SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry - 605 107

Department of Computer Science and Engineering

Minutes of 10th Board of Studies Meeting

on

4th February 2026

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Minutes of 10th Board of Studies Meeting

(M.Tech-Computer Science and Engineering)

M.Tech – Computer Science Engineering (Big Data and Analytics)

Agenda of the Meeting	
Item No.:BoS/PG/CSE/BDA 10.1	Welcome Address and to confirm the minutes of the nineth meeting of Board of Studies held on 14.03.2025
Item No.:BoS/PG/CSE/BDA 10.2	To discuss about the Curriculum and syllabus of R-2026 regulation of M.Tech CSE and M.Tech CSE (BDA) for the students going to be admitted in the academic year 2026 - 2027.
Item No.:BoS/PG/CSE/BDA 10.3	Any other item with the permission of chair

Minutes of the Meeting

Dr. N. Danapaquiame , Chairperson, BoS opened the meeting by welcoming and introducing the external members to the internal members and the meeting thereafter deliberated on agenda items that had been approved by the Chairperson

Item No.:BoS/PG/CSE/BDA 10.1

Confirmation of minutes of 9th BoS meeting held on 14.03.2025

Chairperson, BoS, apprised the minutes of 9th BoS.

Item No.:BoS/PG/CSE/BDA 10.2

To discuss about the Curriculum and syllabus of R-2026 Regulation of M.Tech CSE and M.Tech CSE (BDA) for the students going to be admitted in the academic year 2026 - 2027.

The M.Tech Degree curriculum and syllabus approval of semester I to semester IV under Autonomous Regulation 2026 for the M.Tech programme and the students admitted in the academic year 2026–27 were discussed and recommended with the following modifications.

S.No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-2026	I	Mathematical Foundation of Formal Approach P26MAT103	-	The Title Mathematical Foundation of formal approach can be changed to Mathematical Foundation of Computer Science
2	R-2026	I	Advanced Databases P26CST102	V	The Data Warehousing section in Unit V has been removed and may be offered as a separate course if necessary.

					Unit V now incorporates Database Security, Cloud Databases, and Emerging Trends.
3	R-2026	I	Applied Machine Learning P23BDT103	-	It is suggested to replace Applied Machine Learning with Data Visualization, while Applied Machine Learning may be offered in the next semester.
4	R-2026	I	Machine Learning & Big Data Analytics Lab P23BDP101	-	It is proposed that the Big Data Computing Laboratory be replaced, and the Machine Learning & Big Data Analytics Lab be scheduled for the upcoming semester

The above correction were incorporated and approved by BoS members in 10th BoS meeting, and the details are enclosed in Annexure – VII.

Item No.:BoS/PG/CSE/BDA 10.3

Any other item with the permission of chair

The panel discussed about bringing up new research topic in curriculum and to increase admission

The meeting for the above Agenda regarding M.Tech-Computer Science and Engineering and M.Tech-Computer Science Engineering(Big Data and Analytics) was concluded by 3.45 pm with by **Dr. N. Danapaquiame** ,Chairman-BoS and Head of the Department,Department of Computer Science and Engineering,Sri Manakula Vinayagar Engineering College.

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Department of Computer Science and Engineering

Minutes of 10th Board of Studies Meeting

(Ph.D-Computer Science and Engineering)

Agenda of the Meeting	
Item No.:BoS/Ph.D/CSE 10.1	Welcome Address and to confirm the minutes of the ninth meeting of Board of Studies held on 14.03.2025
Item No.:BoS/Ph.D/CSE 10.2	To discuss about the progress of the various scholars of Ph. D. in the department of Computer Science and Engineering.
Item No.:BoS/Ph.D/CSE 10.3	Any other item with the permission of chair

Minutes of the Meeting

Dr. N. Danapaquiame , Chairperson, BoS opened the meeting by welcoming and introducing the external members to the internal members and the meeting thereafter deliberated on agenda items that had been approved by the Chairperson

Item No.:BoS/Ph.D/CSE 10.1

Welcome Address and to confirm the minutes of the nineth meeting of Board of Studies held on 14.03.2025

Chairperson, BoS, apprised the minutes of 9th Bos, its implementation and then it is confirmed with the approval in 9th BoS meeting for the incorporation without any revision

Item No.:BoS/Ph.D/CSE 10.2

To discuss about the progress of the various scholars of Ph. D. in the department of Computer Science and Engineering.

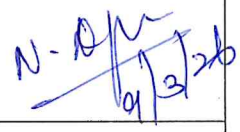
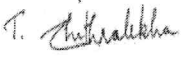
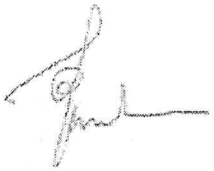
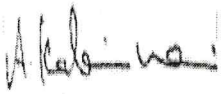
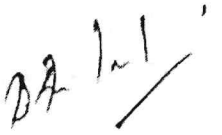
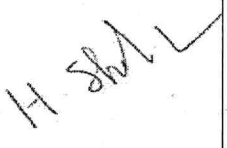
The details about Scholars and their progress is discussed and details is enclosed in Annexure-VIII

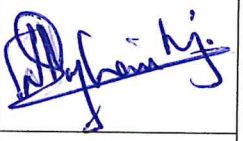
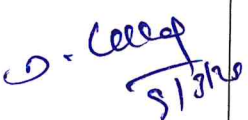
Item No.:BoS/Ph.D/CSE 10.3

Any other item with the permission of chair.

The panel discussed about the publication of scholar

The meeting for the above Agenda regarding Ph.D-Computer Science and Engineering was concluded by 4.30 pm with by **Dr. N. Danapaquiame** ,Chairman-BoS and Head of the Department,Department of Computer Science and Engineering,Sri Manakula Vinayagar Engineering College.

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1	**Dr. N. Danapaquiame, M.E, Ph.D.,** Professor and Head Sri ManakulaVinayagar Engineering College hodcse@smvec.ac.in 9629124512	Chairman	
2.	**Dr. M. Shanmugam, M.E., Ph.D.** Professor, Sri Manakula Vinayagar Engineering College shanmugam.mm@smvec.ac.in 9444370963	Member Secretary	
3	**Dr.T.Chithralekha** Professor, Department of Computer Science, School of Tehnology, Pondicherry University,Pudhucherry tchithralekha.csc@pondiuni.ac.in 9443181282	Subject Expert (Pondicherry University Nominee)	
4.	**Dr.M.Ramakrishnan** Professor and Head, School of Information Technology, Department of Computer Applications, Madurai Kamaraja University, Madurai. ramkrishod@gmail.com 8939432261	Subject Expert (Academic Council Nominee)	
5.	**Dr.A.Kalaivani** Professor, Department of Information Technology, Rajalakshmi Engineering College, Chennai. kalaivani.a@rajalakshmi.edu.in 7904977893	Subject Expert (Academic Council Nominee)	
6.	**Mr.Aroulvel S** Technical Leader, CISCO,Bangalore. aroshanm@cisco.com 9003898387	Representative from Industry	
7.	**Ms.Shakin Banu.H** Design Engineer Specialist British Telecommunication,UK Shakin2cse@gmail.com 9791854301	Postgraduate Alumnus(nominated by the Principal)	
8.	**Dr. M. Ganesan,M.E.,Ph.D.,** Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry ganesan@smvec.ac.in 9486341535	Internal Member	

9.	**Dr. N. Pazhaniraja, M.E., Ph.D.** Associate Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry pazhaniraja.cse@smvec.ac.in 9944808218	Internal Member	
10.	**Dr. S. Saravanan, M.E., Ph.D.** Associate Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry s.saravanan13021973@gmail.com 9894676654	Internal Member	
11.	**Mr. P. Karthikeyan, M.E,Ph.D (Pursuing)** Associate Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry karthikcse@smvec.ac.in 9791553404	Internal Member	
12.	**Mr.B.Thiyagarajan, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry thiyagarajan@smvec.ac.in 9791857984	Internal Member	
13.	**Mr.S.Kumarakrishnan, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry skumarakrishnan@smvec.ac.in 9943073700	Internal Member	
14.	**Mrs.P.Bhavani, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry bhavani@smvec.ac.in 9790176658	Internal Member	
15.	**Mr.D.Rajesh, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry rajesh@smvec.ac.in 9600551422	Internal Member	
16.	**Mr.Arokiaraj Christian Hubert, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry arokiaraj@smvec.ac.in 8056471203	Internal Member	

17.	**Ms. Swathilakshmi. V, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry swathilakshmi@smvec.ac.in 9655020592	Internal Member	
18.	**Mrs. S. Subasree, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry subasree.cse@smvec.ac.in 9488405612	Internal Member	
19.	**Mrs. S. Deeba M.E** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry deebacse@smvec.ac.in 9500564937	Internal Member	
20.	**Mrs. R. Deepa, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry deepa.cse@smvec.ac.in 6380547250	Internal Member	
21.	**Mrs. C. Karthika, M.E** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry karthika1me@gmail.com 9715612122	Internal Member	
22.	**Mr. K. Anbuthiruvarangan,M.E** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry anbuthiruvarangan.cse@smvec.ac.in 9789371731	Internal Member	
23.	**Ms.V. Nivetha, M.Tech** Assistant Professor, Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry nivetha@smvec.ac.in 7094503098	Internal Member	
24.	**Mrs.D.Maladhy, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry maladhy.cse@smvec.ac.in 9787094912	Internal Member	

25.	**Mrs.M.Manjula, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry manjula.cse@smvec.ac.in 9791854392	Internal Member	
26.	**Mrs.V.Indumathy, M.Tech,Ph.D (Pursuing)** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry indumathy.cse@smvec.ac.in 9786637652	Internal Member	
27.	**Mrs.R.Ilamathii, M.Tech** Assistant Professor Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry illamathy.cse@smvec.ac.in 6362084983	Internal Member	
28.	**Mr. M. Elamaran** Professor, Department of English Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry	Internal Member	
29.	**Dr. T. Jayavarthanan,** Professor and Head, Department of Physics Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry	Internal Member	
30.	**Dr. K.Raja,** Associate Professor Department of Mathematics Sri Manakula Vinayagar Engineering College Madagadipet,Pudhucherry	Internal Member	

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

(As per UGC - 2018 Regulations and Affiliated to Pondicherry University)

PUDUCHERRY – 605107

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.TECH.

COMPUTER SCIENCE AND ENGINEERING

(REGULATIONS - 2026)

CURRICULUM AND SYLLABI

CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P26MAT103	Mathematical Foundation of Computer Science	BS	2	1	0	3	40	60	100
2	P26CSTD01	Advanced Data Structures and Algorithms	PC	3	0	0	3	40	60	100
3	P26CST102	Advanced Databases	PC	3	0	0	3	40	60	100
4	P26CSTD02	Cloud and Big Data Analytics	PC	3	0	0	3	40	60	100
5	P26HSTC01	Research Methodology and IPR	HS	2	0	0	2	40	60	100
6	P26CSE1XX	Professional Elective – I *	PE	3	0	0	3	40	60	100
Practical										
7	P26CSP101	Advanced Data Structures and Algorithms Laboratory	PC	0	0	4	2	50	50	100
8	P26HSPC01	Technical Report Writing and Seminar	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P26CSC1XX	Certification Course-I #	AEC	0	0	4	-	100	-	100
10	P26ACT10X	Audit Course-I**	AEC	0	0	2	-	100	-	100
							21	590	410	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P26CST203	Advanced Software Engineering and Testing	PC	3	0	0	3	40	60	100
2	P26CST204	Advanced Operating Systems	PC	3	0	0	3	40	60	100
3	P26CST205	Advanced Python Programming	PC	3	0	0	3	40	60	100
4	P26CST206	Speech and Language Processing	PC	3	0	0	3	40	60	100
5	P26CSE2XX	Professional Elective - II	PE	3	0	0	3	40	60	100
6	P26CSE2XX	Professional Elective - III	PE	3	0	0	3	40	60	100
Practical										
7	P26CSP202	Advanced Python Programming Laboratory	PC	0	0	4	2	50	50	100
8	P26HSPC02	Seminar on ICT: A Hands - On Approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P26CSC2XX	Certification Course-II #	AEC	0	0	4	-	100	-	100
10	P26ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P26CSE1XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P26CSE1XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P26CSE1XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Project Work										
4	P26CSW301	Project Phase - I	PA	0	0	12	6	50	50	100
5	P26CSW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
6	P26CSC301	NPTEL/SWAYAM/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P26CSW403	Project Phase - II	PA	0	0	24	12	50	50	100
							12	50	50	100

*** Professional Elective Courses are to be selected from the list given in Annexure I**
 # Ability Enhancement Courses are to be selected from the list given in Annexure II
**** Audit Courses are to be selected from the list given in Annexure III**

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

Semester	I	II	III	IV	Total
Credits	21	22	17	12	72

Total number of credits required to complete M.Tech in Computer Science and Engineering : 72 credits

ANNEXURE- I

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	P26CSE101	Cloud Computing Technologies
2	P26CSE102	Cyber Attacks Detection and Prevention Systems
3	P26CSE103	Bio-Inspired Computing
4	P26CSE104	Block Chain and Crypto Currency
5	P26CSE105	Edge Computing
Professional Elective-II		
1	P26CSE106	Information Visualization
2	P26CSE107	Quantum Computing
3	P26CSE108	Soft Computing
4	P26CSE109	Neural Networks
5	P26CSE110	Robotic Process Automation
Professional Elective-III		
1	P26CSE211	Deep Learning
2	P26CSE212	Data Storage Technologies
3	P26CSE213	Reinforcement Learning
4	P26CSE214	Mobile Application and Development
5	P26CSE215	Wireless Sensor Networks and IoT
Professional Elective-IV		
1	P26CSE316	Explainable AI
2	P26CSE317	Cloud Security and Analytics
3	P26CSE318	Pattern Recognition
4	P26CSE319	Game Design and Augmented Reality
5	P26CSE320	AI Ethics & Policy
Professional Elective-V		
1	P26CSE421	Image and Video Analytics
2	P26CSE422	Web Application Security
3	P26CSE423	Generative Artificial Intelligence
4	P26CSE424	Human-Computer Interaction
5	P26CSE425	Intelligent Internet of Things
Professional Elective-VI		
1	P26CSE526	Green Computing
2	P26CSE527	Digital Forensics
3	P26CSE528	NoSQL Databases
4	P26CSE529	Knowledge Engineering and Expert Systems
5	P26CSE530	Industrial IoT

ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P26XXCX01	Adobe Photoshop
2	P26XXCX02	Adobe Animate
3	P26XXCX03	Adobe Dreamweaver
4	P26XXCX04	Adobe After Effects
5	P26XXCX05	Adobe Illustrator
6	P26XXCX06	Adobe InDesign
7	P26XXCX07	Autodesk AutoCAD -ACU
8	P26XXCX08	Autodesk Inventor - ACU
9	P26XXCX09	Autodesk Revit - ACU
10	P26XXCX10	Autodesk Fusion 360 - ACU
11	P26XXCX11	Autodesk 3ds Max - ACU
12	P26XXCX12	Autodesk Maya - ACU
13	P26XXCX13	Cloud Security Foundations
14	P26XXCX14	Cloud Computing Architecture
15	P26XXCX15	Cloud Foundation
16	P26XXCX16	Cloud Practitioner
17	P26XXCX17	Cloud Solution Architect
18	P26XXCX18	Data Engineering
19	P26XXCX19	Machine Learning Foundation
20	P26XXCX20	Robotic Process Automation / Medical Robotics
21	P26XXCX21	Advance Programming Using C
22	P26XXCX22	Advance Programming Using C ++
23	P26XXCX23	C Programming
24	P26XXCX24	C++ Programming
25	P26XXCX25	CCNP Enterprise: Advanced Routing
26	P26XXCX26	CCNP Enterprise: Core Networking
27	P26XXCX27	Cisco Certified Network Associate - Level 2
28	P26XXCX28	Cisco Certified Network Associate- Level 1
29	P26XXCX29	Cisco Certified Network Associate- Level 3
30	P26XXCX30	Fundamentals Of Internet of Things
31	P26XXCX31	Internet Of Things / Solar and Smart Energy System with IoT
32	P26XXCX32	Java Script Programming
33	P26XXCX33	NGD Linux Essentials
34	P26XXCX34	NGD Linux I
35	P26XXCX35	NGD Linux II

36	P26XXCX36	Advance Java Programming
37	P26XXCX37	Android Programming / Android Medical App Development
38	P26XXCX38	Angular JS
39	P26XXCX39	Catia
40	P26XXCX40	Communication Skills for Business
41	P26XXCX41	Coral Draw
42	P26XXCX42	Data Science Using R
43	P26XXCX43	Digital Marketing
44	P26XXCX44	Embedded System Using C
45	P26XXCX45	Embedded System with IOT / Arduino
46	P26XXCX46	English For IT
47	P26XXCX47	Plaxis
48	P26XXCX48	Sketch Up
49	P26XXCX49	Financial Planning, Banking and Investment Management
50	P26XXCX50	Foundation Of Stock Market Investing
51	P26XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P26XXCX52	IOT Using Python
53	P26XXCX53	Creo (Modelling & Simulation)
54	P26XXCX54	Soft Skills, Verbal, Aptitude
55	P26XXCX55	Software Testing
56	P26XXCX56	MX-Road
57	P26XXCX57	CLO 3D
58	P26XXCX58	Solid works
59	P26XXCX59	Staad Pro
60	P26XXCX60	Total Station
61	P26XXCX61	Hydraulic Automation
62	P26XXCX62	Industrial Automation
63	P26XXCX63	Pneumatics Automation
64	P26XXCX64	Agile Methodologies
65	P26XXCX65	Block Chain
66	P26XXCX66	Devops
67	P26XXCX67	Artificial Intelligence
68	P26XXCX68	Cloud Computing
69	P26XXCX69	Computational Thinking
70	P26XXCX70	Cyber Security
71	P26XXCX71	Data Analytics
72	P26XXCX72	Databases
73	P26XXCX73	Java Programming

74	P26XXCX74	Networking
75	P26XXCX75	Python Programming
76	P26XXCX76	Web Application Development (HTML, CSS, JS)
77	P26XXCX77	Network Security
78	P26XXCX78	MATLAB
79	P26XXCX79	Azure Fundamentals
80	P26XXCX80	Azure AI (AI-900)
81	P26XXCX81	Azure Data (DP -900)
82	P26XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P26XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P26XXCX84	Microsoft Power Platform (PI-900)
85	P26XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P26XXCX86	Microsoft Excel
87	P26XXCX87	Microsoft Excel Expert
88	P26XXCX88	Securities Market Foundation
89	P26XXCX89	Derivatives Equinity
90	P26XXCX90	Research Analyst
91	P26XXCX91	Portfolio Management Services
92	P26XXCX92	Cyber Security
93	P26XXCX93	Cloud Security
94	P26XXCX94	PMI – Ready
95	P26XXCX95	Tally – GST & TDS
96	P26XXCX96	Advance Tally
97	P26XXCX97	Associate Artist
98	P26XXCX98	Certified Unity Programming
99	P26XXCX99	VR Development

ANNEXURE-III

AUDIT COURSES

(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P26ACTX01	English for Research Paper Writing
2	P26ACTX02	Disaster Management
3	P26ACTX03	Sanskrit for Technical Knowledge
4	P26ACTX04	Value Education
5	P26ACTX05	Constitution of India
6	P26ACTX06	Pedagogy Studies
7	P26ACTX07	Stress Management by Yoga
8	P26ACTX08	Personality Development Through Life Enlightenment Skills
9	P26ACTX09	Unnat Bharat Abhiyan

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **BS**			*End Semester Exam Type: **TE**		
Course Code	**P26MAT103**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Mathematical Foundation of Computer Science**	**2**	**1**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Basic knowledge of matrix, Set theory, functions and relations concepts needed for designing and solving problems.	**K2**
	CO2 Logical operations and predicate calculus needed for computing skill.	**K3**
	CO3 Design and solve Boolean functions for defined problems.	**K3**
	CO4 Apply the acquired knowledge of formal languages to engineering areas like Compiler Design.	**K3**
	CO5 Apply the acquired knowledge of finite automata theory and to design discrete problems to solve by Computers.	**K3**

UNIT- I	**Matrix Algebra**	**Periods: 9**	
Matrices - Rank of a matrix - Solving system of equations – Eigen values and Eigenvectors - Cayley - Hamilton theorem - Inverse of a matrix.			**CO1**
UNIT- II	**Basic Set Theory**	**Periods: 9**	
Basic definitions - Venn diagrams and set operations - Laws of set theory - Principle of inclusion and exclusion – Partitions - Permutation and combination – Relations - Properties of relations - Matrices of relations - Closure operations on relations - Functions - Injective, subjective and objective functions.			**CO2**
UNIT- III	**Mathematical Logic**	**Periods: 9**	
Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication - Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms - Proofs in propositional calculus - Predicate calculus.			**CO3**
UNIT- IV	**Formal Languages**	**Periods: 9**	
Languages and grammars - Phrase structure grammar - Classification of grammars -Pumping lemma for regular languages - Context free languages.			**CO4**
UNIT- V	**Finite State Automata**	**Periods: 9**	
Finite state automata - Deterministic finite state automata (DFA) - Non deterministic finite state automata (NFA) - Equivalence of DFA and NFA - Equivalence of NFA and Regular Languages.			**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. David Makinson, "Sets, Logic and Maths for Computing", Springer Indian Reprint, 2011.
2. Grimaldi, R.P and Ramana, B.V. "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2006.
3. Hopcroft J.E and Ullman,J.D, "Introduction to Automata Theory, Languages and Computation", Narosa Publishing House, Delhi, 2002.
C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

Reference Books

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill, 4th Edition, 2002.
2. Sengadir, T. "Discrete Mathematics and Combinatorics" Pearson Education, New Delhi, 2009.
3. Trembley, J.P. and Manohar, R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2007.
4. Venkataraman, M.K., "Engineering Mathematics", Volume-II, National Publishing Company, Second Edition, 1989.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.

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1. https://sites.math.northwestern.edu/~mlerma/courses/cs310-05s/
2. https://csd.cs.cmu.edu/course-profiles/15-151-Mathematical-Foundations-for-Computer-Science
3. https://www.coursera.org/learn/mathematics-for-computer-science
4. https://www.cse.iitb.ac.in/~supratik/courses/cs719/index.html
5. https://www.irif.fr/~jep/PDF/MPRI/MPRI.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	2	1
2	3	2	1	1	-	1	2	2	1
3	3	2	1	1	-	1	2	2	1
4	3	2	1	1	-	-	2	2	1
5	3	2	1	1	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **TE**		
Course Code	**P26CSTD01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE and CSE(BDA))

Prerequisite	**Basics of Data Structures and Algorithms**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate various algorithm notations and algorithm correctness.	**K2**
	CO2 Construct various applications based on sorting and tree data structure.	**K2**
	CO3 Experiment with the performance of various Text Processing operations.	**K3**
	CO4 Apply graph data structures to the real time applications	**K3**
	CO5 Illustrate the performance of the polynomial time algorithm.	**K2**

UNIT- I	**Algorithm Notations And Representations**	**Periods: 9**	
Mathematical Induction - Asymptotic Notations – Algorithm Analysis - NP-Hard and NP-Completeness – Recurrence Equations – Solving Recurrence Equations – Memory Representation of Multi-dimensional Arrays – Time-Space Tradeoffs.			**CO1**
UNIT- II	**Sorting and Trees**	**Periods: 9**	
Heapsort – Quicksort – Topological sort - Sorting in Linear Time – Elementary Data Structures – Hash Tables – Hash Functions- Binary Search Trees – AVL Trees – Red Black trees – Multi-way Search Trees –B-Trees- Fibonacci Heaps – van Emde Boas Trees – Data Structures for Disjoint Sets.			**CO2**
UNIT- III	**Text Processing Operations**	**Periods: 9**	
Text Processing: String Operations - Brute-Force Pattern Matching - The Boyer-Moore Algorithm - The Knuth-Morris-Pratt Algorithm - Standard Tries - Compressed Tries - Suffix Tries - The Huffman Coding Algorithm - The Longest Common Subsequence Problem (LCS) - Applying Dynamic Programming to the LCS Problem.			**CO3**
UNIT- IV	**Graph Algorithms**	**Periods: 9**	
Elementary graph Algorithms – Minimum Spanning Trees – Single Source Shortest Paths- All Pairs Shortest Paths – Maximum Flow - Multithreaded Algorithms – Matrix Operations.			**CO4**
UNIT- V	**Dynamic Programming**	**Periods: 9**	
Linear programming – Polynomials and Fast Fourier Transform – Number Theoretic Algorithms – Computational Geometry –NP-Completeness – Approximation Algorithms.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2016
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education, Second Edition, 2004.
3. Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Computational Geometry: Algorithms and Applications, Springer, Third edition, 2008.

Reference Books

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", Addison Wesley, Fifth Edition, 2017.
2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company, Sixth Edition, 2016.
3. Narasimha karumanchi, Data Structures and algorithms made easy, Fifth Edition, 2017.
4. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, Fourth Edition, 2007.
5. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, Second Edition, 2002.

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1. https://www.javatpoint.com/data-structure-tutorial/
2. https://www.studytonight.com/data-structures/
3. https://www.tutorialspoint.com/data_structures_algorithms/
4. https://www.w3schools.in/data-structures-tutorial/intro/
5. https://www.geeksforgeeks.org/data-structures

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	1	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	2	3	3	1	3	3	3	3	3
4	2	3	3	1	3	3	3	3	3
5	2	3	3	1	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme : **M.Tech.**					
Semester	**I**	Course Category :**PC**			*End SemesterExamType:**TE**		
Course Code	**P26CSTD02**	Periods/Week			Credit	MaximumMarks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Databases**	**3**	**0**	**0**	**3**	**40**	**60**	**100**

Prerequisite	No prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level
	CO1 Analyze advanced database models including distributed, object-oriented, and NoSQL systems	**K4**
	CO2 Evaluate query optimization and transaction management in distributed environments	**K5**
	CO3 Apply object-relational and NoSQL database features to real problems	**K3**
	CO4 Design components of data warehousing and OLAP for enterprise decision support	**K6**
	CO5 Integrate modern database technologies for scalable, high-performance applications	**K6**

UNIT – I	**Advanced Database Fundamentals**	**Periods:9**
Review of Database Models: Relational, Object-Relational - ER and Enhanced ER Models - Advanced SQL (Views, Triggers, Stored Procedures) - Normalization beyond BCNF (4NF, 5NF) - Query Processing & Optimization basics		**CO1**
UNIT – II	**Distributed Database Systems**	**Periods:9**
Distributed DB Architecture and Design - Distributed Query Processing and Optimization - Distributed Transactions and Concurrency Control - Distributed Recovery Techniques - Fragmentation and Replication Strategies		**CO2**
UNIT – III	**Object and Object-Relational Databases**	**Periods:9**
Object Oriented Data Models - ODMG Standard, ODL and OQL – Object Relational Features of SQL/Oracle - Complex Objects and Type Systems - Inheritance, Encapsulation, Polymorphism in Databases		**CO3**
UNIT – IV	**NoSQL and Modern Data Stores**	**Periods:9**
NoSQL Paradigms: Key-Value, Document, Column-Family, Graph - CAP Theorem, BASE Property - NoSQL Query Languages - Use Cases: MongoDB, Cassandra, Neo4j - Polyglot Persistence concepts		**CO4**
UNIT – V	**Database Security, Cloud Databases and Emerging Trends**	**Periods:9**
Database Security: Authentication and Authorization - Role-Based Access Control (RBAC) - Encryption Techniques (TDE, SSL) - SQL Injection and Database Vulnerabilities - Database Auditing and Compliance - Cloud Databases and DBaaS: Architecture and Deployment Models - Multi-Tenancy - Elastic Scalability - Blockchain and Databases - Edge Databases and Real-Time Data Processing		**CO5**

LecturePeriods:45	**Tutorial Periods:0**	**Practical Periods:-0**	**TotalPeriods:45**

Text Books

1. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian, Roberto Zicari, "Advanced Database Systems", 1st c, Elsevier, 1997
2. M Tamer Ozsu, P Valduriez; "Principles of Distributed Database Systems"; Pearson Education Pvt. Ltd., 2005
3. Pramod J. Sadalage & Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
4. Garcia-Molina, Ullman, Widom, "Database Systems: The Complete Book", 2nd Edition, Pearson College Div, 2008.
5. Alex Berson, Stephen J Smith; "Data Warehousing, Data Mining, and OLAP"; Tata McGraw-Hill Publishing Company Limited, 1997.

Reference Books

1. Raghu Ramakrishnan & Johannes Gehrke, "Database Management Systems", 3rd Edition McGraw Hill Education, 2004.
2. Elmasri & Navathe, "Fundamentals of Database Systems", Addison Wesley Longman, Inc, 1994.
3. S Ceri, G Pelagatti; "Distributed Databases: Principles and Systems"; Tata McGraw-Hill Publishing Company Limited, 1985.
4. Hoffer, Ramesh & Topi, "Modern Database Management", 12th Edition, Pearson College Div, 2015.
5. C. S. R. Prabhu, "Object-oriented Database Systems: Approaches and Architectures", 2nd Edition, Prentice-Hall of India Pvt.Lt 2005.

Web References

1. https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2. https://docs.oracle.com/en/database/other-databases/nosql-database/index.html
3. https://www.mongodb.com/docs/?utm_source
4. https://www.geeksforgeeks.org/dbms/data-warehousing-tutorial/
5. https://www.geeksforgeeks.org/dbms/introduction-to-nosql/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	2	2	2	3	2	2
2	2	3	3	2	2	2	2	3	2
3	3	2	2	3	2	2	2	3	2
4	2	2	3	3	3	2	2	2	3
5	2	2	3	3	3	3	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **TE**		
Course Code	**P26CST102**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud and Big Data Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Cloud computing	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the core concepts of the cloud computing paradigm.	**K3**
	CO2 Apply fundamental concepts in cloud infrastructures.	**K4**
	CO3 Illustrate the fundamental concepts of network virtualization and geo-distributed cloud.	**K4**
	CO4 Identify Big Data and its Business Implications.	**K3**
	CO5 List the components of Hadoop and Hadoop Eco-System, Access and Process Data on Distributed File System.	**K4**

UNIT- I	**Introduction**	**Periods: 9**	
Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Cloud Services - Cloud Service Administration - Cloud Data Management.			**CO1**
UNIT- II	**Cloud Infrastructure**	**Periods: 9**	
Cloud Infrastructure: Introduction - Advancing towards a Utility Model – Evolving IT infrastructure – Evolving Software Applications – Continuum of Utilities- Standards and Working Groups - Standards Bodies and Working Groups – Service Oriented Architecture – Business Process Execution Language – Interoperability Standards for Data Center Management - Utility Computing Technology – Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment - Data Center Challenges and Solutions - Automating the Data Center.			**CO2**
UNIT- III	**Network Virtualization and Geo-Distributed Cloud**	**Periods: 9**	
Cloud computing and server virtualization-networking of virtual machines inside hypervisor – Docker – software defined network – Network virtualization in multi-tenant data centers - VL2 - NVP – Geo distributed cloud data centers			**CO3**
UNIT- IV	**Introduction To Big Data and Hadoop**	**Periods: 9**	
Types of Digital Data - Introduction to Big Data - Big Data Analytics - History of Hadoop - Apache Hadoop - Analysing Data with Unix tools - Analyzing Data with Hadoop - Hadoop Streaming - Hadoop Echo System - IBM Big Data Strategy - Introduction to Ionosphere Big Insights and Big Sheets.			**CO4**
UNIT- V	**HDFS (Hadoop Distributed File System) and Map Reduce**	**Periods: 9**	
The Design of HDFS - HDFS Concepts - Command Line Interface - Hadoop file system interfaces - Data flow - Data Ingest with Flume and Scoop and Hadoop archives - Hadoop I/O: Compression – Serialization Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run – Failures - Job Scheduling - Shuffle and Sort - Task Execution - Map Reduce Types and Formats - Map Reduce Features.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. RajivMisra, Yashwant singh patel, "Cloud and Distributed Computing: Algorithm and systems", Wiley, First edition, 2020.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Ritting house, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Reference Books

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
2. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
3. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd, 2006.
4. Tom White, "Hadoop : The Definitive Guide", O'reily Media, Third Edition, 2012.
5. Pete Warden, "Big Data Glossary", O'Reily, 2011

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1. www.coltdatacentres.net/Cloud Technology
2. www.redhat.com/en/topics/cloud-computing/what-is-cloud-infrastructure
3. www.digitalocean.com/community/tutorials/an-introduction-to-big-data-concepts-and-terminology
4. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/
5. https://www.tutorialspoint.com/hadoop/hadoop_big_data_overview.htm

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	2	2	1	-	1	3	-
2	1	1	2	2	1	2	1	-	3
3	2	1	1	2	1	2	1	3	-
4	3	1	2	1	-	1	-	3	1
5	3	1	1	2	-	-	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **HS**			*End Semester Exam Type: **TE**			
Course Code	**P26HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology and IPR**	**2**	**-**	**-**	**2**	**40**	**60**	**100**

(Common to all M.Tech Courses)

Prerequisite	No prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Gain Knowledge to formulate the research problem.	**K2**
	CO2 Understand the concepts to carry out the literature review, ethics and research analysis.	**K2**
	CO3 Explain the way of writing technical paper and presentation methods.	**K2**
	CO4 Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	**K2**
	CO5 Ability to understand about IPR and filing patents in R & D.	**K3**

UNIT- I	**Research Problem Formulation**	**Periods: 6**	
Meaning of research problem- Sources of research problem - criteria characteristics of a good research problem - errors in selecting a research problem - scope and objectives of research problem. Approaches of investigation of solutions for research problem - data collection – analysis – interpretation - necessary instrumentations.			**CO1**
UNIT- II	**Literature Review**	**Periods: 6**	
Effective literature studies approaches – analysis – plagiarism and research ethics			**CO2**
UNIT- III	**Technical Writing /Presentation**	**Periods: 6**	
Effective technical writing - how to write report – paper - developing a research proposal - format of research proposal - Presentation and assessment by a review committee.			**CO3**
UNIT- IV	**Introduction To Intellectual Property Rights (IPR)**	**Periods: 6**	
Nature of Intellectual Property: Patents – Designs - Trade and Copyright. Process of Patenting and Development: Technological research – innovation – patenting - development. International Scenario: International cooperation on Intellectual Property - Procedure for grants of patents - Patenting under PCT.			**CO4**
UNIT- V	**Intellectual Property Rights (IPR)**	**Periods: 6**	
Patent Rights: Scope of Patent Rights - Licensing and transfer of technology - Patent information and databases - Geographical Indications - New Developments in IPR - Administration of Patent System - IPR of Biological Systems - Computer Software etc. Traditional knowledge Case Studies - IPR and IITs.			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. Stuart Melville and Wayne Goddard, "Research methodology: An introduction for science & Engineering students', Kenwyn Publisher, 1996.
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Lansdowne Publisher, Second Edition, 2001.
3. C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International, Fourth Edition, 2018.

Reference Books

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Limited, 2007.
2. Ranjit Kumar, "Research Methodology: A Step by Step Guide for beginners", Second Edition, 2010.
3. Trochim, "Research Methods: The concise knowledge base", Atomic Dog Publishing, 2005.
4. Fink A, "Conducting Research Literature Reviews: From the Internet to Paper", Sage Publications, 2009.

Web References

1. https://www.scribd.com/document/427419672/Research-Methodology-and-Ipr
2. https://www.isical.ac.in/~palash/research-methodology/RM-lec9.pdf
3. https://www.wipo.int/edocs/pubdocs/en/intproperty/958/wipo_pub_958_3.pdf
4. https://lecturenotes.in/m/21513-research-methodology
5. https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	2	1	1	2	1	3	3	2
2	3	2	1	1	2	1	3	2	2
3	3	2	1	1	2	1	3	2	2
4	3	2	1	1	3	1	3	2	3
5	3	2	1	1	2	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **LE**		
Course Code	**P26CSP101**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms Laboratory**	**-**	**-**	**4**	**2**	**50**	**50**	**100**

Prerequisite	Knowledge about Data Structures and Algorithms	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level
	CO1 Evaluate the algorithm's / program's efficiency in terms of time and space complexity.	**K4**
	CO2 Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3 Construct various applications based on sorting and tree data structure.	**K2**
	CO4 Apply graph data structures to solve real time applications such as network flow and linear programming.	**K3**
	CO5 Illustrate the performance of the polynomial time algorithm.	**K2**

List of Experiments:

1. Implementation of the following Heap Structures.
   a. Min Heap (Insertion, Delete Min, Delete Max)
   b. Skew Heap(Priority Queue operations)
   c. Fibonacci Heap (Priority Queue operations).
2. Implementation of the following Search Structures
   a. AVL Trees (Insertion, Deletion and Search)
   b. Splay Trees (Insertion, Deletion and Search)
   c. B-Trees (Insertion, Deletion and Search) d. Red- Black Trees.
3. Implementation of Convex Hull.
4. Implementation of Topological sort.
5. Implementation of Graph search algorithms.
6. Implementation of Randomized algorithms.
7. Implementation and application of network flow and linear programming problems.
8. Implementation of algorithms using the hill climbing and dynamic programming design techniques.
9. Implementation of recursive backtracking algorithms.
10. Implementation of Branch and Bound Algorithms.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

Reference Books

1. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, Fifth Edition, 2007.
2. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, Introduction to Algorithms, PHI/Pearson Education, Third Edition, 2009.
3. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Wiley India, Second Edition, 2006.
4. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2016
5. Michael T. Goodrich, Roberto Tamassia, David M. Mount," Data Structures and Algorithms in C++",Wiley, Second Edition, 2011.

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1. https://www.javatpoint.com/data-structure-tutorial/
2. https://www.studytonight.com/data-structures/
3. https://www.tutorialspoint.com/data_structures_algorithms/
4. https://www.w3schools.in/data-structures-tutorial/intro/
5. https://www.geeksforgeeks.org/data-structures/

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	1	3	3	3	3	3	3	3	3
4	2	3	3	3	3	3	3	3	3
5	1	3	3	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **HS**			*End Semester Exam Type: **LE**			
Course Code	**P26HSPC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Technical Report Writing and Seminar**	**-**	**-**	**4**	**2**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level
	CO1 Select a subject, narrowing the subject into a topic.	**K2**
	CO2 State an objective and collecting the relevant bibliography (at least 15 journal papers).	**K2**
	CO3 Study the papers and understanding the author's contributions and critically analyzing each paper.	**K3**
	CO4 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**
	CO5 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**

List of Experiments:

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filte	• provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-known journals and conferences, in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research?	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	• Conclude with limitations/issues not addressed by the paper (from the perspective of survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6%(Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	10% (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	5% (conclusions)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Repor
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Vivavoce)
Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	3	1	3	3	2	1	2
2	2	3	2	1	3	2	2	1	2
3	2	3	2	1	3	2	2	1	2
4	2	3	2	1	3	2	2	1	2
5	2	3	2	1	3	2	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				Attendance	End Semester Examination (ESE) Marks	Total Marks
	Weekly Progress	Seminar	Record work	Viva			
Marks	40	30	10	10	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P26CSC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P26CSE101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud Computing Technologies**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Data Science	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain foundational cloud computing concepts, models, and services	**K2**
	CO2 Analyze virtualization and resource management strategies	**K4**
	CO3 Apply cloud platform tools (AWS, Azure, GCP) for real use-cases	**K3**
	CO4 Evaluate cloud security, governance, and compliance mechanisms	**K5**
	CO5 Integrate advanced cloud technologies (DevOps, Containers, Edge) for scalable solutions	**K6**

UNIT- I	**Cloud Computing Fundamentals**	**Periods: 9**
Introduction - Evolution of Cloud Computing - Characteristics, Benefits, Challenges - Cloud Service Models: IaaS, PaaS, SaaS - Cloud Deployment Models: Public, Private, Hybrid, Community - Cloud Reference Architecture		**CO1**
UNIT- II	**Virtualization & Resource Management**	**Periods: 9**
Virtualization Concepts and Types (Full, Para, OS-level) - Hypervisors (Type-1/Type-2) - Resource Provisioning, Scheduling, Load Balancing - Containers & Docker - Virtual Infrastructure Management		**CO2**
UNIT- III	**Cloud Platforms and Services**	**Periods: 9**
AWS, Azure, Google Cloud Platform - Compute Services (EC2, Google Compute, Azure VMs) - Storage Services (S3, Blob, Drive) - Networking in Cloud & CDN - Serverless Functions (Lambda, Cloud Functions)		**CO3**
UNIT- IV	**Cloud Security, Privacy and Management**	**Periods: 9**
Cloud Security Risks and Threat Models - Identity and Access Management - Data Protection and Encryption - SLA, QoS, Governance - Auditing and Compliance in Cloud		**CO4**
UNIT- V	**Advanced Cloud Topics and Case Studies**	**Periods: 9**
Big Data and Cloud (Integration with Hadoop/Spark) - Edge and Fog Computing - Cloud Monitoring and Auto-Scaling - DevOps and CI/CD in Cloud - Case Studies (AWS, Azure, GCP deployments)		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Gopal Shyam & Manvi, "Cloud Computing: Concepts and Technologies", CRC Press, 2021.
2. Dan C. Marinescu, " Cloud Computing: Theory and Practice", Morgan Kaufmann Publishers In, 2013.
3. Kai Hwang, Geoffrey Fox & Jack Dongarra, "Distributed and Cloud Computing", Morgan Kaufmann Publishers In, 2013.
4. Rajkumar Buyya, Broberg & Goscinski, "Cloud Computing: Principles and Paradigms", Wiley, 2013.
5. John Arundel & Justin Domingus, "Cloud Native DevOps with Kubernetes", O'Reilly, 2019.

Reference Books

1. Rajkumar Buyya, Christian Vecchiola & Thamarai Selvi, "Mastering Cloud Computing", Morgan Kaufmann, 2013.
2. Tim Mather, Subra Kumaraswamy & Shahed Latif, "Cloud Security and Privacy", O'Reilly, 2009.
3. Kevin L. Jackson & Scott Goessling, "Architecting Cloud Computing Solutions", Packt Publishing, 2018.
4. Joe Baron et al.," AWS Certified Solutions Architect Official Study Guide", Sybex Inc, 2016.
5. Barrie Sosinsky, "Cloud Computing Bible", John Wiley & Sons Inc, 2011..

Web References

1. https://swayam.gov.in/nd1_noc20_cs20/preview
2. https://nptel.ac.in/courses/106/105/106105167/
3. https://freevideolectures.com/course/4639/nptel-cloud-computing
4. https://cloud.google.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	2	1	1	3	2	2
2	2	3	3	2	2	2	2	3	2
3	2	2	3	3	3	2	2	3	3
4	2	2	2	3	3	3	2	2	3
5	2	2	3	3	3	3	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P26CSE102**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cyber Attacks Detection and Prevention Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand Intrusion Detection and Prevention System	**K2**
	CO2	Illustrate Network Intrusion Detection and Prevention System	**K3**
	CO3	Make use of Network behavior analysis	**K3**
	CO4	Exploit SNORT IDS	**K4**
	CO5	Make use of IDPS Technologies	**K3**

UNIT- I	**Introduction to IDPS**	**Periods: 9**	
IDPS Technologies, Components and Architecture Implementation Uses of IDPS Technologies, Key Functions, Common Detection Methodologies Signature, Anomaly and Stateful Protocol Analysis, Types of IDPS Technologies			**CO1**
UNIT- II	**Host and Network IDPS**	**Periods: 9**	
Application, Transport, Network and Hardware Layer attacks, Sniffing Network Traffic, Replay Attacks,Command Injection, Internet Control Message Protocol Redirect, DDoS, Dangers and defenses with Man-in the Middle, Secure Socket Layer attacks, DNS Spoofing, Defense- in-Depth Approach, Port Security, Use Encrypted Protocols			**CO2**
UNIT- III	**Network Behaviour Analysis**	**Periods: 9**	
Components and Architecture Typical, Network Architecture, Sensor Locations. Honeynets- Gen I, II and III, Honeymole, Detecting the Attack - Intrusion Detection, Network Traffic Capture, Monitoring on the box, Setting up the Realistic Environment.			**CO3**
UNIT- IV	**Working with Snort IDS**	**Periods: 9**	
Introduction to Snort, Snort Alert Modes and Format, Working with Snort Rules, Rule Headers, Rule Options,The Snort Configuration File etc, Plugins, Preprocessors and Output Modules, Using Snort with MySQL.			**CO4**
UNIT- V	**Multiple IDPS Technologies**	**Periods: 9**	
Need for multiple IDPS Technologies, Integrating Different IDPS Technologies -Direct and Indirect,Firewalls, Routers and Honeypots, IPS using IP Trace back - Probabilistic and De- terministic Packet Marking, Marking WLAN Standards, WLAN Components, Threats against WLANs, 802.11 Wireless Infrastruc- ture Attacks,WEP Attacks, Wireless Client Attacks, Bluetooth Attacks, Cellphones, Personal Digital Assistance and OtherHybrid Devices Attack Detection, Jailbreaking.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1.Shui Yu, "Distributed Denial of Service Attack and Defense", Springer, 2014
2.Bradd Lhotsky, "OOSEC Host based Intrusion detection", PACKT Publication, 2013
3.John Hoopes, "Virtualization for Security: Including Sandboxing, Disaster Recovery, High Availability, Forensic Analysis, and Honeypotting", Syngress,2009.

Reference Books

1. Karen Scarfone and Peter Mell, "Guide to Intrusion Detection and Prevention Systems (IDPS)", NIST Special Publication 800-94, 2007
2. Padmavathi Ganapathi,"Cyber Security : Fundamentals, Attacks and Threats, Intrusion Detection and Prevention Systems",2021
3. Mano Paul P, Ravi R, Diana Jeba Jingle," Prevention of Cyber Attacks Using Email Spam Detection and Mitigation",2021.
4. Yuri Diogenes, Erdal Ozkaya, Dr. Erdal Ozkaya," Cybersecurity - Attack and Defense Strategies",2022.
5. Alessandro Parisi,"Hands-On Artificial Intelligence for Cybersecurity", 2019.

Web References

1. https://www.geeksforgeeks.org/cyber-security-tutorial/
2. https://www.simplilearn.com/tutorials/cyber-security-tutorial/types-of-cyber-attacks
3. https://www.mygreatlearning.com/blog/types-of-cyber-attacks/
4. https://cybersecurityguide.org/resources/coding-for-cybersecurity/
5. https://www.codingninjas.com/studio/library/cyber-attacks-and-their-types

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	2	3	2
2	2	2	3	3	2	-	3	3	2
3	2	2	3	3	2	-	2	1	1
4	2	2	3	3	2	-	1	1	2
5	2	2	3	3	2	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P26CSE103**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Bio-Inspired Computing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basic concepts of evolutionary algorithm	**K2**
	CO2 Understand the basic features of neural and immune systems and able to build the neural model.	**K2**
	CO3 Make use of complex and functional high-level phenomena can emerge from low-level interactions.	**K3**
	CO4 Illustrate computational processes derived from neural models.	**K2**
	CO5 Implement simple bio-inspired algorithms like genetic and Particle Swarm Optimization	**K3**

UNIT- I	**Introduction to Evolutionary Algorithm**	**Periods: 9**
Evolutionary algorithm, components of evolutionary algorithm representation (definition of individuals), Evaluation function (Fitness function), Population, parent selection Mechanism, Variation Operators, Survivor Selection Mechanism (Replacement), Initialization, Termination Condition, evolutionary algorithm case study Cellular systems, cellular automata, modeling with cellular systems, other cellular systems, computation with cellular systems, artificial life: analysis and synthesis of cellular systems.		**CO1**
UNIT- II	**Neural Systems**	**Periods: 9**
Biological nervous systems, artificial neural networks, neuron models, architecture, signal encoding ,synaptic plasticity, unsupervised learning, supervised learning, reinforcement learning, evolution of neural networks, hybrid neural systems, case study		**CO2**
UNIT- III	**Developmental and Immune Systems**	**Periods: 9**
Rewriting system, synthesis of developmental system, evolutionary rewriting systems, evolutionary developmental programs, biological immune systems, lessons for artificial immune systems, algorithms and applications, shape space, negative selection algorithm, clonal selection algorithm		**CO3**
UNIT- IV	**Behavioral Systems**	**Periods: 9**
Behavior in cognitive science, behavior in AI, behavior based robotics, biological inspiration for robots, robots as biological models, robot learning, evolution of behavioral systems, learning in behavioral systems, co-evolution of body and control, towards self-reproduction, simulation and reality		**CO4**
UNIT- V	**Genetic Algorithms**	**Periods: 9**
Representation of Individuals, Mutation, Recombination, Population Models, Parent Selection, Survivor Selection, Example Application: Solving a Job Shop Scheduling Problem		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. D. Floreano and C. Mattiussi, "Bio-Inspired Artificial Intelligence", MIT Press, 2008.
2. Tao Song, Pan Zheng, Mou Ling Dennis Wong, Xun Wang, "Bio-Inspired Computing Models and Algorithms", world scientific, 2019
3. F. Neumann and C. Witt, "Bioinspired Computation in combinatorial optimization: Algorithms and their computational complexity", Springer, 2010.

Reference Books

1. D. E. Goldberg, "Genetic algorithms in search, optimization, and machine learning", Addison- Wesley, 1989.
2. Simon O. Haykin, "Neural Networks and Learning Machines", Third Edition, Prentice Hall, 2008.
3. M. Dorigo and T. Stutzle, "Ant Colony Optimization", A Bradford Book, 2004.
4. R. C. Ebelhart, "Swarm Intelligence", Morgan Kaufmann, 2001.
5. Xin-She Yang,Zhihua Cui Renbin Xiao Amir HosseinGandomi Mehmet Karamanoglu "Swarm Intelligence and Bio-Inspired Computation", 1st Edition, Elsevier, 2013.

Web References

1. https://tutorials.one/bio-inspired-computing-approach-in-artificial-intelligence/
2. https://pythonhosted.org/inspyred/
3. https://pdfs.semanticscholar.org ›
4. https://www.frontiersin.org/research-topics/25088/bio-inspired-computation-and-its-applications
5. https://www.sciencegate.app/source/1398722893

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	2	3	2
2	2	2	3	3	2	-	3	3	2
3	2	2	3	3	2	-	2	1	1
4	2	2	3	3	2	-	1	1	2
5	2	2	3	3	2	3	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P26CSE104**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Block Chain and Crypto Currency**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Cryptography	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Design principles of Bitcoin and Ethereum.	**K2**
	CO2 Make use of the Simplified Payment Verification protocol.	**K3**
	CO3 Understand about Cryptocurrency	**K3**
	CO4 Illustrate the Cryptocurrency Regulation	**K3**
	CO5 Implement Blockchain Applications	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.			**CO1**
UNIT- II	**Blockchain**	**Periods: 9**	
Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.			**CO2**
UNIT- III	**Cryptocurrency**	**Periods: 9**	
History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.			**CO3**
UNIT- IV	**Cryptocurrency Regulation**	**Periods: 9**	
Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.			**CO4**
UNIT- V	**Blockchain Applications**	**Periods: 9**	
Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Douglas Robert Stinson and Maura Paterson, "Cryptography: Theory and Practice", CRC press, 2018.
2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography", Packet Publishing Ltd, Kindle Edition, 2017.
3. Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, Kindle Edition, 2016.

Reference Books

1.Imran Bashir, "Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts,DApps, cryptocurrencies, Ethereum, and more", Packt Publishing Limited, 3rd Edition,2020.
2.Andreas M. Antonopoulos,"Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media,2nd Edition 2017.
3.Keith M.Martin ,"Everyday Cryptography: Fundamental Principles & Applications",Oxford University Press, First edition 2016.
4. Dr.Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.
5. Dr. T R Padmanabhan C K Shyamala, N Harini , "Cryptography and Security", Wiley,1st Edition,2011.

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1. http://chimera.labs.oreilly.com/books/1234000001802/ch08.html
2. https://bitcoin.org/bitcoin.pdf
3. https://www.geeksforgeeks.org/introduction-to-crypto-terminologies
4. https://complyadvantage.com/knowledgebase/crypto-regulations/cryptocurrency-regulations-india
5. https://www.proofpoint.com/us/threat-reference/encryption

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	1	3	3	3	3	3	3	3
2	2	2	2	2	-	2	2	2	-
3	3	3	3	3	3	3	3	3	3
4	2	2	2	2	-	2	2	2	-
5	2	2	2	2	-	2	2	2	-

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	**Computer Science and Engineering**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P26CSE105**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Edge Computing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand core concepts, evolution & need for edge computing	**K2**
	CO2 Analyze edge computing architectures and platform components	**K4**
	CO3 Apply resource management, communication & virtualization mechanisms	**K3**
	CO4 Evaluate security & privacy solutions in edge environments	**K5**
	CO5 Integrate advanced edge technologies (AI, 5G) into real use cases	**K6**

UNIT- I	**Fundamentals of Edge Computing**	**Periods: 9**	
Introduction and motivation - Definitions, need & evolution of edge computing vs. cloud & fog computing - Edge ecosystem and enabling technologies - Key challenges: latency, bandwidth, scalability, privacy & security - Use cases: IoT, autonomous systems, smart cities			**CO1**
UNIT- II	**Edge Architectures and Platforms**	**Periods: 9**	
Edge computing architectures (device edge, network edge, cloudlets) - Multi-access Edge Computing standards and frameworks - Edge hardware: edge servers, gateways, sensors, smart devices - Software platforms & middleware for edge deployments - APIs and interfaces for edge applications			**CO2**
UNIT- III	**Resource Management and Communication**	**Periods: 9**	
Resource allocation & task scheduling in edge environments - Load balancing, virtualization & containerization at the edge - Networking protocols & communication stack - Edge data processing & caching - Performance metrics: latency, throughput, energy efficiency			**CO3**
UNIT- IV	**Edge Security, Privacy, and Operations**	**Periods: 9**	
Security challenges in edge computing - Encryption, authentication, access control & secure communication - Privacy-preserving techniques - Fault tolerance & reliability - Monitoring, orchestration & management tools			**CO4**
UNIT- V	**Advanced Topics and Applications**	**Periods: 9**	
Edge AI / Machine Learning at the edge - Integration of edge with 5G networks - Edge-enabled applications: healthcare, AR/VR, industrial IoT - Future trends & research directions (6G, edge blockchain, edge analytics) - Case studies & demos			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Kumari et al., "Edge Computing Fundamentals, Advances and Applications", CRC Press, 2022.
2. Gandomani et al., "Machine Learning for Edge Computing: Frameworks, Patterns & Best Practices", CRC Press, 2023.
3. Lanyu Xu, Weisong Shi, "Edge Computing: Systems and Applications", Wiley-IEEE Press, 2025.
4. Rajkumar Buyya, Satish Narayana Srirama, "Fog and Edge Computing: Principles and Paradigms", Wiley, 2019.
5. Arun Kumar Sangaiah et al., "Edge AI in Future Computing", CRC Press book series,

Reference Books

1. SpringerBriefs in Computer Science, "Edge Computing: A Primer",
2. Situnayake & Plunkett, "AI at the Edge", O'Reilly Media,
3. Research edged compendium, "Edge and Fog Computing for IoT Applications",
4. Coulouris et al, "Distributed Systems: Concepts and Design",
5. Brendan Burns, " Designing Distributed Systems", O'Reilly,

Web References

1. https://en.wikipedia.org/wiki/Edge_computing
2. https://en.wikipedia.org/wiki/Multi-access_edge_computing

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	1	2	1	2	2	3	3	1	3
2	1	2	1	2	2	3	3	3	2
3	1	2	1	2	2	3	2	1	3
4	2	2	2	3	2	3	1	1	2
5	3	1	2	3	2	3	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

(As per UGC - 2018 Regulations and Affiliated to Pondicherry University)

PUDUCHERRY – 605107

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.TECH.

COMPUTER SCIENCE ENGINEERING (BIG DATA ANALYTICS)

(REGULATIONS - 2026)

CURRICULUM AND SYLLABI

CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23MAT104	Mathematical Foundations for Data Analytics	BS	3	0	0	3	40	60	100
2	P23BDT101	Exploratory Data Analysis	PC	3	0	0	3	40	60	100
3	P23BDT102	Big Data Frameworks	PC	3	0	0	3	40	60	100
4	P23BDT103	Data Visualization	PC	3	0	0	3	40	60	100
5	P23HSTC01	Research Methodology and IPR	HS	2	0	0	2	40	60	100
6	P23BDE1XX	Professional Elective - I *	PE	3	0	0	3	40	60	100
Practical										
7	P23BDP101	Big Data Computing Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC01	Technical Report Writing and Seminar	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC1XX	Certification Course-I #	AEC	0	0	4	-	100	-	100
10	P23ACT10X	Audit Course-I**	AEC	0	0	2	-	100	-	100
							21	590	410	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23BDT204	Mining Massive Data	PC	3	0	0	3	40	60	100
2	P23BDT205	Streaming Data Analytics	PC	3	0	0	3	40	60	100
3	P23BDT206	Cloud Computing for Big Data	PC	3	0	0	3	40	60	100
4	P23BDTD01	Distributed Systems	PC	3	0	0	3	40	60	100
5	P23BDE2XX	Professional Elective - II*	PE	3	0	0	3	40	60	100
6	P23BDE2XX	Professional Elective - III*	PE	3	0	0	3	40	60	100
Practical										
7	P23BDP202	Cloud and Streaming Data Analytics Lab	PC	0	0	4	2	50	50	100
8	P23HSPC02	Seminar on ICT a hands on approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23BDC2XX	Certification Course-II #	AEC	0	0	4	-	100	-	100
10	P23ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23BDE3XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P23BDE3XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P23BDE3XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Project Work										
4	P23BDW301	Project Phase – I	PA	0	0	12	6	50	50	100
5	P23BDW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
6	P23BDC301	NPTEL/SWAYAM/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P23BDW403	Project Phase – II	PA	0	0	24	12	50	50	100
							12	50	50	100

*** Professional Elective Courses are to be selected from the list given in Annexure I**
 # Ability Enhancement Courses are to be selected from the list given in Annexure II
**** Audit Courses are to be selected from the list given in Annexure III**

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

Semester	I	II	III	IV	Total
Credits	21	22	17	12	72

Total number of credits required to complete
M.Tech in Computer Science and Engineering : 72 credits

ANNEXURE- I
PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	**P26BDE101**	Machine Learning
2	**P26BDEC01**	Deep Learning
3	**P26BDE102**	Neural Networks
4	**P26CSTD01**	Text,Web,Social Media Analytics
5	**P26BDE103**	Image and Video Analytics
Professional Elective-II		
1	**P26CSEC01**	Data Storage Technologies
2	**P26CSEC03**	Analytics of Things
3	**P26CSTD02**	Real-Time Systems
4	**P26BDEC02**	Information Retrieval
5	**P26BDE204**	Graph Algorithms & Mining
Professional Elective-III		
1	**P26BDE205**	Blockchain Technology
2	**P26BDE206**	Cryptography & Information Security
3	**P26BDE207**	Semantic Web and Knowledge Management
4	**P26BDE208**	Applied Machine Learning
5	**P26BDE209**	Web Analytics and Development
Professional Elective-IV		
1	**P26BDE310**	Optimization Techniques for Analytics
2	**P26CSEC04**	Soft Computing
3	**P26BDE311**	Expert System and Decision Making
4	**P26CSEC02**	Supply Chain Analytics
5	**P26BDE312**	Artificial Intelligence
Professional Elective-V		
1	**P26BDE313**	Advanced Data Structures and Algorithms
2	**P26BDE314**	Multicore Architectures
3	**P26ADEC01**	Models of Computation
4	**P26CSEC05**	User Interface / User Experience Design
5	**P26CSEC06**	Game Design and Augmented Reality
Professional Elective-VI		
1	**P26BDE315**	Speech Recognition
2	**P26BDE316**	Speech and Language Processing
3	**P26BDE317**	Data Driven Decision Making
4	**P26BDE318**	Agile and Software Project Management
5	**P26BDE319**	Reinforcement Learning

ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P26XXCX01	Adobe Photoshop
2	P26XXCX02	Adobe Animate
3	P26XXCX03	Adobe Dreamweaver
4	P26XXCX04	Adobe After Effects
5	P26XXCX05	Adobe Illustrator
6	P26XXCX06	Adobe InDesign
7	P26XXCX07	Autodesk AutoCAD -ACU
8	P26XXCX08	Autodesk Inventor – ACU
9	P26XXCX09	Autodesk Revit – ACU
10	P26XXCX10	Autodesk Fusion 360 – ACU
11	P26XXCX11	Autodesk 3ds Max – ACU
12	P26XXCX12	Autodesk Maya – ACU
13	P26XXCX13	Cloud Security Foundations
14	P26XXCX14	Cloud Computing Architecture
15	P26XXCX15	Cloud Foundation
16	P26XXCX16	Cloud Practitioner
17	P26XXCX17	Cloud Solution Architect
18	P26XXCX18	Data Engineering
19	P26XXCX19	Machine Learning Foundation
20	P26XXCX20	Robotic Process Automation / Medical Robotics
21	P26XXCX21	Advance Programming Using C
22	P26XXCX22	Advance Programming Using C ++
23	P26XXCX23	C Programming
24	P26XXCX24	C++ Programming
25	P26XXCX25	CCNP Enterprise: Advanced Routing
26	P26XXCX26	CCNP Enterprise: Core Networking
27	P26XXCX27	Cisco Certified Network Associate - Level 2
28	P26XXCX28	Cisco Certified Network Associate- Level 1
29	P26XXCX29	Cisco Certified Network Associate- Level 3
30	P26XXCX30	Fundamentals Of Internet of Things
31	P26XXCX31	Internet Of Things / Solar and Smart Energy System with IoT
32	P26XXCX32	Java Script Programming
33	P26XXCX33	NGD Linux Essentials

34	P26XXCX34	NGD Linux I
35	P26XXCX35	NGD Linux II
36	P26XXCX36	Advance Java Programming
37	P26XXCX37	Android Programming / Android Medical App Development
38	P26XXCX38	Angular JS
39	P26XXCX39	Catia
40	P26XXCX40	Communication Skills for Business
41	P26XXCX41	Coral Draw
42	P26XXCX42	Data Science Using R
43	P26XXCX43	Digital Marketing
44	P26XXCX44	Embedded System Using C
45	P26XXCX45	Embedded System with IOT / Arduino
46	P26XXCX46	English For IT
47	P26XXCX47	Plaxis
48	P26XXCX48	Sketch Up
49	P26XXCX49	Financial Planning, Banking and Investment Management
50	P26XXCX50	Foundation Of Stock Market Investing
51	P26XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P26XXCX52	IOT Using Python
53	P26XXCX53	Creo (Modelling & Simulation)
54	P26XXCX54	Soft Skills, Verbal, Aptitude
55	P26XXCX55	Software Testing
56	P26XXCX56	MX-Road
57	P26XXCX57	CLO 3D
58	P26XXCX58	Solid works
59	P26XXCX59	Staad Pro
60	P26XXCX60	Total Station
61	P26XXCX61	Hydraulic Automation
62	P26XXCX62	Industrial Automation
63	P26XXCX63	Pneumatics Automation
64	P26XXCX64	Agile Methodologies
65	P26XXCX65	Block Chain
66	P26XXCX66	Devops
67	P26XXCX67	Artificial Intelligence
68	P26XXCX68	Cloud Computing
69	P26XXCX69	Computational Thinking

70	P26XXCX70	Cyber Security
71	P26XXCX71	Data Analytics
72	P26XXCX72	Databases
73	P26XXCX73	Java Programming
74	P26XXCX74	Networking
75	P26XXCX75	Python Programming
76	P26XXCX76	Web Application Development (HTML, CSS, JS)
77	P26XXCX77	Network Security
78	P26XXCX78	MATLAB
79	P26XXCX79	Azure Fundamentals
80	P26XXCX80	Azure AI (AI-900)
81	P26XXCX81	Azure Data (DP -900)
82	P26XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P26XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P26XXCX84	Microsoft Power Platform (PI-900)
85	P26XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P26XXCX86	Microsoft Excel
87	P26XXCX87	Microsoft Excel Expert
88	P26XXCX88	Securities Market Foundation
89	P26XXCX89	Derivatives Equinity
90	P26XXCX90	Research Analyst
91	P26XXCX91	Portfolio Management Services
92	P26XXCX92	Cyber Security
93	P26XXCX93	Cloud Security
94	P26XXCX94	PMI – Ready
95	P26XXCX95	Tally – GST & TDS
96	P26XXCX96	Advance Tally
97	P26XXCX97	Associate Artist
98	P26XXCX98	Certified Unity Programming
99	P26XXCX99	VR Development

ANNEXURE-III

AUDIT COURSES

(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P26ACTX01	English for Research Paper Writing
2	P26ACTX02	Disaster Management
3	P26ACTX03	Sanskrit for Technical Knowledge
4	P26ACTX04	Value Education
5	P26ACTX05	Constitution of India
6	P26ACTX06	Pedagogy Studies
7	P26ACTX07	Stress Management by Yoga
8	P26ACTX08	Personality Development Through Life Enlightenment Skills
9	P26ACTX09	Unnat Bharat Abhiyan

Department	**Computer Science Engineering (BigData Analytics)**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **BS**			*End Semester Exam Type: **TE**			
Course Code	**P23MAT104**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Mathematical Foundations for Data Analytics**	**3**	**1**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Basic knowledge of matrix, set theory, functions and relations concepts needed for designing and solving problems.	**K1**
	CO2 Design and solve Boolean functions for defined problems.	**K4**
	CO3 Apply the concept of testing of hypothesis for small and large samples in real lifeproblems.	**K1**
	CO4 Concept of linear regression, correlation, and its applications	**K3**
	CO5 List the guidelines for designing experiments and recognize the key historical figuresin Design of Experiments.	**K3**

UNIT- I	**Matrix Algebra**	**Periods: 9**
Matrices - Rank of a matrix - Solving system of equations – Eigen values and Eigenvectors - Cayley - Hamilton theorem -Inverse of a matrix.		**CO1**
UNIT- II	**Mathematical logic**	**Periods:9**
Propositions and logical operators - Truth table - Propositions generated by a set - Equivalence and implication -Basic laws - Some more connectives - Functionally complete set of connectives - Normal forms.		**CO2**
UNIT- III	**Testing of hypothesis**	**Periods:9**
Sampling distributions – Small and large samples –Tests based on Normal, t test, Chi square test,andF test distributions for testing of means, variance and proportions — Contingency table (test fo independent) Goodness. of fit.		**CO3**
UNIT- IV	**Correlation and regression**	**Periods:9**
Correlation –Rank correlation– Regression –Multiple and partial correlation – Method of least squares –Plane of regression – Coefficient of multiple correlation – Coefficient of partial correlation.		**CO4**
UNIT- V	**Design of experiments**	**Periods:9**
Analysis of variance – One way and two-way classifications – Completely randomized design – Randomized block design –Latin square design - 2^2 Factorial design.		**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. David Makinson, "Sets, Logic and Maths for Computing", Springer Indian Reprint, 2011.
2. Grimaldi, R.P and Ramana, B.V. "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2006.
3. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

Reference Books

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Tata McGraw Hill, 4th Edition, 2002.
2. Sengadir, T. "Discrete Mathematics and Combinatorics" Pearson Education, New Delhi, 2009.
3. Trembley, J.P. and Manohar, R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill, New Delhi, 2007.
4. Venkataraman, M.K., "Engineering Mathematics", Volume-II, National Publishing Company, Second Edition, 1989.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.

Web References

1. https://sites.math.northwestern.edu/~mlerma/courses/cs310-05s/
2. https://csd.cs.cmu.edu/course-profiles/15-151-Mathematical-Foundations-for-Computer-Science
3. https://www.coursera.org/learn/mathematics-for-computer-science
4. https://www.cse.iitb.ac.in/~supratik/courses/cs719/index.html
5. https://www.irif.fr/~jep/PDF/MPRI/MPRI.pd

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	-	-	-	1	1	2	1
2	3	2	1	1	-	1	2	2	1
3	3	2	1	1	-	1	2	2	1
4	3	2	1	1	-	-	2	2	1
5	3	2	1	1	-	-	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	Computer ScienceEngineering (Big Data Analytics)	Programme: M.Tech.					
Semester	I	Course Category : PC			*End Semester Exam Type: TE		
Course Code	P23BDT102	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Exploratory Data Analysis	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Handle missing data in the real-world data sets by choosing appropriate methods.	K3
	CO2 Summarize the data using basic statistics. Visualize the data using basic graphsand plots.	K3
	CO3 Identify the outliers if any in the data set.	K2
	CO4 Choose appropriate feature selection and dimensionality reduction.	K3
	CO5 Apply Techniques for handling multi-dimensional data.	K3

UNIT – I	Introduction To Exploratory Data Analysis	Periods:9
Introduction to Exploratory Data Analysis (EDA) - Data Analytics lifecycle- Definition, Motivation, Steps in data exploration- Data Types: Numerical Data – Discrete data, continuous data – Categorical data – Measurement Scales: Nominal, Ordinal, Interval, Ratio – Comparing EDA with classical andBayesian Analysis – Software tools for EDA.		CO1
UNIT – II	**Data Transformation, Correlation Analysis andTime Series Analysis**	**Periods:9**
Transformation Techniques: Performing data deduplication - replacing values – Discretizationand binning. Introduction to Missing data, handling missing data: Traditional methods - MaximumLikelihood Estimation. Types of analysis: Univariate analysis - bivariate analysis - multivariate analysis. Time Series Analysis (TSA): Fundamentals of TSA - characteristics of TSA – Time based indexing - visualizing time series – grouping time series data - resampling time series data.		CO2
UNIT – III	**Data Summarization and Visualization**	**Periods:9**
Statistical summary measures, data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, contingency tables, n-D Statistical data analysis. Visualization: Scatter plots – Dot charts - Bar plots.		CO3
UNIT – IV	**Clustering Algorithms and Dimensionality Reduction**	**Periods:9**
Introduction to Spectral clustering – Document clustering – Minimum Spanning Tree clustering. Overview of Model- based clustering – Expectation-Maximization algorithm – Hierarchical Agglomerative model-based clustering. Outlier detection using Clustering. Principal Component Analysis (PCA) – Singular Value Decomposition – Factor Analysis -Intrinsic Dimensionality.Non Linear methods: Multidimensional Scaling – Manifold Learning – Self-Organizing Maps.		CO4
UNIT – V	**Model Development and Evaluation**	**Periods:9**
Statistical summary measures, data elaboration, 1-D Statistical data analysis, 2-D Statistical data Analysis, contingency tables, n-D Statistical data analysis. Visualization: Scatter plots – Dot charts -Bar plots.		CO5

Lecture Periods: 45	Tutorial Periods: -	Practical Periods: -	Total Periods: 45

Text Books

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python" 1st Edition, 2020, Packt Publishing.
2. Martinez, W , Martinez A & J.L. Solka : Exploratory Data Analysis with MATLAB, CRC Press, A Chapman & HallBook, 3rd Edition, 2017
3. Foster Provost and Tom Fawcett, "Data Science for Business", 1st Edition, 2013

Reference Books

1. Michael Jambu, "Exploratory and multivariate data analysis", 1991, 1st Edition, Academic Press Inc.
2. Charu C. Aggarwal, "Data Mining The Text book", 2015, Springer.
3. Craig K. Enders, "Applied Missing Data Analysis", 2010, 1st Edition, The Guilford Press
4. Kieran Healy , "Data Visualization: A Practical Introduction"1st Edition, 2018
5. Alex Reinhart , "Statistics Done Wrong", 1st Edition, 2015

Web References

1. https://www.dataschool.io/
2. https://www.datascamp.com/
3. https://www.kaggle.com/
4. https://towardsdatascience.com/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	2	2	1	-	1	3	-
2	1	1	2	2	1	2	1	-	3
3	2	1	1	2	1	2	1	3	-
4	3	1	2	1	-	1	-	3	1
5	3	1	1	2	-	-	-	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

*Application Oriented /Problem solving/Design/Analytical in content beyond the syllabus to be given from Unit-5

Department	Computer Science Engineering(Big Data Analytics)	Programme: M.Tech.						
Semester	I	Course Category : PC			*End Semester Exam Type: LE			
Course Code	P23BDP101	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Big Data Computing Laboratory	-	-	4	1	50	50	100

Prerequisite	Basics of Big Data	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Configure Hadoop and perform File Management Tasks.	K2
	CO2 Apply MapReduce programs to real time issues like word count, weather dataset and sales of a company.	K3
	CO3 Critically analyze huge data set using Hadoop distributed file systems and MapReduce.	K2
	CO4 Apply different data processing tools like Pig, Hive and Spark.	K3
	CO5 To validate and analysis the data computing.	K4

List of Experiments:

1. Develop a MapReduce program to calculate the frequency of a given word in agiven file.
2. Develop a MapReduce program to find the maximum temperature in each year.
3. Develop a MapReduce program to find the grades of student's.
4. Develop a MapReduce program to implement Matrix Multiplication.
5. Develop a MapReduce to find the maximum electrical consumption in each year givenelectrical consumption for each month in each year.
6. Develop a MapReduce to analyze weather data set and print whether the dayis shinny or coolday.
7. Develop a MapReduce program to find the number of products sold ineach countryby considering sales data containing fields like Tranction _Date Product Price Payment_Type Name City\State CountryAccount_Created Last_Login Latitude Longitude
8. Develop a MapReduce program to find the tags associated with each movie byanalyzingmovie lens data.
9. XYZ.com is an online music website where users listen to various tracks, the data gets collected whichis given below. The data is coming in log files and looks like as shown below.UserId | TrackId | Shared | Radio | Skip

   111115 | 222 | 0 | 1 | 0

   111113 | 225 | 1 | 0 | 0

   111117 | 223 | 0 | 1 | 1
   111115 | 225 | 1 | 0 | 0
10. Write a MapReduce Number of unique listeners.
    Number of times the track was shared with others
    Number of times the track was listened to on the radio
    Number of times the track was listened to in total
    Number of times the track was skipped on the radio
11. Develop a MapReduce program to find the frequency of books published eachyear and find in which year maximum number of books were published using the following data. Title Author Published year Author country Language No of pages
12. Develop a MapReduce program to analyze Uber data set to find the days on which each basement has more trips using the following dataset. The Uber dataset consists of four columns they aredispatching_base_number date active vehicles trips
13. Develop a program to calculate the maximum recorded temperature by year wise for the weather dataset inPig Latin
14. Write queries to sort and aggregate the data in a table using HiveQL.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 45	Total Periods: 45

Reference Books

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'reilly Media, 2015
2. Glenn J. Myatt, "Making Sense of Data" , John Wiley & Sons, 2007
3. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
4. Michael Berthold, David J.Hand, "Intelligent Data Analysis", Spingers, 2007.
5. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Uderstanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing,2012.

Web References

1. https://hadoop.apache.org/
2. https://spark.apache.org/
3. https://flink.apache.org/
4. https://storm.apache.org/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	2	2	3	2	2
2	1	2	2	2	2	2	3	2	2
3	1	3	3	3	3	3	3	3	3
4	2	3	3	3	3	3	3	3	3
5	1	3	3	3	3	3	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **HS**			*End Semester Exam Type: **LE**		
Course Code	**P23HSPC01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Technical Report Writing and Seminar**	**-**	**-**	**4**	**2**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a subject, narrowing the subject into a topic.	**K2**
	CO2 State an objective and collecting the relevant bibliography (at least 15 journal papers).	**K2**
	CO3 Study the papers and understanding the author's contributions and critically analyzing each paper.	**K3**
	CO4 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**
	CO5 Prepare a working outline and linking the papers and preparing a draft of the paper.	**K2**

List of Experiments:

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filte	□ provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar □ When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-known journals and conferences, in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: □ What is the main topic of the article? □ What was/were the main issue(s) the author said they want to discuss? □ Why did the author claim it was important? □ What simplifying assumptions does the author claim to be making? □ What did the author do? □ How did the author claim they were going to evaluate their work and compare it to others? □ What did the author say were the limitations of their	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

	research? □ What did the author say were the important directions for future research? □ Conclude with limitations/issues not addressed by the paper (from the perspective of survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6%(Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	10% (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	5% (conclusions)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Repor
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Vivavoce)
Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:** 45	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	3	3	1	3	3	2	1	2
2	2	3	2	1	3	2	2	1	2
3	2	3	2	1	3	2	2	1	2
4	2	3	2	1	3	2	2	1	2
5	2	3	2	1	3	2	2	1	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				Attendance	End Semester Examination (ESE) Marks	Total Marks
	Weekly Progress	Seminar	Record work	Viva			
Marks	40	30	10	10	10	-	100

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PROGRESS OF PH.D. SCHOLARS

S. No	Name of the Candidate	Supervisor	Mode	Number of DC Conducted	Number of Course Work Completed
1	Mrs. P. Bhavani	Dr. N. Danapaquiame	Part-Time (Internal)	2	4
2	Mr. Arokiaraj St. Hubert	Dr. J. Madhusudanan	Part-Time (Internal)	2	4
3	Mr. S. Diwahar	Dr. J. Madhusudanan	Part-Time (External)	2	4
4	Mr. G. Aurobind	Dr. R. Ramachandiran	Part-Time (External)	Thesis Submitted	4
5	Ms. T. Prateesshma	Dr. R. Raju	Regular	Viva-Voce Completed.	4