



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 (3rd Cycle)

Dr. N.G.P.- Kalapatti Road, Coimbatore-641048, Tamilnadu, India
Web: www.drngpasc.ac.in | Email: info@drngpasc.ac.in | Phone: +91-422-2369100

REGULATIONS 2026-27 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 2026-27 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

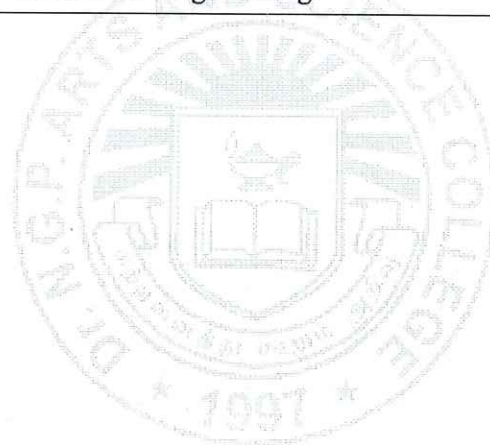
The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

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 (2026 Batch)

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
26CSP1CA	Core - I	Design and Analysis of Algorithms	4	-	-	4	48	3	25	75	100	4
26CSP1CB	Core - II	Advanced Java	4	-	-	4	48	3	25	75	100	4
26CSP1CC	Core - III	Machine Learning	5	-	-	5	60	3	25	75	100	5
26CSP1CD	Core - IV	Advanced Operating Systems	4	-	-	4	48	3	25	75	100	4
26CSP1CP	Core Practical - I	Design and Analysis of Algorithms	-	-	4	4	48	3	40	60	100	2
26CSP1CQ	Core Practical - II	Advanced Java	-	-	4	4	48	3	40	60	100	2
26CSP1DA	DSE - I	Natural Language Processing	5	-	-	5	60	3	25	75	100	5
26CSP1DB		Foundations of Data Science										
26CSP1DC		Advanced Computer 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												
26CSP2CA	Core - V	Deep Learning	4	-	-	4	48	3	25	75	100	4
26CSP2CB	Core - VI	NoSQL Database Management System	4	-	-	4	48	3	25	75	100	4
26CSP2CC	Core - VII	Cloud Computing	4	-	-	4	48	3	25	75	100	4
26MTP2ED	EDC	Mathematics for Computer Science	5	-	-	5	60	3	25	75	100	5
26CSP2CP	Core Practical - III	Deep Learning	-	-	4	4	48	3	40	60	100	2
26CSP2CQ	Core Practical - IV	NoSQL Database Management System	-	-	4	4	48	3	40	60	100	2
26CSP2DA	DSE -II	Computer Vision	5	-	-	5	60	3	25	75	100	5
26CSP2DB		Data Engineering										
26CSP2DC		Wireless and Mobile 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												
26CSP3CA	Core - VIII	Open Source Technologies	4	-	-	4	48	3	25	75	100	4
26CSP3CB	Core - IX	Advanced Python Programming	4	-	-	4	48	3	25	75	100	4
26CSP3CC	Core - X	AI Assisted Software Development	4	-	-	4	48	3	25	75	100	4
26CSP3CD	Core - XI	Research Methodology	5	-	-	5	60	3	25	75	100	5
26CSP3CP	Core Practical - V	Open Source Technologies	-	-	4	4	48	3	40	60	100	2
26CSP3CQ	Core Practical - VI	Advanced Python Programming	-	-	4	4	48	3	40	60	100	2
26CSP3TA	IT	Internship	-	-	-	-	-	3	40	60	100	2
26CSP3DA	DSE -III	Generative AI	5	-	-	5	60	3	25	75	100	5
26CSP3DB		Data Privacy and Security										
26CSP3DC		Network Security										
Total			22		08	30	360				800	28

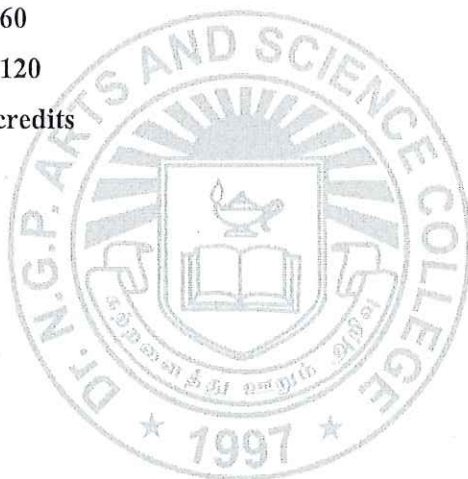
Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Total	Week		CIA	ESE	Total	
Fourth Semester												
26CSP4CV	Core - XII	Project and Viva voce	-	-	-	-	-	3	80	120	200	12
Total											200	12
*Grand Total											2400	92

Theory : CIA 25 : ESE 75

Practical/ IT : CIA 40 : ESE 60

Project : CIA 80 : ESE 120

*Total Credits does not exceed 92 credits



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

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.	26CSP1DA	Natural Language Processing
2.	26CSP1DB	Foundations of Data Science
3.	26CSP1DC	Advanced Computer Networks

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	26CSP2DA	Computer Vision
2.	26CSP2DB	Data Engineering
3.	26CSP2DC	Wireless and Mobile Networks

Semester III (Elective III)

List of Elective Courses

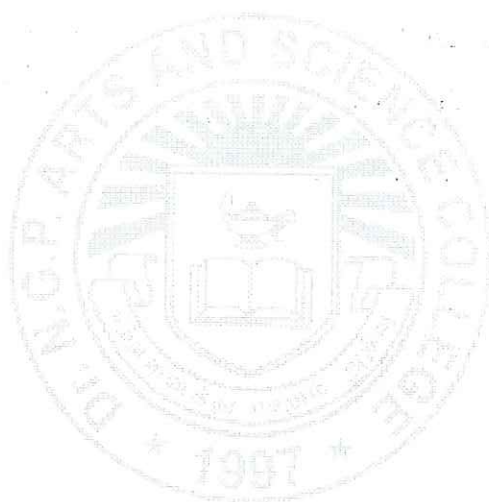
S. No.	Course Code	Name of the Course
1.	26CSP3DA	Generative AI
2.	26CSP3DB	Data Privacy and Security
3.	26CSP3DC	Network Security

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.	26CSPSSA	Fundamentals of Prompt Engineering
2.	26CSPSSB	Text Mining



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Semester - I							
CORE - I: DESIGN AND ANALYSIS OF ALGORITHMS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1CA	DESIGN AND ANALYSIS OF ALGORITHMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - the analysis of asymptotic performance of algorithms - major algorithms and data structures - the design of efficient algorithms for real time applications
Prerequisite	Knowledge on Data Structures and Programming.

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental concepts of algorithm analysis and basic data structures.	K2
CO2	Apply divide and conquer techniques to solve problems.	K3
CO3	Analyze greedy algorithm strategies for solving optimization problems.	K4
CO4	Evaluate dynamic programming techniques for solving optimization problems.	K5
CO5	Design and develop efficient solutions using backtracking, branch and bound techniques.	K6

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

26CSP1CA	DESIGN AND ANALYSIS OF ALGORITHMS
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Syllabus

Unit	Content	Hrs	Resources
I	Algorithms and Elementary Data Structures Algorithms: Definition - Specification - Performance Analysis- Space Complexity - Time Complexity - Asymptotic Notations -Performance Measurement. Elementary Data Structures : Stacks and Queues - Trees - Dictionaries - Priority Queues - Graphs.	9	Text Book
II	Divide and Conquer General Method - Binary Search - Finding Maximum and Minimum - Merge Sort - Quick Sort - Strassen's Matrix Multiplication - Convex Hull.	9	Reference Book
III	Greedy Method The General Method - Knapsack Problem - Tree Vertex Splitting - Job Sequencing with Deadlines - Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm - Single-Source Shortest Paths.	10	Text Book
IV	Dynamic Programming The General Method - Multistage Graphs - All-Pairs Shortest Paths - Single-Source Shortest Paths: General Weights - Optimal Binary Search Trees - 0/1 Knapsack - The Traveling Salesperson Problem - Flow Shop Scheduling.	10	Text Book/NPTEL
V	Backtracking, Branch and Bound Backtracking: The General Method -The 8-Queens problem - Sum of Subsets - Graph Coloring - Hamiltonian Cycles - Knapsack Problem. Branch and Bound: General method - 0/1 Knapsack Problem - Traveling Salesperson problem. Case Study: Evaluate the performance of the Greedy method, Dynamic Programming and Branch and Bound techniques in solving the Knapsack problem by comparing their computational time and Space Complexity.	10	Text Book/You Tube Videos
Total		48	

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

Text book	1.	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2025, "Fundamentals of Computer Algorithms", Second Edition, Universities Press Private Limited, India.
Reference Books	1.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 2022, "Introduction to Algorithms", Fourth Edition, The MIT Press.
	2.	M. H. Alsuwaiyel, 2016, "Algorithms Design Techniques and Analysis" Revised Edition, World Scientific Publishing Co. Pvt. Ltd.
	3.	Kleinberg, Jon, and Eva Tardos, 2014 "Algorithm Design", First Edition, Pearson new international Edition.

Journal and Magazines	https://link.springer.com/chapter/10.1007/978-1-4612-4400-4_1
E-Resources and Website	https://nptel.ac.in/courses/106105157

Learning Method	Chalk and Talk/ Assignment/Seminar/Case Study
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Focus of the Course	Skill Development/ Employability
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Semester - I CORE - II: ADVANCED JAVA							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1CB	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 Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand about Java beans and swing.	K2
CO2	Apply the Java Servlet life cycle and session management techniques to implement dynamic web responses.	K3
CO3	Apply events in JSP and Java Mail API.	K3
CO4	Evaluate specific Enterprise Java Bean (EJB) architectures and design patterns for scalable enterprise solutions.	K5
CO5	Design and develop robust applications implementing Database Connectivity using JDBC and Embedded SQL.	K6

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

26CSP1CB	ADVANCED JAVA
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Syllabus

Unit	Content	Hrs	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, Java Mail API Java Server Pages- Introduction - Tags: Variable Objects - Request String: Parsing Other Information - User Session - Cookies- Session objects. Java Mail API: Java Mail - Java fail API and Java Activation Framework - Protocols - Exceptions - Send, Retrieval and Deleting Email Messages - Replying to and Forwarding an Email Message- Sending Attachments - Forwarding an Email Message - Receiving Attachments - Searching an Email Folder.	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
Total		48	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)
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Text book	1.	Herbert Schildt, 2017, "Java The Complete Reference", Tenth Edition, Tata McGraw Hill (Unit I-II).
	2.	Jim Keogh, 2006, "J2EE: The Complete Reference", McGraw Hill Education (Unit III - V)
Reference Books	1.	Herbert Schildt, 2020, "Java, A Beginners Guide", Eighth Edition, Oracle Press.
	2.	Bert Bates, Karthy Sierra, Eric Freeman, Elisabeth Robson, 2009, "Head First Design Patterns", First 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, 2020, "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 Method	Chalk and Talk/ Assignment/Seminar
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Focus of the Course	Skill Development/ Employability
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Semester - I CORE - III: MACHINE LEARNING							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1CC	MACHINE LEARNING	CORE	60	-	-	5

Preamble	This course has been designed for students to learn and understand - the fundamental mathematical concepts of learning theory and Bayesian decision-making to effectively handle data uncertainty - Dimensionality Reduction, Clustering and Nonparametric Methods to discover hidden patterns in complex datasets - Linear Discrimination and transition to deep learning through Multilayer Perceptron and Backpropagation
Prerequisite	Programming basics, Linear Algebra, Probability and Statistics, Data Structure and Algorithms.

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply supervised and Probably Approximately Correct Learning Theory.	K3
CO2	Analyze Bayesian and parametric decision methods.	K4
CO3	Examine clustering and dimensionality reduction.	K4
CO4	Evaluate nonparametric models and decision trees.	K5
CO5	Design MLP and neural network architectures.	K6

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

26CSP1CC	MACHINE LEARNING
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Syllabus

Unit	Content	Hrs	Resources
I	Supervised Learning Machine Learning: Basics - Applications. Supervised Learning: Learning a class - Vapnik - Chervonenkis Dimension - Probably Approximately Correct (PAC) Learning - Noise - Learning Multiple Classes - Regression - Model Selection and Generalization - Dimensions of a Supervised Machine Learning Algorithm.	11	Text Book
II	Bayesian Decision Theory Classification - Losses and Risks - Discriminant Functions - Association Rules. Parametric Methods: Maximum Likelihood Estimation - The Bayes' Estimator - Parametric Classification - Regression - Tuning Model Complexity - Model Selection Procedures. Multivariate Methods: Multivariate Data - Parameter Estimation - Estimation of Missing Values - Multivariate Normal Distribution - Multivariate Classification - Tuning Complexity - Discrete Features - Multivariate Regression.	12	Text Book
III	Dimensionality Reduction Subset Selection - Principal Component Analysis - Feature Embedding - Factor Analysis - Singular Value Decomposition and Matrix Factorization - Multidimensional Scaling - Linear Discriminant Analysis - Canonical Correlation Analysis - Isomap - Locally Linear Embedding - Laplacian Eigenmaps. Clustering: Mixture Densities - k-Means Clustering - Expectation-Maximization Algorithm - Mixtures of Latent Variable Models - Supervised Learning after Clustering - Spectral Clustering - Hierarchical Clustering. Case Study : Choosing the Number of Clusters.	13	Text Book
IV	Nonparametric Methods Nonparametric Density Estimation - Generalization to Multivariate Data - Nonparametric Classification - Condensed Nearest Neighbor - Distance-Based Classification - Outlier Detection - Nonparametric Regression: Smoothing Models. Decision Trees: Univariate Trees - Pruning - Rule Extraction from Trees - Learning Rules from Data - Multivariate Trees.	12	Text Book

V	Linear Discrimination Generalizing the Linear Model – Geometry of the Linear Discriminant – Pairwise Separation – Gradient Descent – Logistic Discrimination – Learning to rank. Multilayer Perceptron (MLP): The Perceptron – Training a Perceptron – Boolean Functions – Multilayer Perceptron – MLP as a Universal Approximator – Backpropagation Algorithm – Overtraining – Learning Hidden Representations – Autoencoders – Word2vec Architecture.	12	Text Book
	Total	60	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)
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Text book	1. Ethem Alpaydin, 2020, "Introduction to Machine Learning", Fourth Edition, The MIT Press.
Reference Books	1. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, 2020, "Machine Learning", Pearson Education.
	2. Stephen Marsland, 2014, "Machine Learning-An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition.
	3. Kevin P. Murphy, 2012, "Machine Learning: A Probabilistic Perspective", MIT Press.
	4. P. Flach, 2012, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press.

Journal and Magazines	https://www.mdpi.com/2227-7390/13/3/451?hl=en-IN
E-Resources and Website	https://onlinecourses.nptel.ac.in/noc21_cs85/preview?hl=en-IN

Learning Method	Chalk and Talk/ Assignment/Seminar
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Focus of the Course	Skill Development/ Employability
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Semester - I CORE - IV: ADVANCED OPERATING SYSTEMS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSF1CD	ADVANCED OPERATING SYSTEMS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - advanced operating system concepts including distributed, multiprocessor, database and real-time systems - resource management, Synchronization, Scheduling, Concurrency control and Recovery techniques - analytical and problem-solving skills for designing efficient and reliable computing systems.
Prerequisite	Knowledge on fundamental operating system concepts.

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Classify distributed mutual exclusion algorithms into token-based and non-token-based approaches.	K2
CO2	Apply the architecture and algorithms of Distributed Shared Memory (DSM) in distributed environments.	K3
CO3	Analyze the interconnection networks used in multiprocessor systems.	K4
CO4	Evaluate concurrency control issues in database systems.	K5
CO5	Construct real-time schedules using clock-driven and hybrid scheduling approaches.	K6

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

26CSP1CD	ADVANCED OPERATING SYSTEMS
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Syllabus

Unit	Content	Hrs	Resources
I	Distributed Operating System Operating Systems: Overview – Functions - Design Approaches - Types - Synchronization Mechanisms - Concept of a Process - Concurrent Process - Semaphores – Distributed Operating System: Introduction - Architecture - Issue - Communication primitives - Distributed Mutual Exclusion: Classification - Non-Token Based Algorithm: Lamport- Ricart - Agrawala - Maekawa - Token Based Algorithm: Suzuki - Kasami's Broadcast - Singhal's Heuristic - Raymond's Tree-Based.	10	Text Book
II	Distributed Resource Management Distributed File Systems: Architecture - Design Issues. Distributed Shared Memory (DSM): Architecture- Algorithms for Implementing DSM. Distributed Scheduling: Issues in Load Distributing - Components - Load Distributing Algorithms - Performance Comparison-Selecting a Suitable Load Sharing Algorithm. Failure Recovery: Concept - Classification of Failures - Backward and Forward Error Recovery - Recovery in Concurrent Systems-Consistent Set of Checkpoints - Check pointing for Distributed Database Systems.	10	Text Book
III	Multi Processor Operating System Multiprocessor System Architectures: Basics - Interconnection Networks for Multiprocessor Systems - Caching - Structure - Design Issues - Threads - Process Synchronization - Process Scheduling - Memory Management. Case Study: Multiprocessor System Architectures in an E-Commerce Data Center.	9	Text Book
IV	Database Operating System Introduction - Requirements of a Database Operating System - Concurrency Control: Database Systems - Model of Database Systems - Problem of Concurrency Control - Serializability Theory - Distributed Database Systems - Concurrency Control Algorithms: Synchronization Primitives - Lock Based Algorithms - Timestamp Based Algorithms- Optimistic Algorithms - Concurrency Control Algorithms.	10	Text Book
V	Real-time Operating System Real-Time Systems: Applications - Basic Model - Characteristics - Safety and Reliability - Types of Real-Time Tasks - Timing Constraints. Real-Time Task Scheduling: Characteristics - Task Scheduling: Clock-Driven Scheduling - Hybrid Schedulers - Event-Driven Scheduling - Earliest Deadline First Scheduling. Case Study: Commercial Real Time Operating Systems.	9	Text Book
Total		48	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)
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Text book	1.	Mukesh Singhal and Niranjana G. Shivaratri, 2019, "Advanced Concepts in Operating Systems - Distributed, Database, and Multiprocessor Operating Systems", Second Edition, Tata McGraw-Hill.
	2.	Rajib Mall, 2016, "Real-Time Systems: Theory and Practice", Second Edition, Pearson Education India.
Reference Books	1.	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, 2017, "Operating System Concepts", Seventh Edition, John Wiley & Sons.
	2.	Daniel P Bovet and Marco Cesati, 2015, "Understanding the Linux kernel", Third edition, O'Reilly.
	3.	Pradeep, K. Sinha, 1997, "Distributed Operating Systems Concepts and Design", First Edition, Prentice Hall of India.

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
Focus of the Course	Skill Development/ Employability

Semester - I CORE PRACTICAL - I: DESIGN AND ANALYSIS OF ALGORITHMS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1CP	DESIGN AND ANALYSIS OF ALGORITHMS	CORE	-	-	48	2 /

Preamble	This course has been designed for students to learn and understand • organize and store data efficiently • code optimization for performance and efficiently • creating scalable, efficient solutions to complex problems
Prerequisite	Knowledge on Algorithms

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental concepts of algorithm design paradigms.	K2
CO2	Apply appropriate algorithm to solve real-world graph-related optimization problems.	K3
CO3	Analyze the performance and efficiency of searching and sorting algorithms using iterative and recursive approaches.	K4
CO4	Evaluate the effectiveness of Dynamic Programming with Branch and Bound methods.	K5
CO5	Design efficient algorithms for problem-solving.	K6

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

26CSP1CP	DESIGN AND ANALYSIS OF ALGORITHMS
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S.No

List of Programs

- 1 Implement Binary Search using iterative and recursive methods.
- 2 Implement Strassen's Matrix multiplication using Non recursive approach.
- 3 Apply Divide and Conquer technique to arrange a set of numbers using Quick sort.
- 4 Implement Knapsack Problem using Greedy approach.
- 5 Implement Kruskal's algorithm using Greedy technique.
- 6 Implement Floyd's Algorithm for the All-Pairs Shortest-Paths Problem using Dynamic Programming.
- 7 Implement Dijkstra's Algorithm for Single-Source Shortest Path Problem.
- 8 Construct Optimal Binary Search trees using Dynamic Programming.
- 9 Implement Sum of Subsets problem using Backtracking.
- 10 Implement 8-Queens Problem using Backtracking.
- 11 Implement Knapsack problem using Branch and Bound Method.
- 12 Find the solution of Travelling Salesperson problem using Branch and Bound Technique.

Application

Develop a system that optimizes the delivery route for a logistics company. The system must decide which packages to carry and the most efficient path to deliver.

Text Book	1.	Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2025, "Fundamentals of Computer Algorithms", Second Edition, Universities Press Private Limited, India.
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Learning Method	Demonstration/ Hands on Experiments
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Focus of the Course	Skill Development/ Employability
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Semester - I CORE PRACTICAL - II : ADVANCED JAVA							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1CQ	ADVANCED JAVA	CORE		-	48	2

Preamble	This course has been designed for students to learn and understand • advanced usage of control flow statements • AWT components to design user interfaces • dynamic web page using JSP technology
Prerequisite	Knowledge on Java Programming

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand advanced Java features.	K2
CO2	Apply AWT and Swing frameworks to design and develop applications.	K3
CO3	Analyze enterprise Java architectures and Mail API.	K4
CO4	Design and Construct Servlet and JSP technologies to build dynamic web applications.	K6
CO5	Evaluate the performance and scalability of Java applications	K5

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

26CSP1CQ	ADVANCED JAVA
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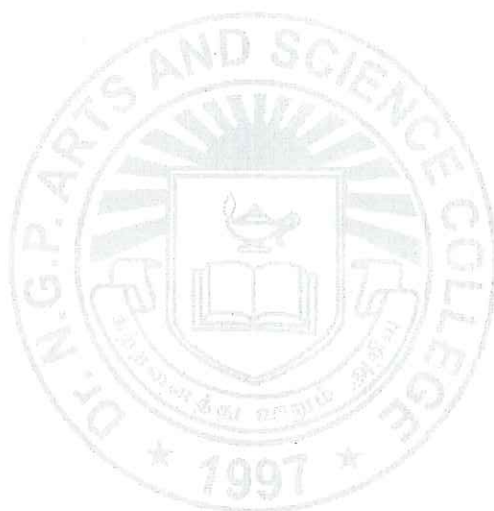
S.No	List of Programs
1	Programs to create applet incorporating features such as images, shapes, background, and foreground color.
2	Create applications using simple GUI.
3	Develop applications using Java Bean.
4	Create applications using Swing.
5	Programs to demonstrate AWT Components with Event Handling.
6	Programs to perform Session Tracking.
7	Program to send an email using Java Mail API.
8	Programs to send email with attachment using Java Mail API.
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

Application

Use Java technologies including Java Beans, Swing, Servlets, JSP, Java Mail API, Enterprise Java Beans (EJB), and JDBC to develop GUI-based, web-based, and enterprise-level applications for real-time problem-solving with database connectivity and email functionalities.

Text Books	1.	Herbert Schildt, 2017, "Java The Complete Reference", Tenth Edition, Tata McGraw Hill.
	2.	Jim Keogh, 2006, "J2EE: The Complete Reference", McGraw Hill Education.

Learning Method	Demonstration/ Hands on Experiments
Focus of the Course	Skill Development/ Employability



Semester - I							
DSE - I: NATURAL LANGUAGE PROCESSING							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1DA	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	Apply different NLP analysis techniques.	K3
CO3	Develop a model for applying discourse processing and natural language generation in real-world applications.	K6
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	S	S	S	S	S
CO2	S	S	M	S	S
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

26CSP1DA	NATURAL LANGUAGE PROCESSING
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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 Models - Statistical Language Model.	12	Text Book
II	Word Level, Syntactic and Semantic Analysis Word Level Analysis: Regular Expressions - Finite-State Automata - Spelling Error Detection and Correction. Syntactic Analysis: Context- Free Grammar - Constituency - Parsing - Probabilistic Parsing. Semantic Analysis: Lexical Semantics - Ambiguity - Word sense Disambiguation.	12	Text Book
III	Discourse Processing and Natural Language Generation Discourse Processing: Cohesion - Reference Resolution - Discourse Coherence and structure. Natural Language Generation: Architecture - Generation Task and Representations - Applications.	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 Machine Translation Systems - Translation involving Indian Languages. Lexical Resources: Wordnet -Framenet - Stemmers - Taggers. Case study: Evaluate the effectiveness of a corpus-based machine translation approach for handling informal Hindi-English translation.	12	Text Book
V	Information Retrieval and Lexical Resources Design Features of Classical, Non-Classical models- Information Retrieval (IR) Models: Natural Language Processing in IR - Relation Matching - Knowledge-based Approaches- Conceptual Graphs in IR- Cross-lingual Information Retrieval.	12	Text Book
Total		60	

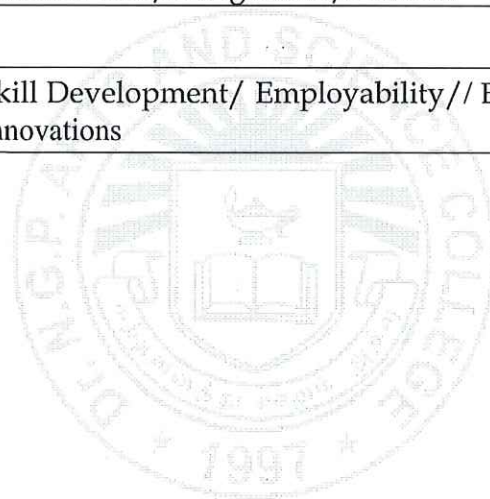
Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Tanveer Siddiqui, 2023, "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", 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=eea%20ce1d14e266a5cd44fe781a874c662928602fd
E-Resources and Website	https://www.deeplearning.ai/resources/natural-language-processing/

Learning Method	Chalk and Talk/ Assignment/Seminar
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Focus of the Course	Skill Development/ Employability// Entrepreneurial Development/ Innovations
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Semester - I DSE - I: FOUNDATIONS OF DATA SCIENCE							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1DB	FOUNDATIONS OF DATA SCIENCE	DSE	60		-	5

Preamble	This course has been designed for students to learn and understand - the fundamental concepts of data science, data analytics life cycle and types of data analysis - data preprocessing, visualization techniques and statistical methods for effective data interpretation - the applications of time-series, social media and business analytics in solving real-world problems.
Prerequisite	Basic knowledge of mathematics, statistics and fundamental programming concepts.

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the data analytics life cycle, data science tools, and SQL in handling real-world data problems.	K2
CO2	Apply data visualization techniques and tools to represent data.	K3
CO3	Analyze statistical methods and probability concepts to interpret data in data science applications.	K4
CO4	Evaluate time-series forecasting models for predicting temporal data.	K5
CO5	Design and develop analytics solutions for social media and business applications.	K6

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

26CSP1DB	FOUNDATIONS OF DATA SCIENCE
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Syllabus

Unit	Content	Hrs	Resources
I	Foundations of Data Science Introduction – Data Analytics Life Cycle -Types of Data Analysis – Data Science Tools – Broad areas of Studies in Data Science – Role of SQL in Data Science. Data Preprocessing: Introduction – Data types and Forms – error types – Data Preprocessing Operations.	12	Text Books
II	Data Plotting and Visualization Introduction to Visualization – Visual Encoding – Data Visualization Software – Libraries – Visualization tools: Basic, Specialized, Advanced – Visualization of geospatial data – Data Visualization types.	13	Text Books
III	Statistical Data Analysis Role of statistics in data science - Kinds of statistics: Descriptive statistics, Inferential Statistics – Probability theory.	10	Text Books/ Reference Books
IV	Time – Series Analysis Overview – Components of time-series – Time-series forecasting models: Stochastic models, Support Vector Machine based models, Artificial Neural Network.	12	Text Books
V	Social Media Analytics Overview – Layers – Analytics cycle – Methods. Business Analytics: Life cycle – basic tools – applications - Challenges. Case Study: Use of social media analytics and business analytics to analyze customer feedback and enhance service quality and delivery efficiency.	13	Text Books/ You-tube Videos
Total		60	

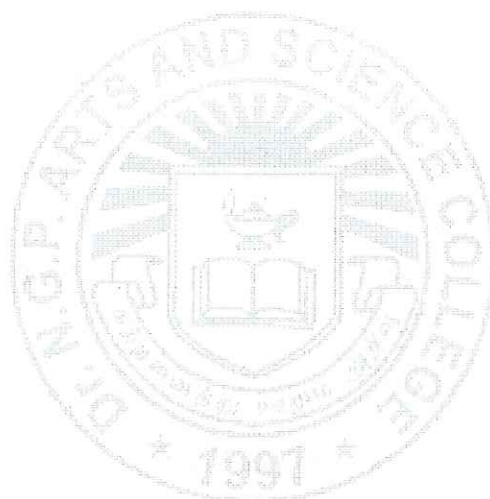
Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text books	1.	Gypsy Nandi, Rupam Sharma, 2020, "Data Science Fundamentals and Practical Approaches", Fourth Edition, McGraw Hill Education.
	2.	Davy Cielen, Arno D.B. Meysman, Mohamed Ali, 2023, " Introduction to Data Science ", DreamTech.
Reference Books	1.	Field Cady, 2017, "The Data Science Handbook", John Wiley & Sons.
	2.	Jiawei Han, Micheline Kamber Jian Pei, 2012, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers.
	3.	Nina Zumel, John Mount, 2020, "Practical Data Science with R", Second Edition, Manning Publications Co.
	4.	Rachel Schutt, Cathy O'Neil, 2017, "Doing Data Science", O'Reilly.

Journal and Magazines	https://journals.sagepub.com-
E-Resources and Website	https://ess.inflibnet.ac.in

Learning Method	Chalk and Talk/ Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability
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Semester - I DSE - I: ADVANCED COMPUTER NETWORKS							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26CSP1DC	ADVANCED COMPUTER NETWORKS	DSE	60	-	-	5

Preamble	This course has been designed for students to learn and understand • Introduce fundamental concepts of computer networks, Internet architecture, and protocol layering • Provide knowledge of application, transport, and network layer protocols for real-world communication systems. • Develop understanding of wireless networks, modern technologies, and security mechanisms in networking environments.
Prerequisite	Basic knowledge of computer fundamentals and data communication concepts.

Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply fundamental concepts of computer networks and protocol layers.	K3
CO2	Analyze application layer protocols such as HTTP, DNS, and email.	K4
CO3	Analyze transport layer protocols including TCP, UDP, and congestion control.	K4
CO4	Evaluate network layer protocols, IP addressing, and routing strategies.	K5
CO5	Design secure and efficient communication systems using networking and security concepts.	K6

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

26CSP1DC	ADVANCED COMPUTER NETWORKS
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction to Networks Protocols-Network Edge-Network Core-Delay, Loss and Throughput in Packet - Switched Networks-Protocol Layers and their Service Models-Networks under attack-History of Computer Networking and the Internet.	11	Text Book
II	Application Layer Principles of Network Applications -The Web and HTTP-Electronic Mail in the Internet-Domain Name System – The Internet's Directory Service-Peer-to-Peer File Distribution-Video Streaming and Content Distribution Networks-Socket Programming.	12	Text Book
III	Transport Layer Introduction and Transport Layer Services-Multiplexing and Demultiplexing-Connectionless Transport -Principles of Reliable Data Transfer-Connection Oriented Transport -TCP Congestion Control.	12	Text Book
IV	Network Layer Data Plane - Router - The Internet Protocol IPv4, Addressing, IPv6.Control Plane-Routing Algorithms- Open Shortest Path First -Routing Among the ISPs: Border Gateway Protocol - Software Defined Networking-Internet Control Message Protocol Network Management and Simple Network Management Protocol, Network Configuration Protocol /YANG(Yet Another Next Generation)	13	Text Book
V	Link Layer and Security in Network The Link Layer and LANs: Introduction to the Link Layer Error Detection and Correction Techniques. Security in networks: Principles of Cryptography -Message Integrity and Digital Signatures Securing E-Mail-Securing TCP Connections- IPSec and Virtual Private Networks Securing Wireless LAN 4G/5G Cellular Networks Operational Security. Case Study: Content Delivery Networks (CDN) - Netflix	12	Text Book
Total		60	

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

Text book	1.	James F. Kurose, Keith W. Ross, 2022, "Computer Networking: A Top-Down Approach", Eighth Edition, Pearson.
Reference Books	1.	Andrew S. Tanenbaum, David J. Wetherall, 2022, "Computer Networks", sixth Edition, Pearson Education/PHI.
	2.	Behrouz A. Forouzan, 2014, "Data Communications and Networking", Fifth Edition, McGraw-Hill, ISBN-13: 978-0-13-381474-3.
	3.	Larry L. Peterson, Bruce S. Davie, 2013, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann, ISBN-13: 978-1-29-201438-8.
	4.	William Stallings, 2017, "Data and Computer Communications", Tenth Edition, Pearson, ISBN-13: 978-0-13-350648-8.

Journal and Magazines	https://dl.acm.org/journal/ton
E-Resources and Website	https://ocw.mit.edu/courses/6-829-computer-networks-fall-2002/

Learning Method	Chalk and Talk/ Assignment/Seminar/ Case Study
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Focus of the Course	Skill Development/ Employability
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Amesh
 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 College		
APPROVED		
Date 21st 02.04.26	AC -	GB -