The EJB Container – EJB Classes - EJB Interfaces – Deployment Descriptors: Referencing EJB - Sharing Resources - Security Elements - Query Elements - Assembly Elements - Session Java Bean: Stateless and Stateful- Creating a Session Java Bean- Entity Java Bean - Message -Driven Bean	10	NPTEL
V	**Database Connectivity** JDBC Objects : The Concept of JDBC - JDBC Driver types –JDBC Packages – Database Connection – Statement Objects – ResultSet – Transaction Processing - JDBC and Embedded SQL : Tables and Indexing - Inserting, Selecting and Updating Data	10	You Tube Videos

Text book	1.	Herbert Schildt, 2018, "Java The Complete Reference", 10th Edition, Tata McGraw Hill (Unit I-II)
	2.	Jim Keogh, 2002, "J2EE: The Complete Reference", McGraw Hill Education (Unit III – V)
Reference Books	1.	Herbert Schildt, 2018, "Java, A Beginners Guide", 8th Edition, Oracle Press
	2.	Bert Bates, Karthy Sierra, Eric Freeman, Elisabeth Robson, 2009, "Head First Design

		Patterns", 1st Edition, O'Reilly
	3.	Robert Pattinson, 2018, "The Ultimate Beginners Guide for Advance Java", First Edition, Amazon Digital Services LLC
	4.	E Ramaraj P Geetha S Muthukumaran,2018, "Advanced JAVA Programming", First Edition, Pearson, Noida

Journal and Magazines	https://coderanch.com/t/395092/java/Java-Developers-Journal
E-Resources and Website	https://www.geeksforgeeks.org/java/
	https://www.javatpoint.com/java-tutorial

Learning Methods	Chalk and Talk / Assignment / Seminar
Focus of the Course	Skill Development / Employability

SEMESTER I							
CORE III: INFORMATION SECURITY							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1CC	**INFORMATION SECURITY**	CORE	60		-	5

Preamble	This course has been designed for students to learn and understand
	• The crucial concepts of information systems security.
	• The best security practices and ethics.
	• The design and implementation of secure systems
Prerequisite	Knowledge in Cyber Security

Course Outcomes (Cos)		
CO.No	Course Outcomes (COs) Statement	Bloom's Taxanomy Knowledge Level
CO1	Apply Basic Crypto and Symmetric Key Crypto.	K4
CO2	Demonstrate the Public Key Crypto.	K3
CO3	Understand the Advanced Cryptanalysis Concepts.	K2
CO4	Understand Authentication and Authorization.	K2
CO5	Apply Authentication Security Syllabus: Protocols.	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	

24CSP1CC – CORE: INFORMATION SECURITY

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Crypto and symmetric key crypto** Crypto Basics: Classic Crypto-Modern Crypto - Taxonomy of Cryptography and Cryptanalysis - Symmetric Key Crypto: Stream Ciphers - A5/1 - RC4 - Block Ciphers - DES - Triple DES - AES - Block Cipher Modes - Integrity.	12	Text Book
II	**Public key Crypto** RSA - Diffie Hellman - Elliptic Curve Cryptography - Public Key Notation - Uses for Public Key Infrastructure - Hash Functions: Cryptographic Hash Functions - Non Cryptographic Hashes - Uses for Hash Functions.	12	Reference Book
III	Advanced Cryptanalysis Enigma: Enigma Cipher Machine - Enigma Key Space - Rotors - Enigma Attack - RC4 in WEP: RC4 Algorithm - RC4 Cryptanalytic Attack - Preventing Attacks on RC4 - Linear and Differential Cryptanalysis: Tiny DES - Differential Cryptanalysis of TDES - Linear Cryptanalysis of TDES - RSA Timing Attack.	12	Text Book
IV	Authentication and Authorization Authentication: Authentication Methods - Passwords - Biometrics - Two Factor Authentication - Single Sign-On and Web Cookies - Authorization: Evolution of Authorization - Access Control Matrix - Multilevel Security Models - Firewalls - Intrusion Detection Systems.	12	NPTEL
V	**Authentication and Real-World Security Protocols** Authentication protocols: Simple Security Protocols - Authentication Protocols - Authentication using Symmetric and Public Keys - Session Keys - Authentication and TCP - Zero Knowledge Proofs - Real World Security Protocols: SSH - SSL - IPSec. Case Study: Security Issues - issues in Internet of Things (IoT) based Applications	12	You Tube Videos

Text book	1.	Mark Stamp,2018,"Information Security: Principles and Practice", Wiley Publications, Second Edition
	2.	Jim Keogh, 2002, "J2EE: The Complete Reference", McGraw Hill Education (Unit III – V)

Referenc eBooks	1.	Kim, David, Solomon, Michael G, 2018, "Fundamentals of information systems security", Jones & Bartlett Learning
	2.	Jason Andress, 2019, "Foundations of Information Security: A Straightforward Introduction", No Starch Press
	3.	Andrej Volchkov, 2019, "Information Security Governance Framework and Toolset for CISOs and Decision Makers", Auerbach Publications
	4.	Nina Godbole, 2017, "Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices", Second Edition, Wiley

Journal and Magazines	https://www.infosecurity-magazine.com/
E-Resources and Website	https://www.geeksforgeeks.org
	https://www.javatpoint.com

| Learning Methods | Chalk and Talk / Assignment / Seminar |

| Focus of the Course | Skill Development / Employability |

SEMESTER I							
CORE IV: SOFTWARE PROJECT MANAGEMENT							
Semester	Course Code	Course Name	Category	L	T	P	Credit
I	24CSP1CD	SOFTWARE PROJECT MANAGEMENT	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - Theoretical and methodological aspects in software project management. - Numerous process models for choosing the appropriate projects. - The required skills for managing projects, project teams, and stakeholder.
Prerequisite	Knowledge on software projects

Course Outcomes (Cos)		
CO.No	Course Outcomes (COs) Statement	Bloom's Tax anomy Knowledge Level
CO1	Remember the process of Software Project Management.	K1
CO2	Identify the theoretical and methodological issues involved in modern Software Project Management.	K1
CO3	Prepare the activity planning and evaluate the risks involved in it	K3
CO4	Analyze project monitoring activities	K3
CO5	Develop quality products by working as a team.	K4

MAPPING WITH PROGRAMME OUTCOMES					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

24CSP1CD – CORE: SOFTWARE PROJECT MANAGEMENT

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Importance of SPM** Definition of Project - Software Project Vs Other Types of Project - Contract Management and Technical Project Management – Activities Covered by SPM - Plans, Methods and Methodologies - Some Ways of Categorizing Software Projects – Stakeholders - Setting Objectives -Information and Control in an organization	10	Text Book
II	**Methodologies and Technologies** Choice of Process Models – The Waterfall Model - The Spiral Model - Software Prototyping - Agile Methods -Extreme Programming (XP) - Selecting the Most Appropriate Process Model. The Rapid Application Development – The V – Process Model - Software Effort Estimation: The Basis for Software Estimating - Software Effort Estimation Techniques - Bottom-up Estimating - The Top-down Approach and Parametric Models - Estimating by Analogy - COCOMO Parametric Productivity Model. Resource Allocation: The Nature of Resources - Identifying Resource Requirements - Scheduling Resources - Creating Critical Paths	10	Text Book
III	**Activity Planning** Project Schedules - Projects and Activities -Sequencing and Scheduling Activities - Network Planning Model - Formulating a Network Model – The Forward Pass – The Backward Pass - Identifying the Critical path - Activity Float – Shortening the Project Duration - Identifying Critical Activities - Activity-on-Arrow Networks. Risk Management: Definition of Risk -Categories of Risk - Risk Identification - Risk Assessment - Risk Planning – Risk Management - Evaluating Risks to the Schedule - Applying the PERT Technique -Critical Chain Concepts.	8	Text Book
IV	**Creating the Framework** Collecting the Data - Visualizing Progress – Cost Monitoring - Earned Value Analysis - Prioritizing Monitoring - Getting the Project Back to Target - Change Control. Managing Contracts: Types of Contract - Stages in Contract Placement - Typical Terms of a Contract – Contract Management -Acceptance. Managing People in Software Environments: Understanding Behavior-Organization Behavior: A Background - Selecting the Right Person for the Job -Instruction in the Best Methods - Motivation - The Oldham-Hackman Job Characteristics Model - Stress - Health and Safety - Some Ethical and Professional Concerns.	10	Text Book

V	**Working in Teams** Becoming a Team - Decision Making – Organizational Structures - Coordination Dependencies - Dispersed and Virtual Teams - Communication Genres - Communication Plans - Leadership. Software Quality: The Place of Software Quality in Project Planning - The Importance of Software Quality - Defining Software Quality - Product versus Process Quality Management- Quality Management Systems - Process Capability Models - Techniques to Help - Enhance Software Quality – Testing - Quality Plans - Acquisition Planning – Procurement – Case Study: Approaches to Software Life Cycle	10	Text Book	

Text Books

1 Bob Hughes, Mike Cotterell, Rajib Mall, 2017 , "Software Project Management", 6th Edition, Tata McGraw Hill

References

1 Adolfo Villafiorita, 2018, "Introduction to Software Project Management", CRC Press.
2 S.A. Kelkar, 2016, "Software Project Management A Concise Study", 3rd Edition,PHI Learning Private Limited.
3 Bharat Bhushan Agarwal,ShivangiDhall, Sumit Prakash Tayal, 2016, "Software Project Management", 1st Edition, University Science Press Pvt. Ltd.
4 Ian Sommerville, 2017, "Software Engineering", 1st Edition, Person India Pvt, Ltd

Journal and Magazines	https://www.ijsepm.latticescipub.com
E-Resources and Website	https://www.geeksforgeeks.org

Learning Methods	Chalk and Talk / Assignment / Seminar

Focus of the Course	Skill Development / Employability

SEMESTER I							
CORE PRACTICAL - I: ADVANCED DATA STRUCTURES							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1CP	ADVANCED DATA STRUCTURES	CORE	-	-	48	2

S. No	List of Programs
1	Program that implements stack (its operations) using i) Arrays ii) Linked list (Pointers).
2	Program that implements Queue (its operations) using i) Arrays ii) Linked list (Pointers).
3	Program to implement Doubly Linked List and Circularly Linked List.
4	Program to perform the operations Insert, Delete, Search for a key element in a binary search tree.
5	Program to implement the tree traversal methods
6	Program to perform the operations Insert, Delete, Search for a key element in an AVL tree.
7	Program to implement Hash Tables using Linked List.
8	Program to Implement Hashing by using any one collision technique.
9	Program to Implement of Heap Operations.
10	Program to Implement of Heaps using Priority Queues.
11	Program to implement Dynamic Equivalence.
12	Program to implement Recursive Decomposition.

SEMESTER I							
CORE PRACTICAL – II: ADVANCED JAVA							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1CQ	ADVANCED JAVA	CORE	-	-	48	2

S.No	List of Programs
1	Programs using Java control statements.
2	Programs to implement the Collection with Iterator.
3	Programs to create applet incorporating features such as images, shapes, background, and foreground color.
4	Create applications using simple GUI.
5	Programs to perform some applications using Java Bean.
6	Create applications using Swing.
7	Programs to demonstrate AWT Components with Event Handling.
8	Programs to perform Session Tracking.
9	Java servlet programs to implement sendredirect() Method (using Http servlet class).
10	Servlet programs using HTTP Servlet.
11	Create web applications using JSP.
12	Programs with JDBC to interact with database.

SEMESTER I						
DSE-I: DIGITAL IMAGE PROCESSING						
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CSP1DA	DIGITAL IMAGE PROCESSING	DSE-I	60	-	-	5

Preamble	This course has been designed for students to learn and understand
	• The concepts of image sensing and acquisition.
	• The Image enhancement operations.
	• The Image filtering, compression and segmentation.
Prerequisite	Knowledge on Digital Image Processing

Course Outcomes (Cos)		
CO. No	Course Outcomes (COs)Statement	Bloom's Taxonomy Knowledge Level
CO1	Grasp image processing techniques and image sensing.	K2
CO2	Understand image enhancement operations.	K2
CO3	Gain knowledge on filtering and restoration.	K3
CO4	Understand image segmentation.	K3
CO5	Identify image compression and watermarking.	K5

Mapping with Program Outcomes:

Cos /POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓			✓	
CO5	✓	✓	✓	✓	✓

24CSP1DA – DSE: DIGITAL IMAGE PROCESSING

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Digital Image Processing** Origins - Example Fields - Steps in digital image processing - elements of visual perception - light and electromagnetic spectrum - image sensing and acquisition - image sampling and quantization - relationship between pixels.	12	Text Book
II	**Intensity Transformation and Spatial Filtering** Intensity Transformation Function - Histogram Processing - Fundamentals of Spatial Filtering - Smoothing Spatial Filters - Sharpening Spatial Filters -- Low Pass Filters - Combining Spatial Enhancement methods -Filtering in the Frequency Domain-Selective Filtering - Fast Fourier Transform.	12	Text Book
III	**Image Restoration and Reconstruction** A model of the image degradation /restoration process - Noise models - Restoration in the presence of Noise only-Spatial Filtering - Periodic noise reduction using Frequency Domain Filtering - Estimating the Degradation Function - Wiener Filtering-Constrained Least Squares Filtering - Geometric Mean Filter.	12	Text Book
IV	**Image Segmentation** Point, Line and Edge Detection – Thresholding – Segmentation by Region Growing and Splitting and Merging – Super pixels – Region segmentation using Graph Cuts – Segmentation using Morphological Watersheds – The use of Motion in segmentation.	12	Text Book
V	**Image Compression and Watermarking** Fundamentals – Huffman coding – Golomb Coding – Arithmetic Coding – LZW Coding – Run – length Coding – Symbol based coding – Bit-plane coding – Block Transform coding – predictive coding- Wavelet coding. Case Study: Image Security: Steganography-Watermarking	12	Text Book

Textbook	1.	Rafael C. Gonzalez, Richard E. Woods, 2020,"Digital Image Processing ", Fourth Edition, Pearson
Reference Books	1.	Anil K Jain, 2015,"Fundamentals of Digital Image. Processing", Fourth Edition, Pearson Education..
	2.	KSanjay Sharma, 2015,"Fundamentals of Digital Image Processing", 5th edition, SK Kataria and Sons.

3.	Castleman, 2016, "Digital Image Processing ", First Edition , Pearson
4.	Dr. Shashidhar Sonnad, Dr.Vybhav.K, Dr.P.Joel Josephson ,Dr. Kapil Joshi, 2022, "Digital Image Processing ", First Edition, Book Rivers.

Journal and Magazines	https://www.sciencedirect.com/science/article/abs/pii/S00652539086 08902 https://www.hilarispublisher.com/scholarly/digital-image-processing-journals-articles-ppts-list-257.html
E-Resources and Website	https://www.tutorialspoint.com/dip/dip_useful_resources.html

Learning Methods	Chalk and Talk / Assignment / Seminar

Focus of the Course	Skill Development / Employability

		SEMESTER I					
		DSE-I : ADVANCED DATA MINING					
Semester	**Course Code**	**CourseName**	**Category**	**L**	**T**	**P**	**Credits**
I	24CSP1DB	**ADVANCED DATA MINING**	DSE-I	60	-	-	5

Preamble	This course has been designed for students to learn and understand • The concepts of data visualization techniques. • The Genetic algorithms and web mining. • The Support Vector Machines and text mining
Prerequisite	Knowledge on Data Mining

CourseOutcomes(Cos)		
CO.No	**CourseOutcomes(COs)Statement**	**Bloom'sTaxonomy KnowledgeLevel**
CO1	Understand the data visualization techniques	K2
CO2	Understand the concepts of OLAP	K2
CO3	Apply various regression and clustering methods	K3
CO4	Explain the concept of mining data on web.	K4
CO5	Illustrate the role of data mining techniques with SVM	K5

MappingwithProgram Outcomes:					
Cos /POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓		✓	✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

24CSP1DB – DSE: ADVANCED DATA MINING

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Data Mining and Data Visualization:** Data Scales-Data Categories-Databases and Data Warehouses-Data Mining-Supervised and Unsupervised Learning-Steps in Data Mining. Data Visualization Techniques: Graphics and Visualization- Summarization Vs Visualization- Graphics-One Variable Diagrams- Multi-variable diagrams- Hierarchical Charts- Data Visualization Technology-Software for Data Visualization.	12	Text Book
II	**Online Analytical Processing:** OLAP - Data Cubes and Cuboids-Aggregation Measures-OLAP Schemas-OLAP Operations-OLAP Variants-Mobile OLAP-Multimedia OLAP. Decision Trees: Graph Theory-Trees-Decision Trees-Measures for Node Splitting-Induction Algorithms- Pruning Decision Trees-Applications. Association Rules: Meaning of Association Rules-Association Rule Mining-The Apriori Principle-The FP-Growth Algorithm.	12	Text Book
III	**Regression and Cluster Analysis:** Regression - Sample Covariance-Interpretation of Correlation Coefficient-Multivariate Data-Multiple Linear Regressions. Cluster Analysis: Meaning of Clustering- Cluster Display-Dissimilarity Metrics-Clustering Algorithms-Cluster Validation Techniques.	12	Text Book
IV	**Genetic Algorithms and Web Mining:** Genetic Algorithms: Genetic Operators-Mutation and Crossover-Implementation of GA. Web Mining: Web Search Engines-Web Mining-Implementing Web Mining-Web Structure Mining-Measures for Web Structure Mining-PageRank Algorithm-Generalized PageRank Algorithm- Web Query Mining-Semantic Web Mining-Image Mining-Table Mining.	12	Text Book
V	**Support Vector Machines and Text Mining:** Binary SVM-Lagrangian Formulation-Weighted SVM- Soft-Margin SVM- Multi-class SVM-Kernels-Least Squares SVM-Nonlinear SVM-Support Vector Regression-SVM Vs Statistical Classifiers. Text Mining: Text Mining Workflow-	12	Text Book

| | | Term by document Matrix(TD-Matrix)- Text Classification-Metrics for Text Mining-Applications of Text Mining. Case study:Detecting Parkinson's disease | | |

Textbook	1.	RajanChattamvelli, 2016, "Data Mining Methods", 2nd Edition,Narosa Publishing House
Reference Books	1.	J.Han and M. Kamber, 2011, "Data Mining Concepts and Techniques", 3rd Edition, Harcourt India Pvt. Ltd, New Delhi
	2.	K.P. Soman, ShyamDiwakar, V.Ajay, 2003, "Insight into Data Mining Theory and Practice ",1st Edition, Prentice Hall of India Pvt. Ltd
	3.	Pang-Ning Tan, Michael Steinbach, Vipin Kumar, 2019," Introduction to Data Mining", 2nd Edition, Pearson Education
	4.	Arun.K.Pujari, 2013,"Data Mining Techniques",3rd Edition,University Press India Limited

JournalandMagazines	https://link.springer.com/book/10.1007/978-3-031-22137-8
E-ResourcesandWebsite	https://www.ngdata.com/data-mining-resources/

Learning Methods	Chalk and Talk / Assignment / Seminar

Focus of the Course	Skill Development / Employability

SEMESTER I							
DSE I: COMPUTER COMMUNICATION NETWORKS							
Semester	Course Code	CourseName	Category	L	T	P	Credits
I	24CSP1DC	COMPUTER COMMUNICATION NETWORKS	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand
	• The concepts of Communication Networks.
	• The Networking Devices and the advanced types of Networks.
	• The Network Applications and Management
Prerequisite	Knowledge on Computer Networks

Course Outcomes (Cos)		
CO. No	Course Outcomes (COs) Statement	Bloom's Taxanomy Knowledge Level
CO1	Understand the concepts in Communication Network.	K2
CO2	Understanding the overview of Networking Devices.	K3
CO3	Impart knowledge on data link and link interfaces.	K4
CO4	Gain knowledge on VLANs and WLANs	K4
CO5	Impart Knowledge on Wide area network and Ability to apply Network Applications	K5

Mapping with Program Outcomes:					
Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	-	✓	✓
CO4	✓	-	✓	✓	✓
CO5	✓	✓	✓	✓	✓

24CSP1DC – DSE: COMPUTER COMMUNICATION NETWORKS

Syllabus:

Unit	Content	Hrs	E- Content / Resources
I	**Communication Network** Packet-Switched Networks-Packet Switching Versus Circuit Switching-Data, Packets, and Frames-The Internet and ISPs-Classification of ISPs-Types of Packet-Switched Networks-Connectionless Networks-Connection-Oriented Networks-Packet Size and Optimizations-Foundation of Networking Protocols-Addressing Scheme in the Internet.	12	Text Book
II	**Networking Devices** Network Interface Cards (NICs)- Switching and Routing Devices-Wireless Switching and Routing Devices-Wireless Access Points and Base Stations-Wireless Routers and Switches-Antennas in Wireless Devices-Modems-Multiplexers-Frequency-Division Multiplexing (FDM)-Time-Division Multiplexing.	12	Reference Book
III	**Data Links and Link Interfaces** Data Links-Data Link Types-Link Encoder-Error Detection and Correction on Links-Error Detection Methods-Cyclic Redundancy Check (CRC) Algorithm-Flow Control on Links-Stop-and-Wait Flow Control-Sliding-Window Flow Control-Link Access by Multiple Users-Wireless Channel Access by Multiple Users-Link Aggregation.	12	Text Book
IV	**Local Area Networks** Local Area Networks and Networks of LANs-LANs and Basic Topologies-LAN Protocols-Networks of LANs-MAC/IP Address Conversion Protocols-Address Resolution Protocol (ARP)- Reverse Address Resolution Protocol (RARP)-Spanning-Tree Protocol (STP)- Virtual LANs (VLANs)- Wireless LANs-IEEE 802.11 Wireless LAN Standard.	12	Text Book
V	**Wireless Wide Area Network and Management** Wireless Wide Area Network and LTE Technology-Infrastructure of Wireless Networks-Cellular Networks-Mobile IP Management in Cellular Networks-Home Agents and Foreign Agents-Agent Discovery Phase-Registration-Mobile IP Routing-Generations of Cellular Networks-Long-Term Evolution (LTE) Technology. Basic Network Applications and Management: Overview of the Application Layer-Domain Name System (DNS)- Electronic Mail (E-Mail)- World Wide Web (WWW). **Case study:** Emerging concepts in next generation networks.	12	You Tube Videos

Text book	1.	Nader F. Mir, 2018, "Computer and Communication Networks", Second Edition, Pearson Education
Referenc	1.	Behrouz A. Forouzan, 2007, "Data Communications and Networking", Fourth Edition, McGraw Hill Higher Education

eBooks	2.	Larry L. Peterson, Bruce S. Davie, 2011,"Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann.
	3.	Cory Beard, William Stallings, 2015,"Wireless Communication Networks and Systems", Pearson.
	4.	William Stallings, 2010,"Data and Computer Communications",9th Edition, Pearson.

| Journal and Magazines | Computer networks and communications | IEEE Journals & Magazine | IEEE Xplore |
| E-Resources and Website | https://www.geeksforgeeks.org/basics-computer-networking/ |

| Learning Methods | Chalk and Talk / Assignment / Seminar |

| Focus of the Course | Skill Development / Employability |

BoS Chairman/HoD
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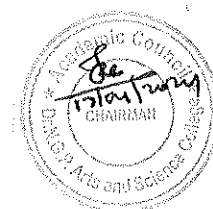
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M.Sc Computer Science (Students admitted during the AY 2024-25)

Semester – II								
CORE : ADVANCED PYTHON PROGRAMMING								
Semester	Corse Code	Course Name	Category	L	T	P	Credits	
II	24CSP2CA	**ADVANCED PYTHON PROGRAMMING**	CORE	48	-	-	4	

Preamble	This course has been designed for students to learn and understand • Data Manipulation using NumPy and Pandas • Data Visualization using Matplotlib • Keras and Tensor Flow.
Prerequisite	Knowledge on Python Programming

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand Scientific Computing using NumPy	K2
CO2	Demonstrate the Data Manipulation and Analysis using Pandas	K3
CO3	Illustrate Visualization in python using Matplotlib	K3
CO4	Explore Artificial Neural Network with Keras	K4
CO5	Implement Tensor Flow Models	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2	✓	✓	✓		✓
CO3		✓	✓	✓	
CO4		✓	✓		✓
CO5	✓		✓	✓	✓

24CSP2CA	CORE: ADVANCED PYTHON PROGRAMMING

Syllabus

Unit	Content	Hrs	Resources
I	**NumPy** NumPy Arrays - Computation on Numpy Arrays - Universal Functions - Aggregations - Computation on Arrays: Broadcasting, Comparisons, Masks, Boolean Logic - Fancy Indexing - Sorting Arrays - Structured Arrays.	9	Text Book & Reference Book
II	**Data Manipulation with Pandas** Pandas - Objects -Data Indexing and Selection - Operating on Data - Handling Missing Data -Hierarchical Indexing -Combining Datasets: Concat and Append,Merge and Join, Aggregation and Grouping - Time Series.	10	Text Book & Reference Book
III	**Visualization with Matplotlib** Importing Matplotlib- Setting Styles - Line Plots - Scatter Plots - Visualizing Errors - Density and Contour Plots - Histograms, Binnings and Density - Customizing: Plot Legends, Color bars, Ticks - Multiple Subplots - Text and Annotation - Three-Dimensional Plotting in Matplotlib - Visualization with Seaborn.	10	Text Book & Reference Book
IV	**Artificial Neural Network with Keras** Perceptron - Multilayer Perceptron (MLP) and Backpropagation – MLP: Regression, Classification, Implementation - Building an Image Classifier Using the Sequential API - Building a Regression MLP Using the Sequential API - Building Complex Models Using the Functional API - Subclassing API to Build Dynamic Models - Fine-Tuning Neural Network Hyperparameters	10	Text Book & Reference Book
V	**Training and Deploying TensorFlow Models** Serving a TensorFlow Model - Deploying a Model to a Mobile or Embedded Device - Equipped Virtual Machine – Colaboratory - Managing the GPU RAM -Placing Operations and Variables on Devices -Parallel Execution Across Multiple Devices - Training Models Across Multiple Devices - Case Study.	9	Text Book & Reference Book
	Total	48	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text books	1.	Jake VanderPlas, 2017, "Python Data Science Handbook - Essential Tools for Working with Data", O'Reilly Media, Inc.
	2.	Beijing Boston, Farnham Sebastopol, Tokyo, 2019, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems"O'Reilly Media, Inc., 2nd Edition
Reference Books	1.	Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis, 2019," Advanced Python Programming", Packt Publishing.
	2.	Martin C. Brown., 2018, "Python: The Complete Reference ", McGraw Hill
	3.	Mark Lutz, 2013, "Learning Python", O'Reilly Publication, 5th edition.
	4.	Ashok Kamthane, Amit Kamthane, 2018, "Programming and Problem Solving with Python", McGraw Hill Education India Private Limited.

Journal and Magazines	https://www.codemag.com/Magazine/ByCategory/Python
E-Resources and Website	www.python.org

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

Semester – II
CORE : MODERN DATABASE MANAGEMENT SYSTEMS

Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24CSP2CB	MODERN DATABASE MANAGEMENT SYSTEMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • principles and concepts of advanced DBMS • Parallel, Distributed, object oriented and XML Databases • NoSQL Databases and Big Data Storage Systems.
Prerequisite	Knowledge on SQL

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand Database system concepts	K2
CO2	Infer Parallel and Distributed query processing techniques	K3
CO3	Examine Distributed Database Concepts	K4
CO4	Analyze NoSQL Database concepts	K4
CO5	Explore Document Databases	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2	✓	✓	✓		✓
CO3		✓	✓	✓	✓
CO4	✓	✓	✓		✓
CO5	✓		✓	✓	✓

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

| 24CSP2CB | CORE: MODERN DATABASE MANAGEMENT SYSTEMS |

Syllabus

Unit	Content	Hrs	Resources
I	**Database System Architecture** Centralized Database Systems - Server system architectures - Parallel systems - Distributed Systems - Transaction Processing in Parallel and Distributed Systems - Cloud-Based Services - Data Partitioning - Dealing with Skew in Partitioning - Replication - Parallel Indexing - Distributed File Systems.	9	Text Book
II	**Parallel and Distributed Query Processing** Parallel Sort - Parallel Join - Parallel Evaluation of Query Plans - Shared - Memory Architectures - Query Optimization for Parallel Execution - Parallel Processing of Streaming Data - Distributed Query Processing.	9	Text Book
III	**Distributed Database Concepts** Distributed Database Design: Data Fragmentation, Replication, Allocation Techniques- Concurrency Control and Recovery in Distributed Databases - Transaction Management in Distributed Databases - Query Processing and Optimization in Distributed Databases - Types of Distributed Database Systems - Distributed Database Architectures.	10	Text Book
IV	**NoSQL Databases and Big Data Storage Systems** NoSQL database: Introduction - Types–Consistency Availability Partition tolerance (CAP) Theorem - Document-Based NOSQL Systems and MongoDB - NOSQL Key-Value Stores - Column-Based NOSQL Systems - NOSQL Graph Databases.	10	Text Book
V	**Document Databases** XML Tools and Standards - XML Databases - XML Support in Relational Systems - JSON Document Databases - JSON Databases: Data Models in Document Databases - Early JSON Databases - MemBase and CouchBase database - Column Databases: Data Warehousing Schemas - Column Database Architectures.	10	Text Book & You Tube Videos
	Total	48	

Text books	1.	Abraham Silberchatz, Henry F.Korth, S.Sudharshan, 2019 "Database System Concepts", Seventh Edition, McGraw Hill.
	2.	Guy Harrison, 2015 "Next Generation Databases NoSQL, NewSQL, and Big Data", Apress.
	3.	Ramez Elmasri, Shamkant B. Navathe, 2016 "Fundamentals of Database Systems ,Seventh Edition, Pearson Publication
Reference Books	1.	C. J. Date, 2019, "Database Design and Relational Theory: Normal Forms and All That Jazz", Third Edition, Apress Publisher.
	2.	Manu Sharma, 2021, "MongoDB complete guide", First Edition, BPB Publications.

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Journal and Magazines	https://stmcomputers.stmjournals.com
E-Resources and Website	https://www.edx.org/learn/relational-database-management-systems https://coursera.org

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

Semester – II CORE : NEURAL NETWORKS AND FUZZY LOGIC							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24CSP2CC	NEURAL NETWORKS AND FUZZY LOGIC	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • Neural Networks and Fuzzy Logic Control • concepts of fuzzy logic and Artificial Neural Networks • design of various intelligent control
Prerequisite	Knowledge on Neural Networks and Fuzzy Logic

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Familiarize the concepts of feed forward neural networks	K2
CO2	Understand the feedback networks	K2
CO3	Analyze the concept of fuzziness involved in various systems	K3
CO4	Implement fuzzy logic control and adaptive fuzzy logic	K4
CO5	Apply fuzzy logic control to real time systems	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓		✓
CO3	✓	✓		✓	
CO4		✓	✓	✓	✓
CO5	✓			✓	

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24CSP2CC	CORE: NEURAL NETWORKS AND FUZZY LOGIC

Syllabus

Unit	Content	Hrs	Resources
I	**Fundamentals of Neural Networks** Basic concepts – Model of Artificial Neuron - Neural Network Architecture: Single Layer Feed Forward Network, Multilayer Feed Forward Network, Recurrent Networks – Characteristics of Neural Networks – Taxonomy of Neural Network Architectures – History of Neural Network Research – Early Neural Network Architectures - Application Domain.	9	Text Book
II	**Backpropagation Networks** Architecture of Back Propagation Network: Perceptron Model, Single Layer Artificial Neural Network – Back Propagation Learning – Applications – Effect of Tuning Parameters – Selection of Parameters in BPN – Variation of standard Back Propagation Algorithm: Adaptive, Genetic Algorithm, Augmented BP Networks.	9	Text Book
III	**Adaptive Resonance Theory** Cluster structure - Vector Quantization - Classical Adaptive Resonance Theory (ART) Networks - Simplified ART Architecture – ART1: Architecture, Special Features, Algorithm – ART2: Architecture, Algorithm – Applications: Character Recognition Using ART1, Classification of Soil, Prediction of Load from Yield Line Patterns, Chinese Character Recognition.	10	Text Book
IV	**Fuzzy Set Theory** Fuzzy versus Crisp – Crisp Sets: Operation, Properties, Partition, Covering – Fuzzy Sets: Membership Function, Fuzzy Sets and Crisp Sets, Basic operations, Properties – Crisp Relation – Fuzzy Relations.	10	Text Book
V	**Fuzzy Logic and Inference** Crisp Logic: Laws, Inference in Propositional Logic – Predicate Logic - Interpretations of Predicate Logic – Inference in Predicate Logic – Fuzzy Logic: Quantifiers, Inference – Fuzzy Rule Based System – Defuzzification Methods – Applications: Greg Viot's Fuzzy Cruise Controller, Air Conditioner Controller.	10	Text Book
	Total	48	

Text book	1.	S.Rajasekaran, G.A.Vijayalakshmi Pai, 2023, "Neural Networks, Fuzzy Logic and Evolutionary Algorithms Synthesis and Applications", PHI.
Reference Books	1.	Simon Haykin, 2016, "Neural Networks and Learning Machines", Pearson Pvt. Ltd.

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	2.	Sathish Kumar, 2015, "Neural Networks – A Classroom Approach", McGraw Hill Pvt. Ltd.
	3.	Christopher M. Bishop, 2015 "Neural Networks for Pattern Recognition", 5th Edition, Cambridge.
	4.	Timothy J. Ross, 2016, "Fuzzy Logic with Engineering Applications", 4th Edition, John Wiley & Sons Ltd. Publications.

| Journal and Magazines | https://cis.ieee.org/publications/t-neural-networks-and-learning-systems |
| E-Resources and Website | https://lps.ufrj.br/~caloba/Livros/Haykin2009.pdf
https://www.shiksha.com/online-courses/neural-network-fuzzy-logic-certification |

| Learning Method | Chalk and Talk/Assignment/Seminar |

| Focus of the Course | Skill Development/ Employability |

SEMESTER - II
EDC: ADVANCED OPERATIONS RESEARCH

Semester	Course Code	Course Name	Category	L	T	P	Credits
II	24MTP2ED	ADVANCED OPERATIONS RESEARCH	EDC	60	-	-	5

Preamble	This course has been designed for students to learn and understand
	• the number of different situations which can be characterized as sequencing problems
	• the replacement of depreciable assets
	• the various components of a queueing system
Prerequisite	Knowledge on Basic Mathematics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the algorithm of processing n jobs through two or more machines	K1
CO2	Analyze some equipment replacement decisions	K4
CO3	Analyze the situations where a single and multiple channel waiting line models apply	K4
CO4	Demonstrate the way of making decisions under certainty, uncertainty & risk	K2
CO5	Apply business problems involving goal, integer and dynamic programming problems	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓		✓	✓
CO3	✓		✓	✓	✓
CO4	✓	✓			✓
CO5	✓	✓	✓	✓	✓

24MTP2ED	EDC: ADVANCED OPERATIONS RESEARCH

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Sequencing Problem:** Notations terminology and assumptions - solution to sequencing problems: algorithm of processing n jobs through two machines - algorithm of processing n jobs through three machines - algorithm of processing n jobs through m machines - algorithm of processing 2 jobs through m machines.	12	Textbook/ Reference book1
II	**Replacement Theory:** Introduction - Failure mechanism of items - considerations leading to replacement - O.R. methodology of solving replacement problems - replacement policy for equipment/asset which deteriorates gradually - replacement of items that fail suddenly.	10	Textbook/ Reference book1
III	**Queuing Theory:** Introduction - Elementary queuing system - single server queuing model: $(M/M/1):(\infty/FCFS)$ - multiple server queuing model: $(M/M/k):(\infty/FCFS)$ - multi-phase service queuing model: $(M/E_k/1):(\infty/FCFS)$ - benefits and limitations of queuing theory.	12	Textbook/ Reference book 2
IV	**Decision Analysis:** Introduction - few management applications - ingredients of decision problem - types of decision making environments: decision making under certainty - decision making under risk - decision making under uncertainty - Bayesian decision rule - posterior analysis - decision tree analysis.	11	Textbook/ Reference book3
V	**Goal, Integer and Dynamic Programming:** Concepts - goal programming model formulation - concepts of integer programming - some integer programming formulation techniques - concepts of dynamic programming - formulation and solution of dynamic programming problem.	15	Textbook/ Reference book1
	Total	**60**	

Note: Distribution of marks 80% Problem and 20% Theory

Text Book	1.	Kapoor V.K. ,2021, "Operations Research - Quantitative Techniques for Management", Sultan Chand & Sons, New Delhi.
Reference Books	1.	Taha H. A., 2006, "Operations Research: An Introduction", 5th Edition, Prentice Hall of India Private Limited, New Delhi.
	2.	Gupta P. K, Hira D.S., 2021, "Operations Research", 7th Edition, S. Chand & Company Limited, New Delhi.
	3.	Man Mohan, Gupta. P.K, 2004, "Problems in Operations Research", 14th Edition, Sultan Chand & Sons, New Delhi.
	4.	Kanti Swarup, Gupta P. K, Man Mohan., 2018, "Operations Research", 19th Edition, Sultan Chand & Sons, New Delhi.

Journal and Magazines	https://link.springer.com/journal/12351
E-Resourcesand Website	https://www.youtube.com/playlist?list=PLdkTgdqMAkho-Cc61LW10z9bONMVAzS19

Learning Method	Chalk and Talk

Focus of the Course	Skill development, Entrepreneurial Development

Semester – II							
CORE PRACTICAL : ADVANCED PYTHON PROGRAMMING							
Semester	**Corse Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24CSP2CP	**ADVANCED PYTHON PROGRAMMING**	**CORE PRACTICAL**		-	48	2

Preamble	This course has been designed for students to implement • Data Manipulation using NumPy and Pandas • Data Visualization using Matplotlib • Keras and Tensor Flow.
Prerequisite	Knowledge on Python Programming

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Demonstrate Scientific computing using NumPy	K3
CO2	Demonstrate the Data Manipulation and Analysis using Pandas.	K3
CO3	Illustrate Visualization in python using Matplotlib	K2
CO4	Perform Learning Model using Keras	K4
CO5	Implement Perceptron Model in TensorFlow	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓		✓	✓	
CO3	✓	✓	✓		✓
CO4	✓	✓	✓	✓	
CO5	✓			✓	✓

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

24CSP2CP | CORE PRACTICAL: ADVANCED PYTHON PROGRAMMING

S.No	List of Programs
1	Develop a Python script to perform basic operations using NumPy.
2	Create a structured array for the student's details which includes Student id, Student name, Height, Class and perform Sorting, Grouping operations.
3	Perform Universal and Aggregate functions in NumPy.
4	Implement the concept of Pandas to demonstrate data handling, indexing and Slicing Operations.
5	Build a DataFrame and display the specific dictionary data that includes index and labels to: a) Display the summary details b) Count the number of rows and columns c) Select the specific rows and columns d) Count the number of rows with NaN values e) Iterate the DataFrame to display the specific rows.
6	Demonstrate the use of Matplotlib modules in plotting.
7	Build a Dataset in Excel file. Create a Python script to import Dataset into Pandas DataFrame and perform Read, Sort, Export operations in it.
8	Implement Regression Model in Keras.
9	Implement Image Classifier using CNN in Keras.
10	Perform Transfer Learning using a Pretrained Model on Keras.
11	Implement Simple Vector Addition in TensorFlow
12	Implement a Perceptron in TensorFlow Environment.

Reference Books	1.	Paul Gries, Jennifer Campbell, Jason Montojo, 2018, "Practical Programming: An Introduction to Computer Science Using Python 3", Pragmatic Bookshelf, 3rd Edition.
	2.	Aurelien Geron, 2018, "Handson Machine Learning with Scikit-Learn and TensorFlow", O'Reilly Media, Inc.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

Semester – II							
CORE PRACTICAL: MODERN DATABASE MANAGEMENT SYSTEMS							
Semester	**Corse Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	24CSP2CQ	**MODERN DATABASE MANAGEMENT SYSTEMS**	**CORE PRACTICAL**		-	48	2

Preamble	This course has been designed for students to implement • fundamental database operations • query concurrency and performance measurement techniques • NoSQL paradigms.
Prerequisite	Knowledge on SQL

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Perform the fundamental database operations, including selection, projection, and join operations	K3
CO2	Evaluate concurrent queries and measure their performance	K4
CO3	Implement the concept of Parallel Processing	K4
CO4	Implement the concept of NoSQL Paradigms	K4
CO5	Create XML data models and perform queries using XPath or XQuery	K5

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓		✓	✓	
CO3	✓	✓	✓		✓
CO4	✓	✓	✓	✓	
CO5	✓			✓	✓

24CSP2CQ | CORE PRACTICAL: MODERN DATABASE MANAGEMENT SYSTEMS

S.No	List of Programs
1	Execute concurrent queries and measure query performance.
2	Perform parallel join operations.
3	Create a simple column-based NoSQL database and demonstrate column-based storage and retrieval.
4	Experiment with different data fragmentation techniques (horizontal, vertical, and hybrid) in a distributed setup.
5	Perform MongoDB CRUD Operations, Indexing and Sharding.
6	Demonstrate CRUD operations in MongoDB.
7	Perform Multimedia data Processing in MongoDB.
8	Demonstrate Transformation in MongoDB.
9	Implement the concept of basic key-value store using a NoSQL system for storing and retrieving large amounts of data.
10	Perform basic graph operations.
11	Create an XML data model and integrate it with a relational system to support XML data in a relational database.
12	Create an XML database, load XML data and perform queries using XPath or XQuery.

Reference Book	1.	Ramez Elmasri, Shamkant B. Navathe, 2020 "Fundamentals of Database Systems", 7th Edition, Pearson Publication.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester – II DSE: DEEP LEARNING							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24CSP2DA	DEEP LEARNING	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • methods and terminologies involved in deep neural network • CNN architecture and computer vision • RNN architecture.
Prerequisite	Knowledge on Artificial Intelligence and Machine Learning

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Acquire basic knowledge on Deep Learning concepts	K2
CO2	Understand the methods and terminologies in Deep Neural Network	K2
CO3	Examine the core components of Convolutional Neural Networks	K3
CO4	Categorize knowledge of different Generative Adversarial Network variants	K4
CO5	Explore representational learning in the text domain	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	
CO2	✓	✓	✓		✓
CO3	✓	✓	✓	✓	✓
CO4		✓	✓	✓	✓
CO5	✓			✓	✓

24CSP2DA	DSE: DEEP LEARNING

Syllabus

Unit	Content	Hrs	Resources
I	**Deep Learning Concepts** Machine Learning: Types – Process - Machine Learning Versus Traditional Computer Programming –- Model Evaluation - Model Representation and Interpretability - Loss Functions – Limitations - Neural Network: Understanding the biological Neuron – Exploring the Artificial Neuron – Types of Activation Functions: Hyperbolic Tangent (Tanh), ReLU (Rectified Linear Unit), Softmax.	12	Text Book
II	**Training Deep Neural Network** Deep L-layer Neural Network - Forward and Backward Propagation in Deep Learning - Initializing Weights - Batch, Mini-batch and Stochastic Gradient Descent - Optimization Algorithms: Gradient Descent with Momentum, Adagrad, Adadelta, RMSProp , Adam – Regularization – Normalization of inputs.	12	Text Book
III	**Convolutional Neural Network** Computer Vision - Challenges in Traditional ANN – Building Blocks - Building a Conventional Neural Network - Popular CNN Architectures: LeNet5, AlexNet, VCG16, ResNet, GoogLeNet, UNet.	12	Text Book
IV	**Deep Learning Architectures** Encoder-Decoder Architecture – Attention Mechanism – Transformer Architecture: Multi-headed Attention, Transformer Modes, Popular Transformer Architectures – Generative Adversarial Network (GAN): Basic Concepts – Popular Variants– Applications.	12	Text Book
V	**Representation Learning** Scenarios - Autoencoder Fundamentals - Representation Learning in Text – Word Embedding – Document Embedding - Sequence-based Models: Sequence Data, Recurrent Neural Network, Long Short-term Memory, Gated Recurrent Units, Bi-directional Models, Language Modeling and Sequence Models– Transfer Learning. Case Study: Colourization of Grayscale Images.	12	Text Book
Total		**60**	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Amit Kumar Das, SaptarsiGoswami, PabitraMitra, AmlanChakrabarti, 2021, "Deep Learning", Pearson Education.
Reference Books	1.	Ian Goodfellow, YoshuaBengio and Aaron Courville, 2017, "Deep Learning", MIT Press.
	2.	M. Gopal, 2022, "Deep Learning Core Concepts, Methods and Applications" Pearson Education .
	3.	Umberto Michelicci, 2018, "Applied Deep Learning: A Case-based Approach to Understanding Deep Neural Networks", Apress.

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Journal and Magazines	https://link.springer.com/article/10.1007/s42979-021-00815-1)
E-Resources and Website	https://www.javatpoint.com/deep-learning-algorithms

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

Semester – II DSE: PREDICTIVE ANALYTICS							
Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24CSP2DB	PREDICTIVE ANALYTICS	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • predictive analytics techniques to analyze patterns in existing data • classification models and their application in predictive tasks • model combination techniques to improve prediction accuracy
Prerequisite	Machine Learning and Statistical Techniques

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Gain knowledge on Predictive Analytics and Process Models	K2
CO2	Acquire skills in data preprocessing	K2
CO3	Explore Principal Component Analysis and clustering algorithms	K3
CO4	Implement predictive models	K4
CO5	Apply Time Series Modelling and Forecasting	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓		✓		✓
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓		✓

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M.Sc. Computer Science(Students admitted from the AY 2024-25)

| 24CSP2DB | DSE: PREDICTIVE ANALYTICS |

Syllabus

Unit	Content	Hrs	Resources
I	**Analytics and Process Models** Analytics – Predictive Analytics - Supervised Vs Unsupervised learning – Parametric Vs Non- Parametric Models – Statistic and Analytics – Challenges in Using Predictive Analytics – Predictive Analytics Processing Steps: CRISP-DM (The Cross –Industry Standard Process Model for Data mining) - Defining Data for Predictive Modeling – Defining the Target Variable - Defining Measures of Success for Predictive Models.	12	Text Book
II	**Data Understanding and Data Preparation** Single Variable Summaries – Mean – Standard Deviation – The Normal Distribution – Uniform Distribution – Skewness – Kurtosis - Data Visualization in one Dimension – Histograms – Multiple Variable summaries – Variable Cleaning – Incorrect Values – Consistency in Data Formats – Outliers – Multidimensional Outliers - Missing Values - Fixing Missing Values – Features Creation	12	Text Book
III	**Descriptive Modelling** Data Preparation Issues with Descriptive Modeling – The PCA (Principal Component Analysis) Algorithm – Applying PCA to New Data – PCA for Data Interpretation – Clustering Algorithm – The K-Mean Algorithm – Data Preparation for K-Mean – Selecting the Number of Clusters - Interpreting Descriptive Model – Standard Cluster Model Interpretation – Problem with Interpretation Methods – Identifying Key Variables in Forming Cluster Models – Cluster Prototypes - Cluster Outliers	12	Text Book
IV	**Predictive Modeling** Decision Tree –Building Decision Tree – Decision Tree Splitting Metrics – Decision Tree Knobs and Options - Logistic Regression – K- Nearest Neighbour – Naive Bayes – Regression Models – Linear Regression.	12	Text Book
V	**Forecasting** Introduction – Nature of Forecasts- Forecasting Processes – Resource for Forecasting – Graphical Displays – Time Series Plot – Plotting Smoothed Data – Numerical Description of Time Series Data – Stationary Time Series - Autocovariance and Autocorrelation Functions – Use of Data Transformation and Adjustments – Transformations – Trend and Seasonal Adjustment – General Approach to Time Series Modelling and Forecasting	12	Text Book
	Total	60	

Text books	1.	Dean Abbott, 2014, "Applied Predictive Analytics", Wiley Publication.
	2.	Douglas C. Montgomery Cheryl L. Jenning Mural Kulahci,2015, "Time Series Analysis and Forecasting", Second Edition, John Wiley and Sons.

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Reference Books	1.	Anasse Bari, Mohamed Chaouchi, Tommy Jung, 2017, "Predictive Analytics for dummies",SecondEdition,John Wiley & Sons.
	2.	John D. Kelleher (Author), Brian Mac Namee, 2020, "Fundamentals of Machine Learning for Predictive Data Analytics," 2nd Edition, The MIT Press.
	3.	Trevor Hastie, Robert Tibshirani, Jerome Friedman,2009, "The Elements of Statistical Learning-Data Mining, Inference, and Prediction", 2nd Edition, Springer Verlag.
	4.	Subhashini Chellappan, Seema Acharya, 2019, "Big Data and Analytics", 2ndEdition, Wiley.

Journal and Magazines	https://www.codemag.com/Magazine/ByCategory/ Predictive%20analytics
E-Resources and Website	https://www.manchesterdigital.com/post/tangentworks-uk-ltd/predictive-analytics-for-dummies-free-e-book-for-manchester-digital-members ,https://www.coursera.org/learn/predictive-analytics

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

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Semester – II
DSE: ADVANCED NETWORKS

Semester	Corse Code	Course Name	Category	L	T	P	Credits
II	24CSP2DC	ADVANCED NETWORKS	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • Routing Protocol Architecture • characteristics of wireless and mobile networks • Security in Computer Networks
Prerequisite	Networking fundamentals, Routing and Switching

Course Outcomes (Cos)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand Routing Protocol Architecture.	K2
CO2	Analyse Networking Sensors and Synchronization	K3
CO3	Examine Software-Defined Networking	K3
CO4	Explore Wireless and Mobile Networks	K3
CO5	Analyze security in Computer Networks	K4

Mapping with Program Outcomes:

Cos / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓
CO3			✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

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24CSP2DC	DSE : ADVANCED NETWORKS

Syllabus

Unit	Content	Hrs	Resources
I	**Network Basics** Definition – Nature and Scope - Importance –Functions of Networking and Network Routing-IPv4 and IPv6 Addressing- Service Architecture- Protocol Stack Architecture, Router Architecture- Network Topology Architecture- Network Management Architecture, Global Telephone Network- Communication Technologies-Routing Algorithms: Shortest Path, Widest path and Spanning Tree.	14	Text Book
II	**Networking Sensors** Introduction- Medium Access Control- The S-MAC Protocol- IEEE 802.15.4 Standard and ZigBee- General Issues-Geographic, Energy-Aware Routing- Unicast Geographic Routing-Routing on a Curve-Energy-Minimizing Broadcast -Energy-Aware Routing to a Region-Attribute-Based Routing-Directed Diffusion-Rumour Routing - Geographic Hash Tables- Infrastructure Establishment: Topology Control- Clustering- Time Synchronization- Localization and Localization Services	14	Text Book
III	**Software-Defined Networking (SDN)** Fundamental Characteristics of SDN- SDN Operation- SDN Devices-Controller, SDN Applications- Alternate SDN Methods-SDN in Other Environments: Wide Area Networks- Service Provider and Carrier Networks- Campus Networks- Hospitality Networks- Mobile Networks- Optical Networks- SDN vs P2P/Overlay Networks.	12	Text Book
IV	**Wireless and Mobile Networks** Wireless Links and Network Characteristics -WiFi 802.11 Wireless LANs -Cellular Networks 4G and 5G -Mobility Management Principles - Impact on higher layer protocols.	10	Reference Book
V	**Security in Computer Networks** Principles of Cryptography - Message Integrity and Digital Signatures- End-Point Authentication- Securing E-Mail - Securing TCP Connections - Network Layer Security - Securing Wireless LANs and 4G/5G cellular Networks -Operational Security	10	Reference Book
	Total	**60**	

Text books		
	1.	Deepankar Medhi and Karthikeyan Ramasamy, 2017. "Network Routing: Algorithms, Protocols, and Architectures", Morgan Kaufmann Series in Networking.
	2.	Feng Zhao & Leonidas J.Guibas, 2007. "Wireless Sensor Networks An

		Information Processing Approach", Elsevier.
	3.	Paul Goransson Chuck Black, 2014"Software Defined Networks", 1st Edition, A Comprehensive Approach, Morgan Kaufmann.
Reference Books	1.	James F. Kurose and Keith W. Ross, 2017, "Computer Networking", Eighth Edition, Pearson Publication.
	2.	Patricia A. Morreale, James M. Anderson, 2014 "Software Defined Networking, Design and Deployment", CRC Press.

Journal and Magazines	-
E-Resources and Website	https://www.sciencedirect.com/book/9780128007372/network-routing. https://www.google.co.in/books/edition/Wireless_Sensor_Networks/ BkaQkhkWGfoC?hl=en&gbpv=1&printsec=frontcover https://sdnexpert.ir/wp-content/uploads/2021/04/Paul-Goransson-Chuck-Black-Timothy-Culver-Software-Defined-Networks_-A-Comprehensive-Approach-Morgan-Kaufmann-2016.pdf

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability

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APPROVED

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