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 80 : ESE 120

***Total Credits does not exceed 92 credits**

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

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

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 Tax anomy 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/S0065253908608902 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's Taxonomy 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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Dr. N. G. P. Arts and Science College
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Dr.N.G.P. Arts and Science College
APPROVED
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Academic Council
CHAIRMAN
Dr.N.G.P. Arts and Science College

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	✓		✓	✓	✓

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.

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	✓			✓	

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.

	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) :(∞/FCFS) - multiple server queuing model: (M/M/k) :(∞/FCFS) - multi-phase service queuing model: ($M/E_k/1$) :(∞/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	✓			✓	✓

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

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.

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	✓	✓	✓		✓

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.

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

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	✓	✓	✓	✓	✓

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

BoS Chairman/HoD
Department of Computer Science
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048

Dr.N.G.P. Arts and Science Coll
APPROVED

BoS- 18th	AC - 18th	GB -
07/11/24	26/11/24	

Academic Council * Dr.N.G.P. Arts and Science College * CHAIRMAN

Semester – III CORE VIII: DATA SCIENCE ESSENTIALS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3CA	DATA SCIENCE ESSENTIALS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • operations of elementary data structures • the prediction methods • various Data Visualisation Techniques
Prerequisite	Knowledge on Data Visualization

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the Data Science Process and the types of data.	K2
CO2	Apply the basic concepts of R to analyze and interpret its advantages and disadvantages in data analysis.	K3
CO3	Impart knowledge on control statements and various built-in functions.	K3
CO4	Visualize the data in different forms of chart.	K4
CO5	Apply the concepts of machine learning algorithms.	K5

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

24CSP3CA	DATA SCIENCE ESSENTIALS

Syllabus

Unit	Content	Hrs	Resources
I	**Data Science in Big Data World** Benefits and uses of Data Science and Big Data- Facets of Data- The Data Science Process - The Big Data Ecosystem and Data Science. Overview of the Data Science Process- Defining research goals and creating a project charter- Retrieving Data- Cleansing, Integrating and transforming Data- Exploratory Data Analysis- Build the models.	9	Text Book
II	**The R Environment** History, Features and Importance of R- Advantages and Disadvantages of R-Applications of R-The R Script File-Comments-Operators-Variables-Basic Data Types-Data Structures-Vector-List- Matrices.	9	Text Book
III	**Data Structures and Control Statements, Files** Data Frames- Factors- Arrays-The if, if...else, if...else ladder-Basic Loop Structures- The Break, Next and Repeat Loop-R Functions-The return Function- Built in Functions Variable Scope and Lifetime- Recursive Functions - Reading and Writing Data into Files - Reading Data from Excel - Reading HTML and XML Files.	9	Text Book
IV	**Plotting Graphs in R** Plotting a Histogram- Plotting a Bar Graph- Plotting a Line Chart- Plotting a Scatter Plot Plotting Box plot Graphs-Density Plots- Saving a plot in R- Customising Text in a Graph Advanced plots with ggplot.	9	Text Book
V	**Machine Learning Algorithms** Simple Linear Regression-k- Nearest Algorithm - Decision Trees - K-means Algorithm Naïve Bayes Classification - Support Vector Machine. Case Study: Facebook Mining and Web Scraping	12	Text Book
	Total	**48**	

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

Text book	1.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2016," Introducing Data Science", Manning Publications Co, New York.
	2.	Reema Thareja, 2021, "Data Science and Machine Learning with R", McGraw Hill Education, India.
Reference Books	1.	Rafael A. Irizarry, 2019, "Introduction to Data Science: Data Analysis and Prediction Algorithms with R", CRC Press.
	2.	B. Uma Maheswari, R. Sujatha, 2021, "Introduction to Data Science: Practical Approach with R and Python", Wiley.

	3.	Jared P. Lander, 2018, "R for Everyone: Advanced Analytics and Graphics", 2nd Edition, Pearson Education.
	4.	Chantal D. Larose, Daniel T. Larose, 2019, "Data Science Using Python and R", 1st Edition, Wiley.

Journal and Magazines	https://ieeexplore.ieee.org/document/8701415
E-Resources and Website	https://builtin.com/data-science

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability / Innovations

Semester – III CORE IX :ADVANCED OPERATING SYSTEMS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3CB	ADVANCED OPERATING SYSTEMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • the fundamentals of Operating Systems • gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms • gain insight on the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.
Prerequisite	Knowledge on fundamental operating system concepts and its functionality

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the concepts of various synchronization, scheduling and memory management issues.	K2
CO2	Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.	K2
CO3	Identify the different features of real time and mobile operating systems.	K3
CO4	Install and use available open source kernel.	K4
CO5	Modify existing open source kernels in terms of functionality or features used.	K5

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

24CSP3CB	ADVANCED OPERATING SYSTEMS

Syllabus

Unit	Content	Hrs	Resources
I	**Fundamentals Of Operating Systems** Overview – Functions of Operating Systems - Design Approaches - Types of Operating Systems - Synchronization Mechanisms – Concept of a Process - Concurrent Process - Semaphores -Processes Deadlocks: Preliminaries - Models of Deadlocks -Deadlock Detection-Deadlock Prevention-Deadlock Avoidance.	8	Text Book
II	**Distributed Operating Systems** Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols	10	Text Book
III	**Distributed Resource Management** Distributed File Systems – Design Issues - Distributed Shared Memory: Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Components Load Distributing Algorithm– Fault Tolerance: Two-Phase Commit Protocol – Non *blocking Commit Protocol	10	Text Book
IV	**Protection & Data Security** Introduction - Preliminaries - The Access Matrix Model - Implementation of Access Matrix Model- Advanced Models of Protection - A Model of Cryptography - Private Key Cryptography: Data Encryption Standard - Public Key Cryptography- Multiple Encryption - Authentication in Distributed Systems Case Studies: The UNIX Operating System - Hydra Kernel - Amoeba	10	Text Book
V	**Multi Processor Operating Systems** Multiprocessor System Architectures- Basics of Multi Processor Architecture Systems - Interconnection Networks for Multiprocessor Systems - Caching - Multiprocessor Operating Systems - Operating Systems Design Issues - Threads - Process Synchronization - Process Scheduling - Memory Management	10	Text Book
	Total	**48**	

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

Text book	1.	Mukesh Singhal and Niranjan G. Shivaratri, 2019, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Second Edition, Tata McGraw-Hill.
Reference Books	1.	Rajib Mall, 2016, "Real-Time Systems: Theory and Practice", Second Edition, Pearson Education India.
	2.	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, 2017, "Operating System Concepts", Seventh Edition, John Wiley & Sons.
	3.	Daniel P Bovet and Marco Cesati, 2015, "Understanding the Linux kernel", 3rd edition, O'Reilly.

Journal and Magazines	https://ieeexplore.ieee.org/document/1658969
E-Resources and Website	https://openlibrary.org/books/OL1419780M/Advanced_concepts_in_operating_systems

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study

Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations / Intellectual Property Rights

Semester – III CORE X: DISTRIBUTED COMPUTING							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3CC	DISTRIBUTED COMPUTING	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • basic concepts of Distributed Computing • networking protocols used in Distributed Computing • identify Applications of Distributed Computing
Prerequisite	Knowledge on Networks

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the basic architecture and algorithms used in Distributed Computing.	K2
CO2	Learn the fault tolerance and distributed systems.	K3
CO3	Utilize the modern software and technical skills in order to control concurrency in 5 distributed transactions.	K3
CO4	Develop various web applications and automate the real time problems.	K4
CO5	Evaluate and apply knowledge to gain insights into distributed systems for addressing real-world problems.	K5

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

24CSP3CC	DISTRIBUTED COMPUTING

Syllabus

Unit	Content	Hrs	Resources
I	**Distributed Computing Systems** Scheduling of Divisible Loads on Heterogeneous Distributed Systems - Introduction - The System Model - Analysis of Optimal Solution - Analysis of Two Slave System -The Sport Algorithm.	10	Text Book
II	**Fault Tolerance Mechanisms in Distributed System** Distributed System Architecture - Fault Tolerance Systems - Basic Concept of Fault Tolerance System - Fault Tolerance Mechanism in Distributed System - Real-Time Network Simulation - Supporting Real-Time Performance - Applications and Case Studies.	9	Text Book
III	**Software in Distributed Systems** Introduction - The Platform for Research Collaborative Computing - Prototyping Optimal Design Platform For Engineering - A Performance-Driven Approach For Restructuring Distributed Object-Oriented Software - Restructuring Scheme.	9	Text Book
IV	**Analysis and Design of Distributed Pair Programming System** Introduction - Analysis and Interaction in DPP System - Requirements of DPP System - Design of DPP System - High Voltage Power Grid Optimization Models - An Asynchronous Distributed Algorithm for Stochastic Unit Commitment.	10	Text Book
V	**Applications of Distributed Computing** Assigning Real-Time Tasks in Environmentally Powered Distributed Systems - Introduction - Preliminaries - ACO Solution - Cloud/Fog Computing System Architecture and Key Technologies for South-North Water Transfer Project safety	10	Text Book
	Total	**48**	

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

Text book	1.	Zoran Gacovski, 2019, "Parallel and Distributed Computing Applications", 2nd Edition, Arcler Press.
Reference Books	1.	Hiroyuki Takizawa, Hong Shen, Toshihiro Hanawa, 2023, "Parallel and Distributed Computing, Applications and Technologies", Springer.
	2.	Peter Kacsuk, Dieter Kranzlmuller, Zsolt Nemeth, Jens Volert, 2021 "Distributed and Parallel Systems Cluster and Grid Computing", 2nd Edition, Springer.
	3	S.K. Basu, 2016, "Parallel and Distributed Computing Architectures and

		Algorithms", 1st Edition, PHI.
	4.	Kai Hwang, Geoffrey C. Fox, Jack J.Dongarra, 2012, "Distributed and Cloud Computing From Parallel Processing to the Internet of Things , Elsevier.

Journal and Magazines	https://link.springer.com/journal/44227
E-Resources and Website	Distributed Computing: Principles, Algorithms, and Systems eBook : Kshemkalyani, Ajay D., Singhal, Mukesh: Amazon.in: Kindle Store https://www.cs.uic.edu/~ajayk/DCS-Book

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study

Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations

Semester – III CORE XI: RESEARCH METHODOLOGY							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3CD	RESEARCH METHODOLOGY	CORE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • the fundamental concepts of Research Methodology • various data collection, sampling, measurement and analysis techniques for solving research problems • the processes involved in preparing, formatting, and publishing research thesis and papers following academic standards
Prerequisite	Knowledge on basic Research Concepts

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the basic concepts of research problem and research design.	K2
CO2	Understand the measurement and scaling techniques.	K3
CO3	Experiment different data collection methods for doing research process.	K3
CO4	Demonstrate Sampling and Hypothesis Testing.	K4
CO5	Develop Research Paper and Thesis Writing skills.	K5

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

24CSP3CD | RESEARCH METHODOLOGY

Syllabus

Unit	Content	Hrs	Resources
I	**Introduction to Research** Meaning - Objectives - Motivation - Types - Research Approaches - Significance of Research - Research Methods Vs Methodology - Research and Scientific Method - Importance of Knowing How Research is Done - Research Process - Criteria of Good Research. Defining the Research Problem: Definition - Selecting the Problem -Necessity of Defining the Problem - Technique Involved in Defining a Problem. Research Design: Meaning - Need for Research Design - Features of Good Design -Important Concepts Relating to Research Design - Different Research Designs -Basic Principles of Experimental Designs.	12	Text Book
II	**Sampling Design, Measurement and Scaling Technique** Sampling Design: Census and Sample Survey - Implications of a Sample Design - Steps in Sampling Design - Criteria of Selecting a Sampling Procedure -Characteristics of a Good Sample Design - Different Types of Sample Designs. Measurement and Scaling: Measurement in Research - Measurement Scales -Sources of Error in Measurement - Tests of Sound Measurement - Technique of Developing Measurement Tools - Scaling - Meaning of Scaling - Scale Classification Bases - Important Scaling Techniques - Scale Construction Techniques.	12	Text Book
III	**Data Collection, Processing and Analysis** Methods of Data Collection: Collection of Primary Data - Observation Method - Interview Method - Collection of Data through Questionnaires - Collection of Data through Schedules - Difference between Questionnaires and Schedules - Some Other Methods of Data Collection - Collection of Secondary Data - Selection of Appropriate Method for Data Collection. Processing and Analysis of Data: Processing Operations - Some Problems in Processing - Elements/Types of Analysis - Statistics in Research - Measures of Central Tendency - Measures of Dispersion - Measures of Asymmetry (Skewness) - Measures of Relationship.	12	Text Book
IV	**Sampling, Hypothesis Testing and Chi-Square Test** Sampling Fundamentals: Need - Definitions - Important Sampling Distributions - Sampling Theory - Estimation - Estimating the Population Mean – Estimating Population Proportion - Sample Size and its Determination. Testing of Hypotheses: Definition - Basic Concepts - Procedure - Flow Diagram - Measuring the Power of a Hypothesis Test - Tests of Hypotheses - Important Parametric Tests. Chi-Square Test:	12	Text Book

	Chi-square as a Test for Comparing Variance - Chi-square as a Non Parametric Test - Conditions for the application of Chi-square Test - Steps Involved in Applying Chi-Square Test - Important Characteristics of Chi-Square Test.		
V	**Preparation of Thesis and Research Papers** The IMRAD (Introduction, Materials and Methods, Results and Discussion) Structure for Research Reporting – The Structure of a Thesis – Formatting Requirements of a Thesis – Thesis Editing – Research Papers – Selecting a Journal –The Structure of a Research Paper – Other Considerations in the Preparation of Articles – Review and Peer Review – Copyediting and Proofreading – Review Papers – Conference Papers – Electronic Publications – Short notes and Other Forms of Reports – Publish and Flourish.	12	Text Book
	Total	**60**	

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

Text book	1.	Kothari C.R., Gaurav Garg, 2019, "Research Methodology Methods andTechniques", 4th Edition, New Age International Publishers.
	2.	George Thomas C., 2015, "Research Methodology and Scientific Writing", 1st Edition, Ane Books Pvt. Ltd.
Reference Books	1.	Dr.ShanthiBhusan Mishra, Dr.ShashiAlok, 2019, "Handbook of Research Methodology", 1stEdition, Edu creation Publishing.
	2.	Dr.Prabhat Pandey, Dr.Meenu Mishra Pandey, 2015, "Research Methodology:Tools and Techniques", 1st Edition, Bridge Center.
	3.	Ranjit Kumar, 2015, "Research Methodology - A Step by Step Guide forBeginners", 3rd Edition, Sage Publications.
	4.	Steven J. Taylor, Robert Bogdan, Marjorie L. DeVault, 2016, "Introduction to Qualitative Research Methods ", 4th Edition, John Wiley & Sons..

Journal and Magazines	https://www.sciencedirect.com/science/article/pii/S0148296319304564
E-Resources and Website	https://old.mu.ac.in/wp-content/uploads/2014/04/Research-Methodology.pdf https://tripurauniv.ac.in/site/images/pdf/StudyMaterialsDetail/POLS-902C-Research%20Methodology.pdf

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study

Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations

Semester – III CORE PRACTICAL –V : DATA SCIENCE ESSENTIALS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
II	**24CSP3CP**	**DATA SCIENCE ESSENTIALS**	**CORE**		**-**	**48**	**2**

Preamble	This course has been designed for students to learn and understand • the fundamentals of R programming, including data structures, control flow, and function creation for data manipulation • techniques for performing statistical analysis, data visualization, and model building using R • the application of R in real-world scenarios, including regression, prediction and performance evaluation tasks
Prerequisite	Knowledge on Data Visualization

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the concept of Data Processing.	K2
CO2	Understand reading and writing data in different formats.	K3
CO3	Impart knowledge on regression.	K3
CO4	Construct applications using Trees and Graphs	K4
CO5	Visualize the data in different forms of chart.	K5

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

24CSP3CP	DATA SCIENCE ESSENTIALS

S.No	List of Programs
1	Loading a data file of different formats into R environment and perform various data processing tasks.
2	Perform various Data Exploratory Techniques on the processed data.
3	Create a simple calculator using R Operators and Variables.
4	Create a 3 X 3 matrix in R and perform various matrix operations.
5	Demonstrate reading and writing data of different file formats in R.
6	Create matrix to store the results of five players in three matches. Compare each players performance in matches played by them and find out whether their performance has improved comparing to previous matches.
7	An employee's total weekly pay is calculated by multiplying the hourly wage and number of regular hours plus any overtime pay, which in turn is calculated as total overtime hours multiplied by 1.5 times of hourly wage. Write a program that takes as input the hourly wage, total regular hours and total over time hours and prints an employee's total weekly pay.
8	Implement an R program to perform the following i. Calculate Fibonacci Series ii. Calculate the factorial of a given number. iii. Find the GCD of two numbers.
9	i. Create a stacked bar graph and a pie chart to display the marks obtained by students in different Subjects. ii. Create a stacked bar graph depicting temperature and rainfall received for five consecutive days in an area. iii. Create a data frame of random values for gender and height. Draw a density plot and a line which highlights the mean value.
10	Create a simple linear regression model using the mtcars dataset and evaluate the performance of the model using the various evaluation metrics.
11	Use the tidy verse, mlbench and caret packages to predict the diabetes from PimaIndianDiabetes dataset.
12	Download the boston.csv dataset from kaggle and create a regression tree to predict the price of a house medv.

Text Books	1.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2016," Introducing Data Science", Manning Publications Co, New York.

	2.	Reema Thareja, 2021, "Data Science and Machine Learning with R", McGraw Hill Education, India.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester – III CORE PRACTICAL VI: ADVANCED OPERATING SYSTEMS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	**24CSP3CQ**	**ADVANCED OPERATING SYSTEMS**	**CORE**		**-**	**48**	**2**

Preamble	This course has been designed for students to learn and understand • key UNIX system calls and process management techniques using C programming • CPU scheduling algorithms and memory management concepts to simulate and analyze process behavior • synchronization and inter-process communication mechanisms to handle concurrency and resource allocation in operating systems
Prerequisite	Knowledge on Linux, Unix, C and Dev C++-

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Apply UNIX system calls for process control and file handling operations.	K3
CO2	Use UNIX file I/O techniques to perform low-level system programming tasks.	K3
CO3	Develop and simulate UNIX commands using C programming.	K3
CO4	Implement and compare scheduling algorithms like FCFS, SJF, priority, and round-robin.	K4
CO5	Master IPC techniques, synchronization, memory management, and file allocation in UNIX.	K4

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

24CSP3CQ | ADVANCED OPERATING SYSTEMS

S.No	List of Programs
1	Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
2	Write programs using the I/O System calls of UNIX operating system (open, read, write, etc.).
3	Write C programs to simulate UNIX commands like ls, grep, etc.
4	Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5	Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
6	Develop application using Inter-Process Communication (using shared memory, pipes or message queues).
7	Write a C programs to implement UNIX system calls and file management.
8	To synchronize producer and consumer processes using semaphore.
9	To demonstrate communication between process using shared memory.
10	To implement demand paging for a reference string using LRU method.
11	To implement file allocation on free disk space in a contiguous manner.
12	Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.

Text Books	1.	Mukesh Singhal and Niranjan G. Shivaratri, 2019, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Second Edition, Tata McGraw-Hill.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester – III DSE III :NATURAL LANGUAGE PROCESSING							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3DA	NATURAL LANGUAGE PROCESSING	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • the foundational concepts of Natural Language Processing • analytical techniques in NLP • machine translation and retrieval
Prerequisite	Knowledge on basic Machine Learning Concepts.

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand Basics of Natural Language Processing.	K2
CO2	Explain different types of NLP analysis.	K2
CO3	Apply discourse processing and natural language generation techniques.	K3
CO4	Analyze machine translation approaches and their application to Indian languages.	K4
CO5	Evaluate information retrieval models and lexical resources used in NLP systems.	K5

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

24CSP3DA	NATURAL LANGUAGE PROCESSING

Syllabus

Unit	Content	Hrs	Resources
I	**Natural Language Processing** Origin of NLP – Language and knowledge – The Challenges of NLP – Language and Grammar– Processing Indian Language - NLP Applications – Early NLP Systems – Information Retrieval – Various Grammar–based Language Model - Statistical Language Model.	12	Text Book
II	**Word Level Analysis and Syntactic Analysis** Regular Expressions – Finite-State Automata - Morphological Parsing – Spelling Error Detection and Correction – Words and Word classes – Part-of-speech Tagging - Context- Free Grammar – Constituency - Parsing – Probabilistic Parsing – Indian Languages.	12	Text Book
III	**Discourse Processing and Natural Language Generation** Cohesion – Reference Resolution - Discourse Coherence and structure - Architectures of NLG systems – Generation Task and Representations – Applications of NLG	12	Text Book
IV	**Machine Translation** Problems in Machine Translation – Characteristics of Indian Languages – Machine Translation Approaches – Direct Machine Translation – Rule Based Machine Translation – Corpus-based Machine Translation – Semantic or Knowledge-based MT Systems – Translation involving Indian Languages.	12	Text Book
V	**Information Retrieval-I and Lexical Resources** Design Features of Information Retrieval Systems – Information Retrieval Models – Classical Information Retrieval Models – Non-Classical Models of IR – Alternative Model of IR - Evaluation of IR system -- WordNet – FrameNet – Stemmers – Part-of-Speech Tagger – Research Corpora.	12	Text Book
	Total	**60**	

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

Text book	1.	Tanveer Siddiqui, 2018, "Natural Language Processing and Information Retrieval", U.S. Tiwary, Sixth Impression, OXFORD University Press.
Reference Books	1.	Kibble. R, 2013, "Introduction to natural language processing" Published by University of London , Goldsmiths.

	2.	Jacob Eisenstein ,2018, "Natural Language Processing", The MIT Press.
	3.	Ela Kumar, 2013, "Natural Language Processing Paperback", I K International Publishing House Pvt. Ltd.
	4.	Ashish Bansal, 2021, "Advanced Natural Language Processing with TensorFlow 2", Packt Publishing Limited...

Journal and Magazines	https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=eeace1d14e266a5cd44fe781a874c662928602fd
E-Resources and Website	https://www.deeplearning.ai/resources/natural-language-processing/

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations

Semester – III DSE III : BUSINESS ANALYTICS							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3DB	BUSINESS ANALYTICS	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • the importance of business analytics • business analytics for decision making • appropriate analytics and generate solutions
Prerequisite	Knowledge on Data Analysis

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand the role of Business Analytics in decision making.	K2
CO2	Explain descriptive analytics techniques and generate solutions.	K3
CO3	Apply predictive analytics and generate solutions.	K3
CO4	Analyze optimization models including linear, integer, and nonlinear optimization in business decisions.	K4
CO5	Evaluate decisions with Sample Information.	K5

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

24CSP3DB	BUSINESS ANALYTICS

Syllabus

Unit	Content	Hrs	Resources
I	**Introduction to Business Analytics** Business Analytics- Impacts and Challenges- Evolution of Business Analytics Descriptive, Predictive and Prescriptive Analytics- Data for Business Analytics. Models in Business Analytics: Descriptive Models- Predictive Models- Prescriptive Models-Model Assumptions- Uncertainty and Risk-Problem Solving with Analytics: Recognizing a Problem-Defining the Problem- Structuring the Problem-Analyzing the Problem- Interpreting Results and Making a Decision-Implementing the Solution.	12	Text Book
II	**Descriptive Analytics** Data Visualization: The Value of Data Visualization- Creating Charts in Microsoft Excel - Other Excel Data Visualization Tools. Descriptive Statistics: Metrics and Data Classification-Frequency Distributions and Histograms-Percentiles and Quartiles- Cross Tabulations- Descriptive Statistical Measures.	12	Text Book
III	**Predictive Analytics** Trend lines and Regression Analysis: Modeling Relationships and Trends in Data-Simple Linear Regression- Building good Regression Models. Forecasting Techniques: Qualitative and Judgmental Forecasting- The Practice of Forecasting. Data Mining: The Scope of Data Mining. Spreadsheet Modeling and Analysis: Analytics in Practice.	12	Text Book
IV	**Prescriptive Analysis** Linear Optimization: Optimization Models-Developing Linear Optimization Models Solving Linear Optimization Models. Integer and Nonlinear Optimization: Integer Linear Optimization Models- Nonlinear Optimization Models. Optimization Analytics: What-If Analysis for Optimization Models. Visualization of Solver Reports.	12	Text Book
V	**Making Decisions** Decision Analysis: Formulating Decision Problems- Decision Strategies Without Outcome Probabilities- Decision Strategies With Outcome Probabilities- Decision Trees- Decisions with Sample Information- Utility and Decision Making.	12	Text Book
	Total	**60**	

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

Text book	1.	James R. Evans, 2022, "Business Analytics - Methods, Models and Decisions", Third Edition, Pearson Ed.

Reference Books	1.	Christian Albright S and Wayne L. Winston, 2015, "Business Analytics - Data Analysis and Decision Making", Fifth edition, Cengage Learning.
	2.	Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, 2015, " Business Analytics Principles, Concepts, and Applications - What, Why, and How", Pearson Ed.

Journal and Magazines	https://www.scitepress.org/papers/2013/46509/46509.pdf
E-Resources and Website	https://www.coursera.org/specializations/business-analytics

Learning Method	Chalk and Talk/Assignment/Seminar/ Case Study

Focus of the Course	Skill Development/ Employability / Innovations

Semester – III DSE III : NETWORK SECURITY							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
III	24CSP3DC	NETWORK SECURITY	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • the crucial concepts of network security • symmetric and asymmetric cryptography algorithms • data integrity and security for advanced networks
Prerequisite	Knowledge on Networks

Course Outcomes (COs)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Understand fundamental computer and network security concepts including OSI security architecture and attack models.	K2
CO2	Apply different encryption techniques and algorithms to secure network communication.	K3
CO3	Analyze the strengths and weaknesses of different security mechanisms and protocols used to protect network communication.	K4
CO4	Examine the role of authentication, digital signatures, and hash algorithms in securing network communication.	K4
CO5	Evaluate cloud, advanced network security challenges and implement appropriate security countermeasures.	K5

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

24CSP3DC	NETWORK SECURITY

Syllabus

Unit	Content	Hrs	Resources
I	**Computer and Network Security Concepts** Computer Security Concepts - OSI Security Architecture - Security Attacks - Security Services - Security Mechanisms - Fundamental Security Design Principles - Attack Surfaces and Attack Trees - Model for Network Security - Standards. Modular Arithmetic - Prime Numbers - Fermat's and Euler's Theorems.	12	Text Book
II	**Symmetric Cipher** Symmetric Cipher Model - Substitution Techniques - Transposition Techniques - Rotor Machines - Steganography - Traditional Block Cipher Structure - Data Encryption Standard - Strength of DES - Block Cipher Design Principles - Advanced Encryption Standard Finite Field Arithmetic - AES Structure - AES Transformation Functions - AES Key Expansion.	12	Text Book
III	**Asymmetric Cipher** Public-Key Cryptography - Principles of Public-Key Cryptosystems - RSA Algorithm - Diffie-Hellman Key Exchange - Elgamal Cryptographic System - Elliptic Curve Arithmetic - Elliptic Curve Cryptography - Pseudorandom Number Generation Based on an Asymmetric Cipher.	12	Text Book
IV	**Cryptographic Data Integrity Algorithms** Cryptographic Hash Functions - Applications of Cryptographic Hash Functions - Two Simple Hash Functions - Requirements and Security - Hash Functions Based on Cipher Block Chaining - Secure Hash Algorithm - SHA-3 - Message Authentication Requirements - Message Authentication Functions - Requirements for Message Authentication Codes - Security of MACs.	12	Text Book
V	**Security for Cloud and Advanced Networks** Network Access Control - Extensible Authentication Protocol - IEEE 802.1X Port-Based Network Access Control - Cloud Computing - Cloud Security Risks and Countermeasures - Data Protection in the Cloud -Cloud Security as a Service - Addressing Cloud Computing Security Concerns - Wireless Security - Mobile Device Security - S/MIME.	12	Text Book
	Total	**60**	

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

Text book	1.	Stallings, 2017, "Cryptography and Network Security Principles And

		Practice, Seventh Edition Global Edition", Pearson Education & Place.
Reference Books	1.	Atul Kahate, 2019, "Cryptography and Network Security, 4th Edition", McGraw Hill Education.
	2.	Achary. R, 2021 "Cryptography and Network Security An Introduction", Mercury Learning and Information.
	3.	Charlie Kaufman, Radia Perlman, Mike Speciner, Ray Perlner , 2022, "Network Security: Private Communication in a Public World", Pearson Education.

Journal and Magazines	https://www.ibm.com/think/topics/network-security
E-Resources and Website	https://geekflare.com/cybersecurity/learn-network-security/

Learning Method	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations / Intellectual Property Rights

Semester – III SELF STUDY: IPR AND ENTREPRENEURSHIP				
Semester	**Course Code**	**Course Name**	**Category**	**Credits**
III	**24CSPSSA**	**IPR AND ENTREPRENEURSHIP**	**SELF STUDY**	**1**

Syllabus

Unit	Content	Resources
I	**Intellectual Property and World Trade Organization (WTO)** Introduction: Definition of Intellectual Property - Introduction of WTO. Agreement on TRIPS (Trade Related Intellectual Property Rights): General Provisions and Basic Principles of TRIPS - Standards Concerning the Availability, Scope and Use of Intellectual Property Rights - Enforcement of Intellectual Property Rights - Acquisition and Maintenance of Intellectual Property Rights and Related Inter-Partes Procedures - Dispute Prevention and Settlement - Transitional Arrangements- Institutional Arrangements, Final Provisions	Text Book
II	**Patent** Fundamentals of Patent: Definition - History of the Patent in India - Conditions for Grant of Patent – Inventions those are not Patentable - Process and Product Patent - Procedure for Grant of Patent – e-Filing of Patent Application - Temporal and Spatial Aspect of Patent - Opposition to Grant of Patent - Rights of Patentee - Patent Office and Register of Patents - PCT Patent - Exclusive Marketing Rights -Milestones in Indian Patent Law. Transfer and Infringement of Patent Rights: Transfer of Patent Rights - Infringement of Patent Rights - Patent Agents - Challenges in Patent.	Text Book
III	**Copyright and Trade Marks** Copyright: Definition - Meaning of Publication - Copyright Office and Copyright Board - Ownership of Copyright - The Rights of the Owner - Term of Copyright - Registration of Copyright - Infringement of Copyright - Remedies against Copyright Infringement - Internet and Copyright Issue. Trade Marks: Definition - Developing a Trade Mark - Conditions for Trade Mark Registration - Register of Trade Marks - Trends in Trade Marks Applications - Procedure for Trade Mark Registration in India - Term of Trade Mark - Certification Trade Mark - Infringement of Trade Mark - Remedies against Trade Mark Infringement.	Text Book

IV	**Significance of Entrepreneur** Basic Business Concepts for the Prospective Entrepreneur: Production Factors as Resources Needed When Starting an Enterprise - The Enterprise, Its Establishment and The Sectors- Profit and Other Objectives of an Entrepreneur - Informal and Formal Enterprises - Form of Enterprise for A Small Business - The Business Environment. Entrepreneurship and Entrepreneurial Skills: Definitions of an Entrepreneur - The Relationship between Entrepreneurship and Small Business Management - Key Characteristics of Successful Entrepreneurs - Entrepreneurial skills.	Text Book
V	**Ideas for Start-up** The Identification of Feasible Small Business Ideas: Introduction - Cultivating a Creative Attitude - Generating Small Business Ideas: The Generation of Ideas from the Entrepreneur's Skills, Expertise and Aptitudes – Common Needs – Existing Problems – Everyday Activities – Other Sources - The Development and Evaluation of Small Business Ideas. The Business Plan: About the Business Plan – Contents of the Business Plan - The Entrepreneurial Team – Description of the Enterprise – The Objective and Strategy of the Enterprise.	Text Book

Text book	1.	Neeraj Pandey, Khushdeep Dharani, 2014, "Intellectual Property Rights", PHI Learning Pvt. Ltd
	2.	Nieuwenhuizen C, 2015, "Basics of Entrepreneurship", Juta Pvt. Ltd.
Reference Books	1.	Deborah. E. Bouchoux, 2018, "Intellectual Property Right" 5th edition, Cengage Learning.
	2.	Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, 2018, "Entrepreneurship", 10th Edition, Tata McGraw Hill.
	3.	PrabuddhaGanguli, 2008, "Intellectual Property Right", 1st Edition, Tata McGraw Hill.

Journal and Magazines	-
E-Resources and Website	NPTEL / Infosys Springboard

Learning Method	Self Study

Focus of the Course	Skill Development/ Employability

Semester – III SELF STUDY: ORGANIZATIONAL BEHAVIOUR				
Semester	**Course Code**	**Course Name**	**Category**	**Credits**
III	**24CSPSSB**	**ORGANIZATIONAL BEHAVIOUR**	**SELF STUDY**	**1**

Syllabus

Unit	Content	Resources
I	**Nature and Scope of Organisation** Introduction – Concept of Organisation – Features – Types – Concepts of Organisational Typology and its Types – Significance of Organisation – Organisational Goals – Importance – Goal Formulation – Nature of Goals – Goal Changes – Individual and Organisational Goals – Conflict between Individual and Organisational Goals – Nature of Business Organization – Organisation Theory.	Text Book
II	**Organisational Behaviour** Concept and Meaning of Organisational Behaviour (OB) – Characteristics of OB - Key Elements / Forces of OB - Goal of OB – Philosophical Concepts of OB – Fundamental Concepts of OB – OB and Other Fields of Study – Role of OB - Historical Evolution of OB – Approaches to the Study of OB – Models of OB – Challenges and Opportunities of OB.	Text Book
III	**Individual Behaviour and Personality** Personal Factors - Environmental Factors – Organisational Factors – Models of Man / Individual Behaviour. Personality: The Meaning of Personality – Characteristics of Personality - Determinants of Personality – Development of Personality – Personality Traits – Major Traits Influencing Organisational Behaviour- Locus of Control - Matching Personality with Job Types.	Text Book
IV	**Group Functionalities** Definition of Groups – Types of Groups – Theories of Group Formation –Reasons for Group Formation – Factors Affecting Group Performance – Inter-Group Behaviour – Approaches to Inter-Group Relationship – Group Dynamic A Synoptic View. Group Decision Making: Meaning – Nature –Groups –Process – Steps – Styles – Advantages and Disadvantages.	Text Book
V	**Communication and Leadership** Communication: Definitions – Characteristics: Nature of Communication – Elements – Process – Models – Need or Purpose – Importance – Methods (Channels) – Inter	Text Book

	Personal – Cross Cultural Communication. Leadership: Definitions – Nature and Characteristics - Leadership Vs Management –Leadership Styles - Formal and Informal Leaders – Leadership Functions – Importance of Leadership in Management – Process or Techniques of Effective Leadership.	

Text book	1.	Shashi K Gopta, Rosy Joshi, 2014, "Organisational Behaviour", 9th Edition, Kalyani Publishers.
Reference Books	1.	Khanka S.S., 2013, "Organisational Behaviour". 7th edition, Sultan Chand & Sons Publishing.
	2.	Stephen P. Robins, 2008 ,"Organizational Behavior", 11th edition ,PHI Learning / Pearson Education.
	3.	Fred Luthans, 2010, "Organisational Behavior", 11th Edition, McGraw Hill.

Journal and Magazines	-
E-Resources and Website	NPTEL / Infosys Springboard

Learning Method	Self Study

Focus of the Course	Skill Development/ Employability

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Dr.N.G.P. Arts and Science College
APPROVED
BoS- 19th 28/6/25 | AC - | GB -