ABOUT THE DEPARTMENT

Computer Science & Engineering is the Core Department of the Arvind Gavali College of Engineering.

The Department of Computer Science and Engineering (CSE) was established in 2010, affiliated with Dr. Babasaheb Ambedkar Technological University (DBATU), Lonere. The CSE department is originally offering a 60-student intake for the B. Tech. program. The undergraduate intake has doubled to 120 seats.Arvind Gavali College of Engineering, Satara, has introduced the M.Tech. in Computer Science and Engineering (CSE) program from the Academic Year 2026–27 having intake 12, providing students with an opportunity to pursue advanced studies and research in the field of Computer Science and Engineering. The department was accredited by National Assessment and Accreditation Committee (NAAC 1st cycle) in 2016 and 2023(NAAC 2nd cycle) and National Board of Accreditation (NBA) in the year 2023.

The department has all UGC approved faculty members. The department has well-equipped laboratories. With the growing demand for Computer Science Engineers in the Government and private sectors, the department is making the best efforts to produce highly trained and capable engineers who can take up the challenges of the real world. The quality of academic instructions, guidelines, and college activities are designed to produce competent and successful engineers. In the Department, the focus is on preparing professional engineers.

Over the past decade, nine batches have graduated from the department. Students have consistently secured placements in respected companies and also pursued higher studies at prestigious universities. We actively support internships and facilitate participation in national and international competitions, hackathons, project exhibitions, and sports events. Our students have earned accolades at contests such as Diplex, Avishkar, and Rotarex.

The department is well-equipped: we feature smart classrooms with interactive panels, modern laboratories loaded with industry-standard software and hardware, and other academic resources. Our infrastructure supports hands-on and experiential learning, vital for today's tech-oriented education.

For the extra curriculum activities, the Departmental Association (CESA) has been established by the students. This association conducts various technical and cultural events regularly.

“Nothing is impossible for Computer Science Engineers with Skill Oriented Knowledge.”

DEPARTMENT VISION

To emerge as a premier center of excellence in postgraduate computer science education and research, nurturing highly skilled innovators and ethical leaders who drive global technological advancements for the sustainable benefit of industry and society.

DEPARTMENT MISSION

M1	**Advanced Technical Excellence:** To impart deep theoretical and practical knowledge in core computing, advanced algorithmic design, and emerging technologies like Artificial Intelligence and Data Science.
M2	**Research, Innovation & Problem Solving**: To cultivate a robust research culture that empowers students to investigate complex IT problems, utilize modern tools, and engineer innovative, scalable, and secure software systems.
M3	**Leadership, Ethics & Societal Impact:** To instill professional leadership, strong ethical values, and a commitment to lifelong learning, enabling graduates to design computing solutions that responsibly address global societal and industrial challenges.

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO 1	Establish a successful career or pursue higher education globally using a strong computing foundation.
PEO 2	Design secure computing systems that ethically address industrial and societal needs.
PEO 3	Exhibit leadership, ethics, and lifelong learning to adapt to rapid technological changes.

PROGRAM OUTCOMES (PO)

PO 1	An ability to independently carry out research/investigation and development work to solve practical problems.
PO 2	An ability to write and present a substantial technical report/document.
PO 3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO 4	Use research methods to investigate complex IT problems and derive valid conclusions.
PO 5	Apply modern IT tools and techniques to complex computing activities, understanding their limitations.

PO 6	Apply contextual reasoning to assess societal, health, safety, and legal issues in professional practice.

PROGRAM SPECIFIC OUTCOMES (PSO)	
PSO 1	Apply core computing concepts and algorithmic design to develop robust software systems.
PSO 2	Use modern software engineering practices, AI, and data science to build scalable, secure applications

MAPPING OF PEO's TO PO's						
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
PEO 1	**2**	**2**	**2**	**1**	**2**	**1**
PEO 2	**1**	**1**	**1**	**1**	**1**	**-**
PEO 3	**-**	**1**	**1**	**-**	**-**	**2**

MAPPING OF PEO's TO PSO's		
	PSO 1	**PSO 2**
PEO 1	**3**	**1**
PEO 2	**2**	**2**
PEO 3	**1**	**3**

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

B. Range of Credits:

A range of credits from 80 to 88 for a student to be eligible to get a postgraduate degree in engineering.

C. Structure & Definition:

SR. NO.	DEFINATION	CODE
1.	Basic Science Course	BSC
2.	Engineering Science Course	ESC
3.	Program Core Courses	PCC
4.	Program Elective Course	PEC
5.	Multi Minor	MDM
6.	Open Elective	OE
7.	Vocational and Skill Enhancement Course	VSEC
8.	Ability Enhancement Course	AEC
9.	Entrepreneurship /Economics/ Management Courses (Mgt./Economics/Mkt./Finance)	EEM
10.	Indian Knowledge System	IKS
11.	Value Education Course	VEC
12.	Research Methodology (Project)	ELC
13.	Common Egg. Project/Field Project (PBL/Seminar/Mini Project)	
14.	Project	
15.	Internship/OJT (PBL/Seminar/Mini Project/Virtual Internship/Physical)	
16.	Co-curricular Courses	CC

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• e-mail : agcenggsatara@gmail.com
• Website :-www.agce.edu.in
• Institute Code : Engg. DTE EN-6545

As per NEP Guidelines Proposed Scheme of Credit Distribution

Sr. No.	Year	FY		SY		Actual Credit
		I	II	III	IV	
1	Basic Science Course	4	--	--	--	4
2	Engineering Science Course	--	--	--	--	--
3	Program/Professional Core Courses	10	8	--	--	18
4	Program/Professional Elective Course	8	4	--	--	12
5	Multi Minor	--	--	--	--	--
6	Open Elective	--	4	--	--	4
7	Vocational and Skill Enhancement Course	--	2	--	--	2
8	Ability Enhancement Course	--	--	--	--	--
9	Entrepreneurship /Economics/ Management Courses (Mgt./Economics/Mkt./Finance)	--	--	--	--	--
10	Indian Knowledge System	--	2	--	--	2
11	Value Education Course	--	--	--	--	--
12	Research Methodology	--	--	--	--	--
13	Common Egg. Project/Field Project (PBL/Seminar/Mini Project)	--	1	--	--	1
14	Project	--	--	10	20	30
15	Internship/OJT (PBL/Seminar/Mini Project/Virtual Internship/Physical)	--	--	10	--	10
16	Co-curricular Courses	--	--	--	--	--
	Total Credits	**22**	**21**	**20**	**20**	**83**

D. Semester wise credit distribution:

First Year M. Tech. **SEMESTER I**

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs./ Week	CR	Components	Max	Min For Passing	
1	BSC	26MCS1101	Applied Mathematics-Number Theory Concepts	3	1	0	4	4	CA1	15		45
									MSE	20		
									CA2	15		
									ESE	50	20	
2	PCC	26MCS1102	Advanced Design and Analysis of Algorithm	4	0	0	4	4	CA1	15		45
									MSE	20		
									CA2	15		
									ESE	50	20	
3	PEC	26MCS1103	Program Elective-I	4	0	0	4	4	CA1	15		45
									MSE	20		
									CA2	15		
									ESE	50	20	
4	PEC	26MCS1104	Program Elective-II	4	0	0	4	4	CA1	15		45
									MSE	20		
									CA2	15		
									ESE	50	20	
5	PCC	26MCS1105	Research Methodology	4	0	0	4	4	CA1	15		45
									MSE	20		
									CA2	15		
									ESE	50	20	
6	PCC	26MCS1106L	Advanced Laboratory Practices-I	0	0	4	4	2	CA1	25		45
									CA2	25		
									POE	50	20	
7	VEC	26MCS1107	YOGA for Stress Management	0	0	2	2	AU	CA1	25		--
									CA2	25		
									POE	--	--	
			Total	**19**	**1**	**6**	**26**	**22**		**650**		
Total Contact hours=26									**Total Credits = 22**			

Program Elective I (PE-I)

Program Elective - I	
A)	Big Data Analytics and Visualization
B)	Computer Vision
C)	Pervasive Computing

Program Elective II (PE-II)

Program Elective - II	
A)	Augmented Reality and Virtual Reality
B)	Agile Methodologies
C)	Quantum Computing

First Year M. Tech. **SEMESTER II**

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hr/ Week	Cr	Components	Max	Min for Passing	
1	PCC	26MCS1201	Advanced Database Management Systems	4	0	0	4	4	CA1 MSE CA2 ESE	15 20 15 50	 20	45
2	PCC	26MCS1202	Advanced Computer Networks & Security	4	0	0	4	4	CA1 MSE CA2 ESE	15 20 15 50	 20	45
3	PEC	26MCS1203	Program Elective-III	4	0	0	4	4	CA1 MSE CA2 ESE	15 20 15 50	 20	45
4	OE	26MCS1204	Open Elective-I	4	0	0	4	4	CA1 MSE CA2 ESE	15 20 15 50	 20	45
5	VSEC	26MCS1205L	Advanced Laboratory Practices-II	0	0	4	4	2	CA1 MSE CA2 ESE	25 -- 25 50	 20	45
6	ELC	26MCS1206	Mini Project	0	0	2	2	1	CA1 MSE CA2 ESE	25 -- 25 50	 20	45
7	IKS	26MCS1207	IKS Bucket	2	0	0	2	2	CA1 MSE CA2 ESE	25 -- 25 --	 --	20
8	VEC	26MCS1208	Disaster Management / Environmental Engineering	3	0	0	3	AU	CA1 CA2 POE	25 25 --	 --	--
				21	**0**	**6**	**27**	**21**		**700**		

Total Contact Hours = 27 **Total Credits = 21**

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Program Elective III (PE-III)

Program Elective -III	
A)	Cloud and Hybrid Data Storage Architecture.
B)	Generative Adversarial Networks
C)	Soft Computing

Open Elective – I (OE-I)

Open Elective I	
A)	New Labour Codes of India
B)	Green Computing and Sustainability
C)	Environment and Development

IKS Bucket

Indian Knowledge System (IKS)	
A)	Indian Knowledge System (IKS): Concepts and Applications in Engineering
B)	Indian Knowledge System(IKS): Humanities and Social Sciences

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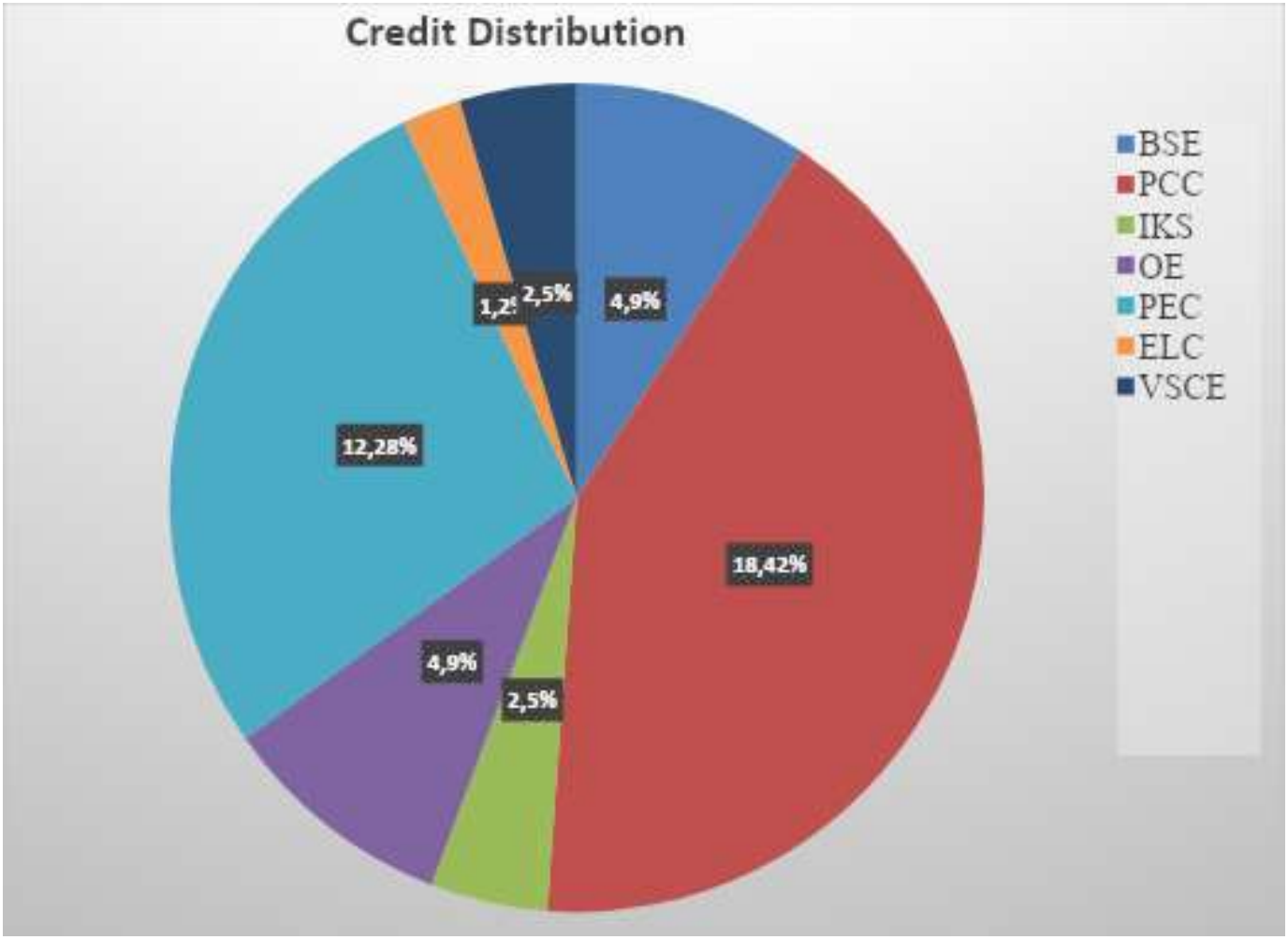
Second Year M. Tech. **SEMESTER III**

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs. / Week	Cr	Component	Max	Min for Passing	
1	ELC	26MCS2301	Internship	0	0	20	20	10	CA1	25		45
									MSE	--		
									CA2	25		
									POE	50	20	
2	ELC	26MCS2302	Dissertation Phase I	0	0	20	20	10	CA1	50		90
									MSE	--		
									CA2	50		
									POE	100	40	
			Total	**0**	**0**	**40**	**40**	**20**		**300**		
Total Contact Hours –40 Total Credits -20												

Second Year M. Tech. **SEMESTER IV**

Sr. No.	Category	Course Code	Course Name	Teaching Scheme					Evaluation Scheme			
				L	T	P	Hrs/Week	Cr	Components	Max	Min for Passing	
1	ELC	26MCS2401	Dissertation Phase II	0	0	40	40	20	CA1	50		90
									MSE	--		
									CA2	50		
									POE	100	40	
			Total	**0**	**0**	**40**	**40**	**20**		**200**		
Total Contact Hours – 40									**Total Credits – 20**			

E. Category wise Credit Distribution



PCC: PROGRAM CORE COURSES

Sr. No.	Course Code	Course Name	L	T	P	Hrs. / Week	Credits
1	26MCS1102	Applied Mathematics- Number Theory Concepts	3	1	0	4	4
2	26MCS1105	Research Methodology	4	0	0	4	4
3	26MCS1106L	Advanced Laboratory Practices-I	0	0	4	4	2
4	26MCS1201	Advanced Database Management Systems	4	0	0	4	4
5	26MCS1202	Advanced Computer Networks & Security	4	0	0	4	4
		Total	15	1	4	20	18

PEC: PROGRAM ELECTIVE COURSES							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	26MCS1103	Big Data Analytics and Visualization	4	0	-	4	4
2		Computer Vision					
3		Pervasive Computing					
4	26MCS1104	Augmented Reality and Virtual Reality	4	0	-	4	4
5		Agile Methodologies					
6		Quantum Computing					
7	26MCS1203	Cloud and Hybrid Data Storage Architecture	4	0	-	4	4
8		Generative Adversarial Networks					
9		Soft Computing					
Total			**12**	**0**	**-**	**12**	**12**

OEC: OPEN ELECTIVE COURSES							
Sr. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Hrs. / Week**	**Credits**
1	26MCS1204	New Labor Codes of India	4	--	--	4	4
2		Green Computing and Sustainability					
Total			**4**	**--**	**--**	**4**	**4**

Title of the Course: Applied Mathematics – Number Theory Concepts	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1101	**3**	1	**--**	4

COURSE Pre-Requisite: Basic knowledge of Engineering Mathematics, Linear Algebra, Probability and Fundamentals of Computer Science.

COURSE DESCRIPTION:

This course provides mathematical foundations required for advanced computing, data science, cryptography, intelligent systems and machine learning. It emphasizes linear algebra, probability theory, statistical inference, number theory and numerical methods used in computational analysis, optimization and secure communication.

COURSE OBJECTIVES:

- To provide mathematical foundations required for advanced computing, data science and intelligent systems.
- To develop understanding of linear algebra, probability and statistical inference used in machine learning and computational analysis.
- To introduce number theoretic techniques used in cryptography and secure computing.
- To apply mathematical and statistical tools for solving real-world engineering and research problems
- To enhance analytical and computational skills through mathematical modelling and data analysis techniques.

COURSE OUTCOMES:

CO	After the completion of the course, the students should be able to
CO1	Apply concepts of vector spaces, matrix factorization and linear transformations in computational systems.
CO2	Analyze statistical distributions and inferential techniques for engineering datasets.
CO3	Use number theory concepts in cryptographic and algorithmic applications.
CO4	Apply probability models and regression techniques for predictive analytics.
CO5	Utilize mathematical methods for optimization, machine learning and intelligent data analysis.

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	2	-
CO2	3	3	-	2	2	-
CO3	3	2	2	-	2	-
CO4	3	3	2	2	3	-
CO5	3	3	3	2	3	-

ASSESSMENT SCHEME:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	**Marks**
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Assignment/ Declared test/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE.

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1	**Linear Algebra Basics and Matrix Decomposition Algorithms – SVD:** Vector spaces and subspaces, Linear independence and dependence, Basis and dimensions, Coordinate vectors, Linear transformation, Orthogonal vectors and orthogonal basis, Gram Schmidt process, Matrix factorization concept, QR decomposition, Singular Value Decomposition (SVD), Low rank approximations.	09
2	**Data Analysis & Probability Theory:** Experiments, outcomes and events, Random variables – discrete and continuous, PMF, PDF, Joint probability distributions, Conditional probability, Bayes theorem, Mean and variance, Binomial, Poisson and Normal distributions, Mathematical expectation, Distributions of several random variables.	08
3	**Statistical Inference and Inferential Statistical Techniques:** Descriptive statistics, Inferential statistics, Measures of central tendency, Measures of dispersion, Correlation analysis, Covariance, Pearson Correlation, Hypothesis testing, Chi-Square test, t-test and z-test, ANOVA, Linear and nonlinear regression, Curve fitting.	08
4	**Number Theory and Cryptography:** Divisibility, GCD and Euclidean algorithm, Congruences and modular arithmetic, Linear congruences, Chinese Remainder theorem, Linear Diophantine equations, Euler's theorem, Fermat's little theorem, Wilson theorem, Solving polynomials, Applications in cryptography and secure communication.	09
5	**Numerical Linear Algebra and Intelligent Data Analysis:** Gaussian elimination in practice, Iterative methods and pre-conditioners, Optimization and gradient descent, Partial derivatives, Jacobian and Hessian, Regression models and evaluation, Bayesian classifiers and network, PCA, Mathematical foundations for machine learning, Intelligent data analysis, Data analytics applications in AI and cyber security.	08

TEXTBOOKS:

Sr. No.	Title	Author	Publisher
1	Linear Algebra and Its Applications	David C. Lay, Steven R. Lay and Judi J. McDonald	Pearson Education, 5th Edition, 2015
2	Probability, Statistics and Random Processes	T. Veerarajan	Tata McGraw Hill, 3rd Edition, 2016
3	A Course in Number Theory and Cryptography	Neal Koblitz	Springer Verlag, Second Edition
4	Linear Algebra Done Right	Sheldon Axler	Springer, 2017
5	Applied Statistics and Probability for Engineers	Douglas C. Montgomery and George C. Runger	Wiley, 2018

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers, 44th Edition, 2017
2	Introduction to Linear Algebra	Gilbert Strang	Wellesley-Cambridge Press, Fifth Edition
3	Mathematics for Machine Learning	Marc Peter Deisenroth et al.	Cambridge University Press
4	Probability and Statistics for Engineers	Richard A. Johnson, Irwin Miller and John Freund	Reference Text
5	Elementary Number Theory	Burton, David M.	W.C. Brown Publishers, 1989
6	Foundation Mathematics for Computer Science	John Vince	Springer International Publishing, 2015

Title of the Course: Advanced Design and Analysis of Algorithm.	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1102	**4**	**0**	**--**	**4**

COURSE Pre-Requisite: Theory of Computation Design and Analysis of Algorithm.

COURSE DESCRIPTION:

Covers sophisticated techniques for designing efficient algorithms and analyzing their complexity, focusing on optimization, randomized algorithms, approximation, and handling NP-hard problems. Key areas include advanced data structures, graph algorithms, flow networks, string matching, and number theory, with an emphasis on algorithmic paradigms such as divide-and-conquer, greedy, and dynamic programming.

COURSE OBJECTIVES:

- Analyze the non-recursive and recursive algorithms and to represent efficiency of these algorithms in terms of the standard Asymptotic notations.
- Devise the Brute Force and Divide and Conquer techniques to design the algorithms and apply these methods in designing algorithms to solve a given problem.
- Explain the Decrease and Conquer, Transform and Conquer algorithm design techniques, and Time versus Space Trade-offs
- Get the idea of Greedy method and dynamic programming methods and apply these methods in designing algorithms to solve a given problem
- Describe and illustrate the idea of Backtracking and Branch and Bound algorithm design techniques to solve a given problem

COURSE OUTCOMES:

CO	**After the completion of the course, the students should be able to**
CO1	Explain the algorithm design techniques and standard asymptotic notations.
CO2	Interpret. Graph data structures are particularly useful in fields such as social Network analysis, recommendation systems, and computer networks.
CO3	Describe String matching algorithms it helps in performing time-efficient tasks in multiple domains
CO4	Identify and explain introduces important algorithms and techniques of scientific computing, focusing on the areas of linear algebra and matrix computations.
CO5	Describe A linear programming algorithm finds a point in the polytope where this function has the smallest (or largest) value if such a point exists and Randomized Algorithms.

ASSESSMENT SCHEME:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Assignment/ Declared test/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	1	0
CO2	3	3	2	2	1	1
CO3	2	3	3	2	2	1
CO4	2	2	3	3	2	2
CO5	2	3	3	2	2	1

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1	**Analysis Techniques:** Growth of Functions: Asymptotic notations, Standard notations and common functions, Beyond standard asymptotic analysis, this includes amortized analysis (evaluating average performance over a sequence of operations, Aggregate, Accounting and Potential Methods) and randomized algorithm analysis.	09
2	**Advanced Data Structures:** Structures like Fibonacci heaps, disjoint set union, and complex search trees.	09
3	**Graph Algorithms:** Techniques for finding strongly connected components, bi-connected components, maximum flow (Ford-Fulkerson, Edmonds-Karp), and efficient shortest path algorithms. Johnson's Algorithm for sparse graphs, Maxflow-mincut theorem, Maximum bipartite matching	09
4	**String Matching:** Algorithms such as KMP (Knuth-Morris-Pratt), Rabin-Karp, and Aho-Corasick, Boyer – Moore algorithms.	09
5	**Optimization Strategies:** Advanced Dynamic Programming (e.g., bitonic TSP) and Approximation algorithms for NP-hard problems.	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Introduction to Algorithms	Thomas H. Cormen, Charles E.Leiserson, Ronald L. Rivest, Clifford Stein	3rd Edition, PHI
2	Algorithms	Kenneth A. Berman	.Cengage Learning. 2002

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Introduction to Algorithms	Cormen, Leiserson, Rivest, Stein	3rd Edition, The MIT Press Cambridge, Massachusetts London, England.
2	The Design and Analysis of Computer Algorithms	Aho, Hopcroft, Ullman	Addison-W~ley Publishing Company Reading. Massachusetts Menlo Park. California London· Amsterdam· Don Mills. Ontario · Sydney
3	Algorithm Design	Kleinberg and Tardos	Boston San Francisco New York London Toronto Sydney Tokyo Singapore Madrid Mexico City Munich Paris Cape Toxvn Hong Kong Montrea.

E-RESOURCES:

1. https://nptel.ac.in/courses/106/101/106101060/

2. http://cse01-iiith.vlabs.ac.in/

3. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms

4. Harvard University - YouTube 5. MIT Open Course Ware – YouTube

Title of the Course: Big Data Analytics and Visualization	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1103	**4**	**0**	**--**	**4**

COURSE Pre-Requisite: Database Management Systems, Computer Networks

COURSE DESCRIPTION:

Big Data Analytics and Visualization is a course designed to provide students with knowledge and practical skills for handling, processing, analyzing, and visualizing large-scale data generated from various sources. The course introduces concepts of big data, data analytics techniques, distributed computing frameworks, and data processing tools used for extracting meaningful insights from complex datasets. It also focuses on data visualization methods and tools to represent analytical results effectively through charts, dashboards, and graphical reports. Students gain understanding of technologies such as Hadoop, MapReduce, data mining, statistical analysis, and visualization techniques that support data-driven decision-making in real-world applications.

COURSE OBJECTIVES:

- To understand the fundamental concepts, architecture, and challenges of Big Data Analytics.
- To learn data processing and distributed computing techniques used for handling large-scale datasets.
- To apply analytical methods and tools for extracting meaningful insights from structured and unstructured data.
- To develop skills in data visualization for effective interpretation and presentation of analytical results.
- To understand real-world applications of big data technologies in decision-making and problem-solving.

COURSE OUTCOMES:

CO	**After the completion of the course, the students should be able to**
CO1	Understand the concepts, characteristics, architecture, and applications of Big Data Analytics.
CO2	Apply distributed computing and data processing techniques for handling large datasets.
CO3	Analyse structured and unstructured data using big data analytics methods and tools.
CO4	Design effective visual representations and dashboards for data interpretation and decision-making.
CO5	Implement big data solutions for real-world applications using modern analytics and visualization tools.

ASSESSMENT SCHEME:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Assignment/ Declared test/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	-	-	1	-
CO2	3	3	2	2	3	-
CO3	3	3	3	3	2	-
CO4	2	3	3	2	3	-
CO5	3	3	3	2	3	1

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1	**Big Data Overview:** characteristics, types, sources, architectures, Data analysis process, Data analytics lifecycle, Preprocessing data, Market and Business Drivers for Big Data Analytics, Business Problems Suited to Big Data Analytics	09
2	**Distributed and Parallel Computing for Big Data:** Cloud Computing and Big Data, In-Memory Computing Technology for Big Data, Introduction to Hadoop, HDFS, MapReduce, YARN, HBase, Combining HDFS and Hbase, Hadoop ecosystem	09
3	**NoSQL Data Management :** Introduction to NoSQL, Impedance mismatch, Emergence of NoSQL, Aggregate data models, Key-value and document data models, Column family stores, Graph databases, Schemaless databases, Distribution models- sharding, Master-slave replication, Peer-peer replication, Sharding and replication, Relaxing consistency - CAP Theorem	09
4	**Matplotlib Anatomy and Tableau Advanced visualization:** How to explore a dataset in Pandas- Building data frames. Anatomy of a Plot, Pie and Bar Charts, Histograms, Customizing your view of the data in Tableau, Chart types, Viewers, Dragging Fields, Shelves and Cards, Multidimensional Hierarchies, Perfect Pivoting, Maps, Dashboards, Advanced visualization Forecasting, Parameters, Background Images, Background Maps	09
5	**R Programming for visualization:** R Basics: Vectors, Factors, Sequences, Subletting, Matrices and Arrays, Lists, Data Frames, Functions, graphical language, geoms and aesthetics, line and point plots, scatterplots, histograms, boxplots, density plots, bar charts heat maps, error bars	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,	Michael Mineli, Michele Chambers, AmbigaDhiraj,	Wiley Publication
2	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot	P. J. Sadalage, M. Flower	Persistence
3	Big Data Fundamentals-Concepts, Drivers and Techniques"	Thomas Erl	Thomas Erl
4	The elements of statistical learning: data mining, inference and prediction	Hastie, T., Tibshirani, R.,, Friedman, J	Springer

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Python and R for the Modern Data Scientist	Rick J. Scavetta, Boyan Angelov	June 2021 Publisher(s): O'Reilly Media, Inc.
2	Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization	DT Editorial Service	Dreamtech Press
3	Data Science and Big Data Analytics	David Dietrich, Barry Hiller	EMC education services, Wiley Publications

E-RESOURCES:

1. https://nptel.ac.in/courses/106104189
2. https://www.unssc.org/courses/e-learning-path-data-analytics-1
3. https://pll.harvard.edu/subject/data-visualization/free

Title of the Course: Computer Vision	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1103	**4**	**--**	**--**	**4**

COURSE Pre-Requisite: Linear Algebra, Probability, Machine Learning, Python Programming.

COURSE DESCRIPTION:

This course provides a comprehensive understanding of computer vision, covering both classical image processing techniques and modern deep learning-based approaches. It includes image enhancement, feature extraction, segmentation, object detection, motion analysis, and 3D vision. The course also explores advanced topics such as SLAM, generative models, and attention mechanisms, enabling students to develop intelligent vision-based systems for real-world applications.

COURSE OBJECTIVES:

- To understand image processing fundamentals and feature extraction techniques
- To apply segmentation and classical computer vision algorithms
- To analyze deep learning models for image classification, detection, and segmentation
- To evaluate motion analysis and tracking algorithms
- To design solutions using 3D vision and geometric modelling

COURSE OUTCOMES:

CO	**After the completion of the course, the student should be able to**
CO1	Explain image formation, enhancement techniques, and feature extraction methods
CO2	Apply segmentation, shape analysis, and feature matching techniques
CO3	Analyze deep learning models for image classification, detection, and segmentation
CO4	Evaluate motion estimation, tracking, and activity recognition methods
CO5	Design systems using 3D vision, camera models, and multi-view geometry

ASSESSMENT SCHEME:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

CA1 and **CA2** are based on Assignment/ Declared test/ Quiz/Seminar/Group discussions presentation, etc.

MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE

CO-PO MAPPING:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	-
CO2	3	3	2	1	2	-
CO3	2	3	3	2	3	1
CO4	2	3	3	3	2	1
CO5	2	2	3	3	3	2

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1.	**Unit I: Image Processing Basics & Features Extraction** Image formation and models, gray-level transformations, histogram processing, spatial filtering, morphological operations, edge detection, corner detection, texture feature extraction:GLCM ,Gabor filters, feature descriptors :SIFT, ORB, HOG.	**8**
2.	**Unit II: Segmentation & Shape Analysis** Image segmentation: Thresholding, clustering techniques: Watershed,K-means, connected components, labelling, shape representation: boundary descriptors, Hough Transform: line detection, feature matching basics, RANSAC algorithm.	**7**
3.	**Unit III: D eep Learning for Computer Vision** Neural networks, training and optimization: backpropagation, optimizers: SGD, Adam, CNN fundamentals, architectures: AlexNet, VGG, ResNet, DenseNet, Object detection: R-CNN, Fast R-CNN, YOLO, Image segmentation: U-Net, Mask R-CNN	**7**
4.	**Unit IV:3D Vision & Geometry** Camera models: perspective, projective, Camera calibration basics: intrinsic parameters, Epipolar geometry, fundamental matrix, homography, 3D reconstruction: triangulation basics, Introduction to SLAM	**6**
5.	**Unit V: Motion Analysis, & Tracking** Optical Flow, Object tracking: Kalman Filter, DeepSORT, Action recognition using CNN + RNN, LSTM basics, Pose estimation	**8**

TEXT BOOKS:

Sr. No	Title	Author	Publisher
1	Digital Image Processing, Fourth Edition, Global Edition.	Gonzalez and. Richard E. Woods	Pearson
2.	Fundamentals of digital image processing	Anil K. Jain	Prentice Hall, Englewood Cliffs,
3	Computer Vision Algorithms and Applications, 2010	Richard Szelinski,	Springer
4	"Computer Vision – A Modern Approach", Second Edition, 2011.	Forsyth and Ponce,	Prentice Hall

REFERENCE BOOKS:

Sr. No	Title	Author	Publisher
1	Fundamentals of Computer Vision,	Mubarak Shah.	Prentice Hall
2	Computer Vision: Models, Learning, and Interface	Simon Prince	Cambridge University Press

E-RESOURCES:

1. nptel.ac.in/courses/106105216
2. Computer Vision | Coursera

Title of the Course: Pervasive Computing	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1103	**4**	**-**	**-**	**4**

COURSE Pre-Requisite:

Computer Networks, Operating Systems, Wireless Communication (basic)

COURSE DESCRIPTION:

Introduces architectures, concepts and challenges of pervasive/ubiquitous computing systems. Covers context-awareness, middleware, mobile/pervasive networking, enabling technologies (sensors, WSN, IoT), interaction and HCI in pervasive settings, and security, privacy, and ethical issues. Emphasis on design of context-aware services, middleware architectures, and applications in smart homes, healthcare, wearable's, and intelligent spaces..

COURSE OBJECTIVES:

- Introduce architectures, vision, and characteristics of pervasive/ubiquitous computing systems.
- Explain enabling technologies (sensors, WSN, IoT nodes, wireless protocols) and resource constraints.
- Teach context collection, reasoning, and middleware design for context-aware services.
- Explore HCI, interaction models, and usability for wearable's and voice-enabled systems.
- Discuss transaction models, security, privacy, trust, and ethical/social implications in pervasive systems.

COURSE OUTCOMES:

CO	**After the completion of the course the student should be able to**
CO1	Explain the architecture, vision, and characteristics of pervasive and ubiquitous computing systems.
CO2	Describe enabling technologies (sensors, WSN, IoT nodes, wireless protocols) and constraints in pervasive environments
CO3	Design context-aware services and middleware architectures for smart environments (e.g., smart homes, offices)
CO4	Analyze HCI, interaction models, and usability in pervasive settings (wearables, voice-enabled systems)
CO5	Evaluate security, privacy, trust, and ethical issues in pervasive and IoT systems.

ASSESSMENT SCHEME:

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CA1	15
MSE	20
CA2	15
ESE	50

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ESE is based on 100% course content with 60-70% weightage for course content covered after MSE

CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	1
CO2	3	2	3	1	3	0
CO3	3	3	2	2	2	1
CO4	2	2	3	3	3	2
CO5	3	3	2	2	2	1

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1	**Introduction to Pervasive & Ubiquitous Computing:** Definition, vision, and evolution of pervasive/ubiquitous computing.Key characteristics: invisibility, context-awareness, unobtrusiveness, adaptability.Differences between mobile computing and pervasive computing.Example architectures: HP Cooltown, Microsoft Easy Living, smart spaces	09
2	**Technologies and Infrastructure :** Embedded devices, sensors, actuators, RFID, NFC, and IoT nodes.Wireless sensor networks (WSN) and low-powered wireless protocols (BLE, ZigBee, LoRa).Smartphones, wearable, smart appliances, and environmental nodes.Energy and resource constraints; power management strategies.	09
3	**Context-Aware and Middleware Systems** : Concept of context: location, time, activity, environment, social, physiological. Context collection, sensing, and reasoning techniques; context models, Pervasive middleware: AURA, GAIA, ONE.WORLD; service discovery, Task migration, resource discovery, and context-driven service adaptation	09
4	**Interaction, HCI, and Smart Environments:** Human–Computer Interaction in pervasive environments, Interaction transparency, context-driven HCI service selection, interaction migration, Smart homes, offices, Intelligent Spaces (e-Campus, IPSpace), ambient intelligence. Voice-enabled pervasive computing and wearable interaction models; usability evaluation.	09
5	**Transactions, Applications, and Security:** Mobile and pervasive transaction models, context-aware transactions, dynamic transaction management.Applications: Internet of Things (IoT), smart traffic, healthcare, wearable systems, social computing.Security and privacy: authentication, authorization, access control, secure discoveryPrivacy issues, trust, ethics, legal and social implications of pervasive computing.	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Ubiquitous Computing: Smart Devices, Environments and Interactions,	Stefan Poslad	Wiley.
2	Pervasive Computing: Technology and Architecture of Mobile Internet Applications	Jochen Burkhardt	Pearson.

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Building the Web of Things (practical IoT integration)	Cormen, Leiserson, Rivest, Stein D. Guinard, V. Trifa, and E. Wilde	Springer, 2017
2	Pervasive Computing: An Application-Based Approach	Guruduth S. Banavar, Norman H. Cohen, Chandra Narayanaswami	Wiley, 2021
3	Pervasive Computing: Engineering Smart Systems	Natalia Silvis-Cividjian	Springer, 2017

Title of the Course: Augmented Reality and Virtual Reality	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1104	**4**	**-**	**-**	**4**

Course Pre-Requisite: Knowledge of Computer Graphics, Human-Computer Interaction, Programming (C++/Python/Unity C#), Linear Algebra and Basic AI concepts.

COURSE DESCRIPTION:

This course introduces students to the rapidly evolving fields of Augmented Reality (AR), Virtual Reality (VR), and Multimedia Computing. Students will develop both theoretical foundations and hands-on implementation skills across the full AR/VR/multimedia pipeline — from media encoding and rendering principles to immersive experience design and deployment. The course bridges computer graphics, human-computer interaction, signal processing, and 3D application development.

COURSE OBJECTIVES:

- Understand fundamentals of AR, VR and MR
- Explore hardware and software components.
- Develop AR/VR applications.
- Understand tracking, rendering and visualization.
- Analyze industrial applications and future trends.

COURSE OUTCOMES:

CO	**After the completion of the course, the students should be able to**
CO1	Explain concepts and technologies of AR/VR/MR.
CO2	Analyze immersive displays, sensors and tracking systems.
CO3	Design AR/VR applications using Unity and Unreal Engine.
CO4	Apply Computer Vision and Rendering Techniques.
CO5	Evaluate AR/VR solutions for real-world applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	2	-
CO2	3	3	2	2	1	-
CO3	3	3	3	2	2	-
CO4	3	3	3	3	2	-
CO5	3	2	2	2	2	-

ASSESSMENT SCHEME:

Two components of Continuous Assessment (CA-1, CA-2), Mid Semester Examination (MSE) and End Semester Examination (ESE) having 30%, 20% and 50% weightage respectively.

Assessment Component	Marks
CA1	15
MSE	20
CA2	15
ESE	50

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COURSE CONTENTS

Unit No.	Unit Title and Contents	Hours
1	**Introduction to Multimedia:** Definition, components, and applications. Multimedia data types: text, audio, image, video, animation. Human perception model for AV systems. Color models: RGB, CMYK, HSV, YCbCr. Multimedia file formats: JPEG, PNG, MP3, AAC, MP4, WebM.	09
2	**Lossless compression:** Huffman, LZW, Run-Length Encoding. Lossy compression: DCT-based image compression, JPEG standard. Audio coding: PCM, ADPCM, MP3/AAC psychoacoustic models. Video compression: Motion estimation, inter/intra-frame coding, H.264/H.265, AV1. Multimedia streaming: protocols (RTSP, HLS, DASH), adaptive bit-rate, CDN, latency optimization.	09
3	**3D coordinate systems, homogeneous coordinates, transformations. Rendering pipeline:** vertex processing, rasterisation, fragment shading. Real-time rendering: OpenGL/Vulkan/WebGL fundamentals. PBR materials, lighting models (Phong, Cook-Torrance). Level of Detail (LoD), occlusion culling, frustum culling. Post-processing: bloom, SSAO, HDR tone-mapping.	09
4	**VR concepts and history; presence, immersion, and embodiment. Head-Mounted Displays (HMDs):** optics, display specs, refresh rate, FOV. 6DoF tracking: IMUs, optical inside-out and outside-in tracking. VR interaction: gaze, gesture, controller, haptics. Spatial audio: HRTF, ambisonics, room acoustics simulation. VR development pipeline: Unity XR / Unreal VR template. Comfort & accessibility: VR sickness, locomotion design, inclusive UX.	09
5	**AR taxonomy: marker-based, marker less, location-based. Camera calibration: intrinsic and extrinsic parameters, distortion correction. Marker tracking:** ArUco, AprilTag, QR-code detection. Feature-based tracking: ORB, SIFT, FAST descriptors. SLAM fundamentals: visual odometry, keyframe selection, map maintenance. Plane detection, scene understanding, occlusion handling. AR development: ARKit, ARCore, OpenCV + Unity AR Foundation. Wearable AR: optical see-through vs. video pass-through displays.	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Augmented Reality: Principles and Practice –	Schmalstieg & Hollerer	CareerMonk Publications
2	Virtual Reality	Steven LaValle	MIT Press
3	Learning Virtual Reality	Tony Parisi	Wiley India Pvt. Ltd..
4	Practical Augmented Reality	Steve Aukstakalnis	CBS Publishers & Distributors
5	Unity Virtual Reality Projects	Jonathan Linowes	Franklin, Beedle & Associates

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Understanding Virtual Reality	Sherman & Craig	MIT Press
2	3D User Interfaces	Doug Bowman	Springer
3	Computer Vision: Algorithms and Applications	Richard Szeliski	Cambridge University Press

Title of the Course: Agile Methodologies	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1104	4	--	--	4

COURSE PRE-REQUISITE:

This course requires the basic knowledge of Software Engineering, programming concepts, and Software Development Life Cycle (SDLC). Students should also be familiar with software testing, project management basics, and team-based software development practices.

COURSE DESCRIPTION:

This course introduces fundamental concepts of linear differential equations, Fourier series, and Laplace transforms with applications in engineering problems. It also covers discrete mathematical structures including relations, functions, and graph theory. The course emphasizes analytical techniques, problem-solving skills, and the application of mathematical tools in areas such as signal processing, system analysis, and computer science

COURSE OBJECTIVES:

- Compare and contrast the differences between Agile and other Traditional project management Methodologies.
- Interpret and apply various Scrum principles, phases and activities of the Scrum methodology
- Develop the Agile Scrum planning principles for real life situations and learn the basics of SAFe for scaled agile
- Understand the Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile
- Identify and use the various tools for Agile development and DevOps principles for CI/CD.

COURSE OUTCOMES:

CO	**After the completion of the course the student should be able to**
CO1	Compare and contrast the differences between Agile and other Traditional project management methodologies.
CO2	Interpret and apply various Scrum principles, phases and activities of the Scrum methodology
CO3	Develop the Agile Scrum planning principles for real life situations and learn the basics of SAFe for scaled agile
CO4	Understand the Agile Testing principles for real life situations and learn the basics of SAFe for scaled agile
CO5	Identify and use the various tools for Agile development and DevOps principles for CI/CD

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	-	-	-	-
CO2	2	3	2	-	-	-
CO3	2	3	3	2	-	-
CO4	2	2	2	3	2	-
CO5	2	2	3	2	3	-

ASSESSMENT SCHEME:

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CA1	15
MSE	20
CA2	15
ESE	50

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MSE is based on 50% of course content.

ESE is based on 100% course content with 60-70% weightage for course content covered after MSE

COURSE CONTENTS

Unit No.	Unit Title and Contents	Hours
1	**Introduction:** Introduction to Software engineering, SDLC, Software process models: waterfall, V model, Iterative model, Spiral model etc. Introduction to Agile: Agile development, The Agile Manifesto and principles, Agile Project management, Specific Agile methodologies: Scrum, XP, Lean, and Kanban. Agile Requirements: User Story and story mapping. Scrum Introduction: What is scrum, Scrum Origins, Why Scrum?	09
2	**Scrum Process Frame Work:** Overview, Scrum Roles, Scrum activities and Artifacts Sprints: Overview, Time Boxed, Short Duration, consistent Duration, No Goal-Altering Changes, Definition of done. Requirements and User Stories: Overview, what are user stories, 3cs, INVEST in good stories, Nonfunctional requirements, Knowledge Acquisition Stories, Story Mapping, Prioritizing Stories (WSJF technique from SAFe), How we do sprint planning, daily scrums, Multiple scrum teams	09
3	**Scrum Planning and Principles:** Multilevel Planning, Portfolio Planning, Product Planning, Release Planning	09
4	**Agile Testing Introduction:** What Is Agile Testing, What Do We Mean by "Agile Testing"? A Little Context for Roles and Activities on an Agile Team How Is Agile Testing Different? Traditional vs. Agile Testing, Ten Principles for Agile Testers, Applying Agile Principles and Values Other Types of testing: Concurrency Testing, Internationalization and Localization, Regression Testing Challenges, User Acceptance Testing, A/B Testing, User Experience Testing, The Agile Testing Quadrants. Planning for Test Automation, Test automation pyramid	09
5	**Introduction to DevOps:** DevOps application - business scenarios, Business drivers for DevOps adoption to big data, Planning the DevOps strategy, Benefits of DevOps. DevOps Framework DevOps Process, DevOps Best Practices, DevOps – Continuous Integration and Delivery Best Practices for CI/CD, Jenkins, Git / Github Creating pipelines, Setting up runners Containers and container orchestration (Dockers and Kubernetes) for application development and deployment, DevOps Continuous Deployment, Chef, Configuration management - puppet, ansible, Continuous monitoring with Nagios; Introduction to DevOps on Cloud	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1.	Essential Scrum: A Practical Guide to the Most Popular Agile Process	Kenneth S. Rubin	Addison-Wesley Professional
2	Agile & iterative Development: A Manger's Guide	Craig Larman	Pearson
3	DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive	Sricharan Vadapalli	Packt

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1.	More Agile Testing: Learning Journeys for the Whole Team	Janet Gregory, Lisa Crispin	Addison Wesley
2.	Software Engineering, A practitioner's Approach	Roger S. Pressman	McGraw Hill International Edition.
3.	DevOps: Puppet, Docker, and Kubernetes	Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu	Packt
4.	Agile Project Management: Creating Innovative Products, Second Edition	Jim Highsmith	Addison-Wesley Professional
5	Learning Agile: Understanding Scrum, XP, Lean, and Kanban	Andrew Stellman, Jennifer Greene	O Reilly

Title of the Course: Quantum Computing	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1104	4	--	--	4

COURSE Pre-Requisite: Linear Algebra, Probability, Computer Science Basics.

COURSE DESCRIPTION:

Covers the mathematical and computer science foundations of quantum computation, focusing **on** the circuit model, quantum states, and measurements. The course explores sophisticated quantum algorithms that offer advantages over classical counterparts, including search and factoring, while also introducing near-term topics like quantum error correction and fault tolerance.

COURSE OBJECTIVES:

- To understand the quantum model of computation and the basic principles of quantum mechanics.
- To analyze the performance of quantum algorithms such as Deutsch-Jozsa, Grover's, and Shor's algorithm.
- To explain essential concepts including entanglement, no-cloning, and quantum teleportation.
- To get the idea of near-term quantum computing, including adiabatic optimization and quantum chemistry simulations.
- To describe the elements of fault-tolerant computing and quantum error correction.

COURSE OUTCOMES:

CO	**After the completion of the course the student should be able to**
CO1	Explain basic quantum protocols such as teleportation and super dense coding.
CO2	Interpret quantum circuits and universality in the context of the standard gate set.
CO3	Describe quantum algorithms for search and factoring and identify their complexity classes.
CO4	Identify applications of quantum computing in fields such as quantum chemistry and Optimization.
CO5	Describe principles of quantum error correction and fault-tolerant quantum architecture.

ASSESSMENT SCHEME:

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MSE	20
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ESE	50

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CO-PO MAPPING:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	1
CO2	3	2	3	1	3	0
CO3	3	3	2	2	2	1
CO4	2	2	3	3	3	2
CO5	3	3	2	2	2	1

COURSE CONTENTS:

Unit No.	Unit Title and Contents	Hours
1	**Foundations of Quantum Mechanics:** Classical vs. Quantum: Limits of classical computing and the "Why" of Quantum.Linear Algebra for Quantum: Complex vector spaces, Bra-ket notation, Inner products, and Unitary matrices. The Qubit: Mathematical representation, Superposition, and the Bloch Sphere	09
2	**Quantum Circuit Model & Hardware:** Single-Qubit Gates: Hadamard (H), Pauli-X (NOT), Pauli-Z, and Phase gates.Multiple-Qubit Gates: CNOT, CZ, Toffoli, and Swap gates.Entanglement: Bell states, EPR paradox, and Superdense coding.Hardware Platforms: Brief overview of Superconducting qubits (IBM), Ion Traps, and Photonic systems.	09
3	**Quantum Algorithms :** Search and Optimization: Deutsch-Jozsa Algorithm, Bernstein- Vazirani Algorithm, Grover's Algorithm.Arithmetic: Quantum Fourier Transform (QFT), Phase Estimation, Shor's Factoring Algorithm.Complexity: Introduction to Quantum Complexity Classes (\(BQP\),\(EQP\), \(P\) vs \(NP\)	09
4	**Quantum Programming & Applications :** Programming Frameworks: Hands-on with IBM Qiskit or Google Cirq. Quantum Cryptography: Quantum Key Distribution (QKD) and the BB84 protocol.Applications: Molecular simulation for chemistry and optimization for supply chains.	09
5	**Noise & Error Correction :** Decoherence: Understanding T1 and T2 relaxation times, Error Correction: Bit-flip and Phase-flip codes, Fault Tolerance: Introduction to surface codes and logical qubits**.**	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Quantum Computation and Quantum Information	Michael A. Nielsen & Isaac L. Chuang	Cambridge University Press

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Quantum Computing for Computer Scientists	Noson S. Yanofsky.	Oxford University Press
2	Quantum Computer Science	N. David Mermin	Oxford University Press
3	Quantum Computing	Mikio Nakahara & Tetsuo Ohmi	CRC Press (Taylor & Francis Group)
4	An Introduction to Quantum Computing	Phillip Kaye, Raymond Laflamme, and Michele Mosca	Oxford University Press

E-RESOURCES:

1. Course on Quantum Computing (IIT Madras/ Kharagpur).

Title of the Course: Research Methodology	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1105	4	0	-	4

COURSE PRE-REQUISITE:

Students should have prior knowledge of:

1. Familiarity with project-based learning (e.g., mini projects, seminars, undergraduate theses)

2. Knowledge of basic statistics (mean, median, variance, standard deviation, probability concepts).

3. Basic skills in technical writing (reports, presentations, documentation).

4. Sound fundamentals of the core engineering/science domain.

COURSE DESCRIPTION:

This course introduces postgraduate students to the principles, methods, and practices of scientific research and technical writing. It focuses on developing the ability to identify research problems, formulate objectives and hypotheses, conduct literature surveys, and apply appropriate research methodologies in engineering and technology domains. The course also covers quantitative and qualitative research techniques, data collection and analysis methods, statistical tools, interpretation of results, and ethical issues in research. Students will gain knowledge of research paper writing, report preparation, citation standards, plagiarism awareness, intellectual property rights, and publication processes. The course enables learners to undertake independent research, prepare dissertations, and contribute effectively to innovation and advanced technological development.

COURSE OBJECTIVES:

The course aims to:

- Understand the philosophy of research in general
- Understand basic concepts of research and its methodologies
- Learn the methodology to conduct the Literature Survey
- Acquaint with the tools, techniques, and processes of doing research
- Learn the effective report writing skills and allied documentations

COURSE OUTCOMES:

CO	After the completion of the course the student should be able to
CO1	Define research and explain its essential characteristics with examples from engineering and science fields.
CO2	Identify and apply different types of research (basic, applied, qualitative, quantitative, exploratory, descriptive, etc.) to specific problems.
CO3	Analyze the outcomes of research such as publications, patents, and technological contributions, and understand their societal and industrial impacts.
CO4	Apply ANOVA and ANCOVA techniques for effective experimental data analysis and interpretation of results.
CO5	Understand and apply the basics of Intellectual Property Rights (IPR) to safeguard innovative research and prevent unethical practices.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	–	–	–	–
CO2	2	3	1	2	1	–
CO3	1	2	2	2	–	2
CO4	2	3	1	3	2	–
CO5	1	1	1	–	–	1

ASSESSMENT SCHEME:

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COURSE CONTENTS

Sr. No.	Unit Title and Contents	Hours
1	**Unit I Definition and Characteristics of Research:** Transaction Basic of Research: Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research. Objective of research. Various functions that describe characteristics of research such as systematic, valid, verifiable, empirical and critical approach, Types - Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches.Engineering Research: Why? Research Questions, Engineering Ethics, conclusive proof-what constitutes, A research project-Why take on?Case Study : Code of Ethics, IEEE Code of Ethics, ACM Software Engineering Code of Ethics and Professional Practice, Code of Ethics especially covering Engineering discipline, various aspects- environment, sustainable outcomes, employer, general public, and Nation, Engineering Disasters.	09
2	**Unit II - Literature Search and Review:** Literature Review, Types of review, Developing the objectives, Preparing the research design including sample Design, Sample size. Archival Literature, why should engineers be ethical? Types of publications- Journal papers, conference papers, books, standards, patents, theses, trade magazine, newspaper article, infomercials, advertisement, Wikipedia & websites, Measures of research impact, publication cost.Case Study : Engineering dictionary, Shodhganga, The Library of Congress, Research gate, Google Scholar, Bibliometrics, Citations, Impact Factor, h-index, I-index, plagiarism, copyright infringement	09
3.	**Unit III - Analysis of Variance and Covariance:** Basic principle of Analysis of Variance, ANOVA Technique, Setting up Analysis of Variance Table, short-cut method for one-way ANOVA, Coding method, Two-way ANOVA, ANOVA in Latin-square design, analysis of co-variance (ANCOVA), assumptions in ANCOVA. Academic Ethics: Plagiarism, exposure on anti-plagiarism tools.	09
4	**Unit IV - Technical Writing and IPR:** Academic writing, sources of information, assessment of quality of journals and articles, writing scientific report, structure and component of research report, types of report – technical reports and thesis, SCOPUS Index, citations, search engines beyond google, impact factor, H-Index. IPR: What is IPR?, importance of patents, types of IPR, process of patent.	09
5	**Unit V - Outcome of Research and Research Presentation:** Relevance, interest, available data, choice of data, Analysis of data, Generalization and interpretation of analysis, Preparation of the Report on conclusions reached, Testing validity of research outcomes, Suggestions and recommendations, identifying future scope. Research presentation: Introduction, Standard terms, Standard research methods and experimental techniques, Paper title and keywords, Writing an abstract, Paper presentation and review, Conference presentations, Poster presentations, IPR, Copyright, Patents, Case Study: Intellectual Property India- services, InPASS - Indian Patent Advanced Search System, US patent, IEEE / ACM Paper templates.	09

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Practical Research Methods,	.Dawson, Catherine	2002, New Delhi, UBS Publishers' Distributors.
2	Research Methodology-Methods and Techniques,	Kothari, C.R	1985 New Delhi, Wiley Eastern Limited.
3	Research Methodology-A Step-by-Step Guide for Beginners,	Kumar, Ranjit	2005, (2nd.ed), Singapore, Pearson Education.
4	Intellectual Property Rights	Neeraj Pandey	1st Edition, PHI
5	Quantitative Techniques for Managerial Decisions	Shrivastava, Shenoy& Sharma	Wiley

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Methods in Social Research,	Goode W J & Hatt P K,	McGraw Hill
2	Basic Computer Science and Communication Engineering	R. Rajaram	(SCITECH)

Certification Course link NPTEL

1. https://www.youtube.com/playlist?list=PLm-zueI9b64QGMcfn5Ckv_8W5Z1d3vMBY
2. https://onlinecourses.swayam2.ac.in/cec20_hs17/preview
3. https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Title of the Course: Advanced Laboratory Practices-I .	**L**	**T**	**P**	**Credit**
Course Code: 26MCS1102L	**--**	**--**	4	2

COURSE Pre-Requisite: Theory of Computation, Design and Analysis of Algorithm, Basics of Programming.

COURSE DESCRIPTION:

Advanced DAA explores the theoretical limits of computation and sophisticated techniques for designing efficient algorithms. The course emphasizes not just "how" an algorithm works, but "why" it works efficiently in terms of mathematical proofs, amortized analysis, and probabilistic outcomes. It is designed for students who have already mastered basic data structures and algorithmic strategies like Greedy and Divide & Conquer.

COURSE OBJECTIVES:

- To introduce students to the advanced methods of designing and analyzing algorithms.
- To allow students to choose an appropriate algorithm and use it for a specific problem..
- To impart knowledge of different classes of problems along with recent developments in the area of algorithmic design.

COURSE OUTCOMES:

CO	**After the completion of the course the student should be able to**
CO1	Apply algorithm to solve problem
CO2	Analyze algorithms involving different strategies for problem solving
CO3	Evaluate the complexity of the algorithm
CO4	Develop the solution for open-ended problems and document it.

ASSESSMENT SCHEME:

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Assessment Component	Marks
CA1	25
MSE	--
CA2	25
POE	50

ASSESSMENT DETAILS:

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- **POE** is based on 100% course content with 50% weightage for course

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	1	1	-
CO2	2	3	2	2	1	-
CO3	3	3	1	2	1	-
CO4	2	2	3	3	2	1

LIST OF EXPERIMENTS:

Note:

Students should implement any Four DAA practical with any four experiments of Group A and four experiments of Group B**.**

Experiment No.	Experiment Title	Hours
1	Implement various algorithms	2
2	Implement BFS algorithm	2
3	Implement DFS algorithm	2
4	Implement Dijkstra algorithm	2
5	Implement kruskal's algorithm	2
6	Implement Floyd-Warshall algorithm	2
7	Implement matrix multiplication.	2
8	Implement RSA algorithm	2
9	Implement CRT	2
10	Implement Fourier transform algorithm	2

Group A:

1. Big Data Analytics and Visualization
2. Computer Vision
3. Pervasive Computing

Experiment No.	Experiment Title	Hours
1	Installation of Hadoop Framework, it‘s components and study the HADOOP ecosystem.	2
2	Write a program to implement word count program using MapReduce	2
3	Implementing DGIM algorithm using any Programming Language	2
4	Image Loading, Exploring and displaying an Image.	2
5	Access and Manipulate of Image Pixels.	2
6	Addition operation of Two Images	2
7	Edge Detection operation using Sobel and Scharr Gradients	2
8	Develop an application that uses GUI components, Font and Colors.	2
9	Develop an application that uses Layout Managers and event listeners.	2
10	Develop a native application that uses GPS location information.	2

Group B:

1. Augmented Reality and Virtual Reality
2. Agile Methodologies
3. Quantum Computing

Experiment No.	Experiment Title	Hours
1	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.	2
2	Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.	2
3	Develop a scene in Unity that includes: I. a cube, plane and sphere, apply transformations on the 3 game objects. II. add a video and audio source	2
4	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the colour and material/texture of the game objects dynamically on button click.	2
5	Propose a sample project with its objectives, vision statement, use cases and UML diagram.	2
6	Compile project release map, user stories for proposed project.	2
7	Identify the story boarding task and detailed release plan for the project.	2
8	Implement single qubit gate simulation- Quantum composer.	2
9	Implement multiple qubit gate simulation- Quantum composer	2
10	Composing simple quantum circuits with Q-Gates and measuring output into classical bits.	2

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Introduction to Algorithms	Cormen Thomas H., Leiserson Charles E., Rivest Ronald L., Stein Clifford	3rd Edition, PHI.
2	The Design and Analysis of Computer Algorithms	Aho, Hopcroft, Ullman	Addison-Wesley Pub. Co., 1974.

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Introduction to Algorithms	Cormen, Leiserson, Rivest, Stein	3rd Edition, The MIT Press Cambridge, Massachusetts London, England.
2	The Design and Analysis of Computer Algorithms	Aho, Hopcroft, Ullman	Addison-W~ley Publishing Company Reading. Massachusetts Menlo Park. California London · Amsterdam Don Mills. Ontario · Sydney
3	Algorithm Design	Kleinberg and Tardos	Boston San Francisco NewYork London Toronto Sydney Tokyo Singapore Madrid Mexico City Munich Paris Cape Toxvn Hong Kong Montrea

E-RESOURCES:

1. NPTEL Videos of 'Data Structures and Algorithms' Course: Link- nptelvideos.in/2012/11/data-structures-and-algorithms.html
2. http://cse01-iiith.vlabs.ac.in/
3. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
4. Harvard University - YouTube 5. MIT Open Course Ware – YouTube.

Title of the Course: Yoga for Stress Management	L	T	P	Credit
Course Code: 26MCS1106	-	-	2	Audit Course

COURSE PRE-REQUISITE:

1. No prior experience in Yoga or physical training is required.
2. Students must be physically and mentally fit to perform basic exercises. (Any severe medical conditions should be reported to the instructor beforehand).
3. A receptive mindset towards holistic health, mindfulness, and discipline.

COURSE DESCRIPTION:

This practical course provides hands-on training in Yoga to enhance physical and mental well-being and effectively manage academic and professional stress. Students will learn and safely practice dynamic sequences like Surya Namaskar, foundational postures (Asanas), breath control (Pranayama), and internal purification techniques (Kriyas). By integrating meditation, deep relaxation (Yoga Nidra), and a balanced yogic diet, students will develop practical skills to regulate their nervous system, improve mental focus, and build lifelong physical and emotional resilience.

COURSE OBJECTIVES:

- To introduce the philosophical foundations of Yoga and fundamental conditioning practices for physical preparedness.
- To demonstrate dynamic sequences and static foundational asanas to improve flexibility, strength, and postural stability.
- To teach relaxing physical postures and the mechanics of the yogic breathing cycle for physiological balance.
- To impart techniques of advanced breath control (Pranayama) and internal cleansing (Kriyas) for nervous system regulation.
- To guide students through meditation, concentration, and deep relaxation techniques for emotional and mental release.

COURSE OUTCOMES:

CO	After the completion of the course the student should be able to
CO1	Explain the core philosophy of Ashtanga Yoga and perform foundational conditioning and loosening exercises safely.
CO2	Demonstrate Surya Namaskar and foundational standing/sitting asanas to enhance physical stability, alignment, and flexibility.
CO3	Practice prone and supine relaxation asanas and utilize the correct mechanics of the breathing cycle (Puraka, Rechaka, Kumbhaka).
CO4	Execute specific Pranayama techniques and purification Kriyas (Kapalbhati, Tratak) to regulate the nervous system and clear mental blocks.
CO5	Apply concentration (Dharana), Omkar chanting, and Yoga Nidra techniques to achieve deep mental relaxation and emotional balance.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	-	-	-	2
CO2	-	-	-	-	-	3
CO3	-	-	-	-	-	3
CO4	-	-	-	-	-	2
CO5	-	-	-	-	-	3

PRACTICAL COURSE CONTENTS:

Expt. No.	Course Contents
1	Introduction to Yoga & Philosophy: Origin, history, explanation of Ashtanga Yoga (8 limbs), and concept of Pancha Kosha Vivek
2	Conditioning & Loosening: Preparatory movements, Loosening Exercises (Sukshma Vyayama), general warming up, and stretching
3	Dynamic Yoga Practice: Surya Namaskar (Sun Salutation) – learning the steps, science of the practice, and breathing synchronization
4	Standing & Sitting Asanas: Practice of foundational postures for stability: Tadasana, Vrikshasana, Padmasana, Vajrasana, and Paschimottanasana
5	Prone & Supine Asanas: Practice of lying postures for spinal health and relaxation: Bhujangasana, Shalabhasana, Setubandhasana, and Naukasana
6	Fundamentals of Breathing: Understanding the breath cycle (Puraka, Rechaka, Kumbhaka). Experience of deep breathing and fast breathing techniques
7	Pranayama Practices: Specific breathing exercises for nervous system regulation: Anulom Vilom, Bhramari, Suryabhedan, and Ujjayi
8	Purification (Shuddhi Kriya): Internal cleansing techniques to remove physical and mental blocks: Kapalbhati and Tratak
9	Meditation & Focus: Preparation for meditation, Omkar chanting, and Dharana (Concentration) practices for mental clarity
10	Deep Relaxation Techniques: Yoga Nidra (guided step-by-step relaxation) and Shavasana for deep emotional and physical stress release
11	Yogic Health, Anatomy & Diet: Understanding Yoga & exercise physiology, concept of holistic health, and the importance of a balanced diet / Sattvic Ahaar
12	Stress Management Application & Review: Applying physical management to handle exam stress, time management, emotional balance, and final practical review

TEXT BOOKS:

Sr. No.	Title	Author	Publisher
1	Light on Yoga	B.K.S. Iyengar	Schocken Books
2	Asana Pranayama Mudra Bandha	Swami Satyananda Saraswati	Yoga Publication Trust, Munger
3	Yoga for Students	Dr. P.D. Sharma	Orient Paperbacks
4	Career Aspects and Management in Physical Education	Amit Arjun Budhe	Sports Publication, New Delhi

REFERENCE BOOKS:

Sr. No.	Title	Author	Publisher
1	Anatomy of Hatha Yoga	H. David Coulter	Motilal Banarsidass Publishers
2	Yoga Pravesh & Yoga Parichay	Yogacharya Dr. Vishwas Mandlik	Yoga Vidya Dham
3	Foundation of Physical Education	Bucher, C.A.	The C.V. Mosby Co.
4	Teaching Methods for Yogic Practices	Gharote, M. L. & Ganguly, H.	Kaivalyadhama, Lonavala