Department of Computer Science and Engineering

Minutes of 7th Board of Studies Meeting (UG)

The Seventh Board of Studies meeting of Computer Science and Engineering Department was held on **7th March 2024 at 1:00 P.M.** at GD Hall, Admin block, Sri Manakula Vinayagar Engineering College, with Head of the Department in the Chair through online mode.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS
1.	**Dr.K. Premkumar, M.E., Ph.D.,** Professor and Head Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry hodcse@smvec.ac.in 9842127679	Chairman
2.	**Mr. M. Shanmugam, M.E.,(Ph.D.)** Associate Professor, Sri Manakula Vinayagar Engineering College Madagadipet,Puducherry shanmugam.mm@smvec.ac.in 9444370963	Member Secretary
3.	**Dr. T. CHITHRALEKHA,** Professor, Department of Computer Science, School of Technology, Pondicherry University, Puducherry tchithralekha.csc@pondiuni.edu.in	Subject Expert (Pondicherry University Nominee)
4.	**Dr. M. Ramakrishnan,** Professor and Head, School of Information Technology, Department of Computer Applications, Madurai Kamaraja University, Madurai. Ph:8939432261 Mail id: ramkrishod@gmail.com	Subject Expert (Academic Council Nominee)
5.	**Dr. A. Kalaivani,** Professor, Department of Information Technology, Rajalakshmi Engineering College, Chennai. 7904977893 Mail: kalaivanianbarasan@rediffmail.com	Subject Expert (Academic Council Nominee)
6.	Aroulvel S, Technical leader, Cisco,Bangalore aroshanm@cisco.com, 9003898387	Representative from Industry

9. A. 3. 1

7.	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.,** Associate Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry ganesan@smvec.ac.in 9486341535	Internal Member
9.	**Dr. R. Ramachandiran, M.Tech., Ph.D.,** Associate Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry ramachandiran@smvec.ac.in 7639031674	Internal Member
10.	**Dr. T. Megala, M.Tech., Ph.D.,** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email :Megalag26@gmail.com 9789722271	Internal Member
11.	**Dr.J.Raja, M.Tech., Ph.D** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering College Madagadipet,Puducherry Email id:rajacse@smvec.ac.in	Internal Member
12.	**Dr. N. Pazhaniraja,** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering College Email:pazhaniraja.cse@smvec.ac.in	Internal Member
13.	**Mr. P. Karthikeyan** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering College Madagadipet,Puducherry Email:karthikcse@smvec.c.in	Internal Member
14.	**Mr.B.Thiyagarajan** Assistant Professor Sri ManakulaVinayagar Engineering College Email:thiyagarajan@smvec.ac.in	Internal Member
15.	**Mr.S.Kumarakrishnan** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Skumarakrishnan@smvec.acin	Internal Member

2.A.3.2

16.	**Mrs.C.Kalpana** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:ckalpana@ smvec.ac.in	Internal Member
17.	**Mrs.P.Bhavani** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Bhavani@ smvec.ac.in	Internal Member
18.	**Mr.D.Rajesh** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:successraju@gmail.com	Internal Member
19.	**Mr.Arokiaraj Christian Hubert** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Arokiaraj@smvec.ac.in	Internal Member
20.	**Ms.Swathilakshmi.V** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Swathilakshmi@gmail.com	Internal Member
21.	**Mrs.Gajalakshmi** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Gajalakshmicse@smvec.ac.in	Internal Member
22.	**Mrs.S.Subasree** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Subasree@smvec.ac.in	Internal Member
23.	**Mrs.S.Deeba** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:deebacse@smvec.ac.in	Internal Member
24.	**Mrs. R. Deepa** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:deepa.cse@smvec.ac.in	Internal Member
25.	**Mrs.C.Karthika** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:karthikacse@smvec.ac.in	Internal Member

2.A.3.3

26.	**Mr.K. Anbuthiruvarangan** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Anbuthiruvarangan.cse@smvec.ac.in	Internal Member
27.	**Mrs.N.Suganya** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Suganaya.cse@smvec.ac.in	Internal Member
28.	**Ms.Nirmala Devi.P** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Nirmala.cse@smvec.ac.in	Internal Member
29.	**Ms.N.Pavithra** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Pavithra.cse@smvec.ac.in	Internal Member
30.	**Dr.M.A.IshrathJahan** Associate Professor, Department of English, SMVEC	Internal Member
31.	**Dr.T.Jayavarthanan** Professor, Department of Physics, SMVEC	Internal Member
32.	**Dr.S.Savithiri,** Professor and Head, Department of Chemistry, SMVEC	Internal Member
33.	**Prof.K.Raja,** Assistant Professor, Department of Mathematics, SMVEC	Internal Member

Agenda of the Meeting	
Item No. : BoS/ UG/ CSE 7.1	Welcome Address and to confirm the minutes of the sixth meeting of Board of Studies held on 22.07.2023.
Item No. : BoS/ UG / CSE 7.2	To discuss and approve Curriculum for 1 to 8 semesters and syllabi of third and fourth Semesters for the B.Tech Computer Science and Engineering students admitted from the academic year 2023-24 under R-2023 Regulation. • Credit Distribution • Course structure • Professional Core Courses • Professional Elective Courses • Open Elective Courses offered to other departments

Item No. : BoS/ UG / CSE 7.3	To discuss the uniqueness of the Curriculum (R-2023)
	• Theory cum Practical Courses
	• Micro and Mini Projects
	• Honours Degree – Courses, Syllabus and Credits
	• Ability Enhancement Courses
	  ○ Skill Enhancement Courses
	  ○ Certification Courses
	• Mandatory courses
	• Introduction of Universal Human Values II
	Sustainable Development Goals (SDG) – Equivalent courses as per

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	NEP 2020.
Item No. : BoS/ UG / CSE 7.4	To discuss and approve the Evaluation Systems for regulation R-2023. • Mark weightage for Continuous Assessment and End Semester Examination • Question paper pattern • Mark requirement to pass the course
Item No. : BoS/ UG / CSE 7.5	• To discuss and approve the Academic Calendar for the even semester 2024.
Item No. : BoS/ UG / CSE 7.6	To apprise about the Industry Institute Interactions of the department of Computer Science and Engineering • Guest lectures • Internship details • MOUs • Industrial Visits • Value Added Courses
Item No. : BoS/ UG / CSE 7.7	To apprise the End Semester Results of the students admitted in the Academic Year 2020-2021 (VII sem), 2021-2022 (V sem), 2022-2023 (III sem) and to discuss about Extra-Curricular and Co-Curricular activities.
Item No. : BoS/ UG / CSE 7.8	To apprise the schedule of the End Semester Examination to be conducted in the month of May/June 2024 and to discuss and recommend the panel of examiners to the Academic Council
Item No. : BoS/ UG / CSE 7.9	Any other item with the permission of chair

Minutes of the Meeting

Dr. K.Premkumar, Chairman, 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 Chairman.

Item No. : BoS/ UG/ CSE 7.1

Confirmation of minutes of 6th BoS meeting held on 22.07.2023

Chairman, BoS, apprised the minutes of 7th BoS, its implementation and then it is confirmed with the approval in 6th BoS meeting for the incorporation of minor revisions needed as mentioned below.

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-23	I	Basics of Electrical and Electronics Engineering-U23ESTC03	VI	Experts Recommended to rename the topic "Need for Modulation" to "Modulation"
2	R-23	I	Practical-Programming in C Laboratory-U23CSPC01	-	Experts recommends to use "To write a C program" instead of "To create a C program"

The above correction was incorporated and approved by BoS members in 6th BoS

2.A.3.5

meeting

Item No. : BoS/ UG/ CSE 7.2

To discuss and approve Curriculum for 1 to 8 semesters and syllabi of third and fourth Semesters for the B.Tech Computer Science and Engineering and students admitted from the Academic year 2023-24 under R-2023 Regulation.

The B.Tech. Degree curriculum and syllabus approval of III and IV semesters under Autonomous Regulations 2023 for the B.Tech programme and the students admitted in the 2023-24 were discussed and recommended with the following modifications.

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	2023	IV	Cloud and big data theory	-	This paper needs to be splitted into two courses. since the syllabus is too heavy. Therefore, the course is framed has cloud computing and moved to 5th semester as suggested by the experts
2	2023	IV	Distributed Systems	-	Distributed system Course is moved to fourth semester elective from fifth semester as suggested by experts
3	2023	VIII	Cryptography for Cybersecurity	-	This course needs to be removed from elective. since already the curriculum has similar paper Network Security and Cryptography

The above correction was incorporated and approved by BoS members in 7th BoS meeting, and the details are enclosed in Annexure - I.

Item No. : BoS/ UG/ CSE 7.3

To discuss the uniqueness of the Curriculum (R-2023)

- Credit Distribution
- Course structure
- Professional Core Courses
- Professional Elective Courses
- Open Elective Courses offered to other departments

- Discussed about the approval of Theory cum Practical Courses, Micro and Mini Projects,Honours Degree – Courses, Syllabus Credits, Ability Enhancement Courses, Mandatory courses Introduction of Universal Human Values II and Sustainable Development Goals (SDG) introducted for B.Tech Computer Science and Engineering under R-2023 regulation from the Academic Year 2023 -2024 and the same is approved by BoS members.The detail of honours is enclosed in **(Annexure-II)**

2.A.3.6

Item No. : BoS/ UG/ CSE 7.4

To discuss and approve the Evaluation Systems for regulation R-2023.

- Mark weightage for Continuous Assessment and End Semester Examination
- Question paper pattern

Mark requirement to pass the course

Discussed about the Evaluation System and Question paper Format under R-2023 for the students admitted from the Academic Year 2023-24 and the same was approved by BoS members

Item No. : BoS/ UG/ CSE 7.5

To discuss and approve the Academic Calendar for the even semester 2024

The Panel of Experts discussed and approved the calendar for the even semester 2024

Item No. : BoS/ UG/ CSE 7.6

To apprise about the Industry Institute Interactions of the department of Computer Science and Engineering

- Guest lectures
- Internship details
- MOUs
- Industrial Visits
- Value Added Courses

The Panel of Experts discussed about the Industry Institute Interactions

Item No. : BoS/ UG/ CSE 7.7

To apprise the End Semester Results of the students admitted in the Academic Year 2020-2021 (VI sem), 2021-2022 (IV sem), 2022-2023 (II sem) and to discuss about Extra-Curricular and Co-Curricular activities

The panel discussed about Results of II ,IV and VI semester and encouraged students to participate in Extra-Curricular and Co-Curricular activities

Item No. : BoS/ UG/ CSE 7.8

To apprise the schedule of the End Semester Examination to be conducted in the month of May/June 2024 and to discuss and recommend the panel of examiners to the Academic Council

Experts have suggested to include faculties from government colleges as the panel of examiners.The suggestion is been incorporated and attached in Annexure-III

Item No. : BoS/ UG/ CSE 7.9

Any other item with the permission of chair.

The panel discussed about bringing up new research topic in curriculum

2.A.3.7

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1.	**Dr.K. Premkumar, M.E., Ph.D.,** Professor and Head Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry hodcse@smvec.ac.in 9842127679	Chairman	
2.	**Mr. M. Shanmugam, M.E.,(Ph.D.)** Associate Professor, Sri Manakula Vinayagar Engineering College Madagadipet,Puducherry shanmugam.mm@smvec.ac.in 9444370963	Member Secretary	
3.	**Dr. T. CHITHRALEKHA,** Professor, Department of Computer Science, School of Technology, Pondicherry University, Puducherry tchithralekha.csc@pondiuni.edu.in	Subject Expert (Pondicherry University Nominee)	
4.	**Dr. M. Ramakrishnan,** Professor and Head, School of Information Technology, Department of Computer Applications, Madurai Kamaraja University, Madurai. Ph:8939432261 Mail id: ramkrishod@gmail.com	Subject Expert (Academic Council Nominee)	
5.	**Dr. A. Kalaivani,** Professor, Department of Information Technology, Rajalakshmi Engineering College, Chennai.	Subject Expert (Academic Council Nominee)	

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	7904977893 Mail: kalaivanianbarasan@rediffmail.com		
6.	Aroulvel S, Technical leader, Cisco,Bangalore aroshanm@cisco.com, 9003898387	Representative from Industry	
7.	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.,** Associate Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry ganesan@smvec.ac.in 9486341535	Internal Member	
9.	**Dr. R. Ramachandiran, M.Tech., Ph.D.,** Associate Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry ramachandiran@smvec.ac.in 7639031674	Internal Member	27/03/2024
10.	**Dr. T. Megala, M.Tech., Ph.D.,** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email :Megalag26@gmail.com 9789722271	Internal Member	
11.	**Dr.J.Raja, M.Tech., Ph.D** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering College Madagadipet,Puducherry Email id:rajacse@smvec.ac.in	Internal Member	27/03/24
12.	**Dr. N. Pazhaniraja,** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering College Email:pazhaniraja.cse@smvec.ac.in	Internal Member	
13.	**Mr. P. Karthikeyan** Associate Professor, Computer Science and Engineering, Sri Manakula Vinyagar Engineering	Internal Member	

2.A.2.15

	College Madagadipet,Puducherry Email:karthikcse@smvec.c.in		
14.	**Mr.B.Thiyagarajan** Assistant Professor Sri ManakulaVinayagar Engineering College Email:thiyagarajan@smvec.ac.in	Internal Member	
15.	**Mr.S.Kumarakrishnan** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Skumarakrishnan@smvec.acin	Internal Member	
16.	**Mrs.C.Kalpana** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:ckalpana@ smvec.ac.in	Internal Member	
17.	**Mrs.P.Bhavani** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Bhavani@ smvec.ac.in	Internal Member	
18.	**Mr.D.Rajesh** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:successraju@gmail.com	Internal Member	
19.	**Mr.Arokiaraj Christian Hubert** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Arokiaraj@smvec.ac.in	Internal Member	
20.	**Ms.Swathilakshmi.V** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Swathilakshmi@gmail.com	Internal Member	
21.	**Mrs.Gajalakshmi** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Gajalakshmicse@smvec.ac.in	Internal Member	

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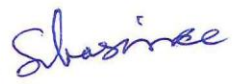
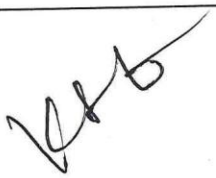
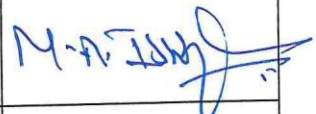
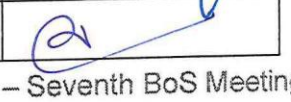
22.	**Mrs.S.Subasree** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:Subasree@smvec.ac.in	Internal Member	
23.	**Mrs.S.Deeba** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:deebacse@smvec.ac.in	Internal Member	
24.	**Mrs. R. Deepa** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:deepa.cse@smvec.ac.in	Internal Member	
25.	**Mrs.C.Karthika** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Email:karthikacse@smvec.ac.in	Internal Member	
26.	**Mr.K. Anbuthiruvarangan** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Anbuthiruvarangan.cse@smvec.ac.in	Internal Member	
27.	**Mrs.N.Suganya** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Suganaya.cse@smvec.ac.in	Internal Member	
28.	**Ms.Nirmala Devi.P** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Nirmala.cse@smvec.ac.in	Internal Member	
29.	**Ms.N.Pavithra** Assistant Professor Sri ManakulaVinayagar Engineering College Madagadipet,Puducherry Pavithra.cse@smvec.ac.in	Internal Member	
30.	**Dr.M.A.IshrathJahan** Associate Professor, Department of English, SMVEC	Internal Member	
31.	**Dr.T.Jayavarthanan**	Internal Member	

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	Professor, Department of Physics, SMVEC		
32.	**Dr.S.Savithiri,** Professor and Head, Department of Chemistry, SMVEC	Internal Member	
33.	**Prof.K.Raja,** Assistant Professor, Department of Mathematics, SMVEC	Internal Member	

2.A.3.18

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

DETAILS OF EQUIVALENT COURSES IN R 2023 CURRICULUM FOR THE COURSES IN R 2020
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Sl. No.	Year / Sem	Name of the Course with code under R-2020 Regulations (All the Courses in a semester to be mentioned with course code)		For Question Paper Setting with respect to R-2020 Regulations		
				Equivalent Course Name with Code in R-2023 Regulations (Courses which are not modified / content reduced)	Course is retained with modification in the content / Course content increased)	If Course is Removed (Yes)
1.	I / I	**Theory:**				
		1. U20BST101	Engineering Mathematics – I (Calculus and Linear Algebra)		U23MATC01/ Engineering Mathematics – I	
		2. U20EST106	Introduction to Engineering: Distinction, Principles and Application			YES
		3. U20EST107	Micro Electronics and Digital System Design			YES
		4. U20EST109	Problem Solving Approach	U23CSTC02 / Problem Solving Approach		
		5. U20EST110	Programming in Python		U23ADTC01 / Programming in Python	
2	I / II	**Theory:**				
		1. U20BST215	Engineering Mathematics – II (Multiple Integrals and Transforms)		U23MATC02 / Engineering Mathematics – II	
		2. U20EST201	Programming in C		U23CSTC01/ Programming in C	
		3. U20CST201	Microprocessors and Microcontrollers			YES
		4. U20CST202	Front-End Web Development			YES
		5. U20CST203	Computer Organization and Architecture			YES
		6. U20CST204	Computer Graphics			YES
3	II/III	**Theory:**				
		1. U20BST322	Numerical Methods			YES
		2. U20EST356	Data Structures	U23CSTC03/ Data Structures		
		3. U20EST359	Programming in C++	U23CSE401/ Programming in C++		
		4. U20CST305	Automata and Compiler Design		U23CSDC01/ Automata and Compiler Design	
		5. U20CST306	Operating Systems	U23CSTC05/ Operating Systems		
		6. U20CST307	Data Communications and Computer Networks			YES

4	II/IV	**Theory:**				
		1. U20BST432	Discrete Mathematics and Graph Theory			YES
		2. U20EST467	Programming in Java	U23ITC02/ Programming in Java		
		3. U20CST408	Database Management Systems		U23CSTC04/ Database Management Systems	
		4. U20CST409	Design and Analysis of Algorithms		U23CSBC01/ Design and Analysis of Algorithms	
		5. U20CSE402	Professional Elective- I E-Business			YES
		6. U20CSE403	Professional Elective- I Object Oriented Analysis and Design			YES
		7. U20ADO401	Open Elective I: Knowledge Representation and Reasoning			YES
		8. U20ADO402	Open Elective I: Introduction to Data Science			YES
5	III/V	1. U20BST546	Probability and Statistics	U23MATC03/ Probability and Statistics		
		2. U20CST510	Handheld Computing: Design and Application Development			YES
		3. U20CST511	Programming in PHP			YES
		4. U20CST512	Software Engineering and Testing	U23CST302/Software Engineering and Testing		
		5. U20CSE5XX	Professional Elective - II			YES
		6. U20XXO5XX	Open Elective – II			YES
6	III/VI	1. U20CST613	Artificial Intelligence and Expert Systems			YES
		2. U20CSCM02	C# and .Net Programming			YES
		3. U20CST615	Cloud Computing and Big Data		U23CST504/ Cloud Computing	
		4. U20CST616	Animation and Visual Effects	U23CST606/ Animation and Visual Effects		
		5. U20CSE6XX	Professional Elective - III			YES
		6. U20XXO6XX	Open Elective - III			YES
7	IV/VII	1. U20ITCM03	IoT and Edge Computing	U23CST707/ IoT and Edge Computing		
		2. U20CST718	Data Science and Digital Marketing Analytics	U23CST708/ Data Science and Digital Marketing Analytics		
		3. U20CSE7XX	Professional Elective –IV			YES
		4. U20XXO7XX	Open Elective – IV: Automation Techniques & Tools- DevOps			YES
8	IV/VIII	1. U20ADCM02	Block chain and Cryptography			YES
		2. U20CSE8XX	Professional Elective – V			YES
		3. U20CSE8XX	Professional Elective – VI			YES

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M. Ramesh

HOD/CSE

ANNEXURE I

2. A. 3. 21

SEMESTER III

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2.A.3.24

Annexure – I

Curriculum and Syllabus 2023 R

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23CST301	Embedded System Architecture and Interfacing	PC	3	0	0	3	25	75	100
3	U23CST302	Software Engineering and Testing	PC	3	0	0	3	25	75	100
4	U23CSDC01	Automata and Compiler Design	PC	3	0	0	3	25	75	100
5	U23CST303	Computer Networks	PC	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSBC01	Design and Analysis of Algorithms	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23CSP301	Embedded System Architecture and Interfacing Laboratory	PC	0	0	2	1	50	50	100
10	U23CSP302	Software Engineering and Testing Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CSC3XX	Certification Course – III**	AEC	0	0	4	-	100	-	100
12	U23CSS301	Skill Enhancement Course – I*	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23CSM303	Climate Change	MC	2	0	0	-	100	-	100
							23	675	625	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC05	Discrete Mathematics and Graph Theory	BS	3	1	0	4	25	75	100
2	U23ITTC02	Programming in Java	ES	3	0	0	3	25	75	100
3	U23CSTC04	Database Management Systems	PC	3	0	0	3	25	75	100
4	U23CSTC05	Operating Systems	PC	3	0	0	3	25	75	100
5	U23CSE4XX	Professional Elective I #	PE	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSB401	Android Programming	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U23ITPC02	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC03	Database Management Systems Laboratory	PC	0	0	2	1	50	50	100
10	U23CSPC04	Operating Systems Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23CSC4XX	Certification Course – IV **	AEC	0	0	4	-	100	-	100
12	U23CSS402	Skill Enhancement Course -II *	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23CSM404	Right to Information and Good Governance	MC	2	0	0	0	100	-	100
							23	675	625	1300

 # Professional Electives are to be selected from the list given in Annexure I

*** Skill Enhancement Courses (1and 2) are to be selected from the list given in Annexure II**

24.3.25

2.A.3.26

Department	Mathematics	Programme: B.Tech.						
Semester	III	Course Category Code: BS			*End Semester Exam Type:TE			
Course Code	U23MATC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Probability and Statistics	3	1	-	4	25	75	100

(Common to All Branches Except CSBS)

Prerequisite	Basic Probability	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Understand the concept of probability.	K3
CO2	Solve the problem on Random variables.	K3
CO3	Understand the concepts of Analysis of variance.	K3
CO4	Learn the applications of Large Samples.	K3
CO5	Analyze the problems in small samples.	K3

UNIT – I	Theory of Probability	Periods:12
Random Experiments - Sample Space - Exhaustive events- Axioms of probability – Conditional probability – Total probability – Bayes theorem.		CO1
UNIT – II	**Random Variables**	**Periods:12**
Discrete Random Variable – Binomial distribution – Poisson distribution. Continuous Random Variable – Exponential distribution – Normal distribution (Excluding Derivation of Mean, Variance and MGF)		CO2
UNIT – III	**Statistics & Analysis of Variances**	**Periods:12**
Correlation – Rank correlation and Regression. Analysis of variance: One-way classifications. and two-way classifications.		CO3
UNIT – IV	**Large Samples**	**Periods:12**
Large Samples: Single Propositions – Difference of Proportions – Single Mean – Difference of Mean – Difference of Standard Deviations.		CO4
UNIT – V	**Small Samples**	**Periods:12**
Test for Single and Difference Mean – Test for Ratio of Variances – Chi-Square test for Goodness of Fit and Independence of Attributes.		CO5

Lecture Periods:45	Tutorial Periods:15	Practical Periods: -	Total Periods:60

Text Books

1. T. Veerarajan, "Probability, Statistics and Random Processes", Tata McGraw-Hill, 3rd Edition, 2008.
2. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, 2019.
3. S.C. Gupta, V.K. Kapur "Fundamental of Mathematical Statistics" Sultan Chand & sons, 12th Edition, 2022.

Reference Books

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna publishers, 3rd Edition,2017
2. William Mendenhall, Robert J. Beaver and Barbara M. Beaver: "Introduction to Probability & Statistics", Cengage Learning, 15thEdition, 2019.
3. Richard. A. Johnson, Irwin Miller and John E. Freund," Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, "An Introduction to Probability and Statistics", Wiley, 3rd Edition 2008.

Web References

1. www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 27

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	2	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	-	-	-	1	-	1	2	1	1
5	3	2	1	1	-	1	-	-	-	1	-	1	2	1	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		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 28

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23CST301	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Embedded Systems Architecture and Interfacing	3	0	0	3	25	75	100

Prerequisite	Digital Design and System Architecture	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Basics of Embedded Systems.	K2
	CO2 Familiarize the basic concepts of 8086 instructions.	K2
	CO3 Learn the Interface modules using 8086.	K3
	CO4 Attain knowledge on 8051 microcontroller instructions and Interfacing.	K2
	CO5 Learn and apply the concepts of real time applications using RTOS.	K3

Unit- I	**Basics of Embedded Systems**	**Periods: 09**	
Introduction to Embedded Systems - Processor in an Embedded System - Classification of Embedded Systems - Examples of Embedded Systems - Embedded hardware units and devices, Embedded software in a system - Complex systems design and processors - Embedded system design process.			**CO1**
Unit- II	**8086 Microprocessor**	**Periods: 09**	
Introduction to 8086 - Microprocessor architecture - Addressing modes - Instruction set and assembler directives - Assembly language programming - Modular Programming - Linking and Relocation - Stacks - Procedures - Macros - Interrupts and interrupt service routines - Byte and String Manipulation.			**CO2**
Unit- III	**Interfacing with 8086**	**Periods: 09**	
Introduction to Peripheral Devices - 8237 DMA Controller, 8255 programmable peripheral interface, 8253/8254 programmable timer/counter, 8259 programmable interrupt controller, 8251 USART and RS232C.			**CO3**
Unit- IV	**8051 Microcontroller**	**Periods: 09**	
Architecture of 8051- I/O Pins Ports - Instruction set - Addressing modes - Assembly language programming: Programming 8051 Timers - Serial Port Programming - Interrupts Programming - LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.			**CO4**
Unit- V	**Real-Time Operating System (RTOS)**	**Periods: 09**	
RTOS - Need of RTOS in Embedded System - Choosing RTOS - MicroC/OS-II - Integrated Development Environment - Simulators - Emulators - Debugging - Case Study: Washing Machine - Application specific Embedded System - Automotive - Domain specific Embedded system.			**CO5**

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

Text Books

1. Dr D A Godse, A P Godse, "Microprocessors & Microcontrollers: 8086 and 8051 Architecture, Programming and Interfacing", Technical Publications, 2020.
2. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 6th Edition 2019.
3. Raj Kamal, "Embedded systems Architecture, Programming and Design", Tata McGraw - Hill, 2016.
4. Shibu K V," Introduction to Embedded Systems", McGraw Hill Education (India) Private Limited, 2014.
5. Wayne Wolf "Computers as components: Principles of Embedded Computing System Design", The Morgan Kaufmann Series in Computer Architecture and Design, 2013.
6. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011.

Reference Books

1. Steve Heath, "Embedded Systems Design", EDN Series, 2013.
2. Lyla B. Das," Embedded Systems an Integrated Approach", Pearson Education, 2013.
3. Krishna Kant, "Microprocessors and Microcontrollers - Architectures, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2014.
4. Doughlas V.Hall, —Microprocessors and Interfacing, Programming and Hardware, TMH 2012.
5. Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition – 2012.
6. Sriram V Iyer, Pankaj Gupta " Embedded Real Time Systems Programming", Tata McGraw- Hill, 2012.

2.A.3.29

Web References

1. Web based 8085 Microprocessor Simulator (web8085.appspot.com)
2. https://exploreembedded.com
3. https://www.udemy.com/course/8051-microcontroller-embedded-c-and-assembly-language/
4. https://www.elprocus.com/peripherals-interfacing-to-the-microcontroller-8051-in-electronics/
5. https://developer.arm.com/products/architecture/cpu-architecture

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	1	-	-	-	-	-	1	1	2	3	3	2
2	2	1	2	1	-	-	-	-	-	1	1	2	3	3	2
3	2	2	3	2	-	-	-	-	-	1	1	2	3	3	2
4	2	1	2	1	-	-	-	-	-	1	1	2	3	3	2
5	2	2	3	2	-	-	-	-	-	1	1	2	3	3	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		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 30

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category: PC				End Semester Exam Type: TE		
Course Code	U23CST302	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Software Engineering and Testing	3	-	-	3	25	75	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Perform Software engineering processes.	K2
	CO2 Make use of software design.	K2
	CO3 Apply different software testing strategies.	K3
	CO4 Illustrate different testing techniques.	K3
	CO5 Apply the different levels of testing.	K3

UNIT - I	Software Engineering Processes	Periods:09
Software engineering concepts – Development activities – Software development lifecycle models – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management – Project Planning – Empirical Estimation Techniques – Staffing Level Estimation – Scheduling – Organization and Team structures – Staffing – Software Requirements specification.		CO1

UNIT - II	Software Design	Periods:09
Characteristics of a Good Software Design – Coupling and Cohesion – Structured Analysis – Data Flow Diagrams – Structured and Detailed Design – Object oriented concepts – UML Diagrams – Use case model – Class diagrams – Interaction diagrams – Activity diagrams – state chart diagrams – Object Oriented Analysis and Design methodology – Characteristics of a good User Interface – Types – A User Interface Design methodology.		CO2

UNIT - III	Software Testing	Periods:09
Introduction to Software testing – Psychology of Testing – Principles of Software Testing – Defects – Defect Prevention Strategies – Role of a tester – Software Testing Life Cycle.		CO3

UNIT - IV	Testing Techniques and Testing Tools	Periods:09
Testing Techniques – Verification vs Validation – Software Testing Methodologies – White Box, Black Box and Grey Box – Static and Dynamic Techniques – Informal Reviews, Walkthroughs, Technical Reviews, Inspection – Structural Techniques, Black Box Techniques, Experienced Based Techniques. Testing Tools: Selenium – Jmeter.		CO4

UNIT - V	Levels of Testing	Periods:09
Levels of Testing – Test Case Design – Building Test Cases – Test data mining – Test execution – Test reporting – Functional Testing – Unit, Integration, System, Acceptance, Regression, Retest – Non Functional Testing – Performance, Memory, Scalability, Compatibility, Security, Cookie, Session, Recovery, Adhoc, Risk Based Testing.		CO5

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

Text Books

1. Glenford J Myers, Corey Sandler, Tom Badgett," The Art of Software Testing", Wiley, 3rd Edition 2015.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Learning, 3rd Edition, 2013.
3. Ian Sommerville, "Software Engineering", Pearson Education, 8th Edition, 2008.

Reference Books

1. Rahul Shende "Software Automation Testing Tools for Beginners", Arizona Business Alliance, 2012
2. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill International Edition, 7th Edition, 2009.
3. S. L. Pfleeger and J.M. Atlee, "Software Engineering Theory and Practice", Pearson Education, 3rd Edition, 2008.
4. Lee Copeland "A Practitioner's Guide to Software Test Design", Artech House Publishers, 2003
5. Cem Kaner "Lessons Learned in Software Testing: A Context-Driven Approach", Wiley; 1st Edition, 2002.

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1. https://nptel.ac.in/courses/106/105/106105150/
2. https://onlinecourses.nptel.ac.in/noc19_cs71/preview
3. https://www.coursera.org/lecture/introduction-software-testing/stages-of-software-testing-process-UMOpe

* TE – Theory Exam, LE – Lab Exam

2.A.3.31

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	-	-	2	-	-	1	3	1	1
2	3	3	3	2	-	-	-	-	2	-	-	1	3	1	1
3	3	3	3	2	2	-	-	-	2	-	-	1	3	1	1
4	3	3	3	2	2	-	-	-	2	-	-	1	3	1	1
5	3	3	3	2	2	-	-	-	2	-	-	1	3	1	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	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSDC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Automata and Compiler Design	3	-	-	3	25	75	100

(Common to CSE and AI&DS)

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the concept of Finite Automata, NFA and DFA.	K2
	CO2 Understand about Context Free Language and Normal Forms	K2
	CO3 Construct Push Down Automata and Turing Machine	K3
	CO4 Explain the concept of Lexical Analysis and Syntax Analysis	K3
	CO5 Describe the Intermediate code generation, Code Optimization and Code Generation	K3

UNIT - I	Finite Automata and Regular Expressions	Periods:09
Introduction: Finite Automata – Deterministic Finite Automata – Non-Deterministic Finite Automata – Conversion from NFA to DFA – NFA with epsilon transition - Eliminating epsilon transition -Regular Expression- Conversion from Regular Expression to NFA- Conversion from Regular Expression to DFA (Direct / Indirect method) – Minimized DFA.		CO1
UNIT - II	**Context-Free Grammar and Normal Forms**	**Periods:09**
Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) – Derivations and Parse trees – Ambiguity in grammars – Normal Forms – Chomsky Normal Form – Greibach Normal Form.		CO2
UNIT - III	**Pushdown Automata and Turing Machines**	**Periods:09**
Push Down Automata (PDA): Definition of the Pushdown Automata - Languages of pushdown automata – CFG to PDA -Turing Machine - Turing machines for regular languages- Turing machine construction for Palindrome, Addition, Subtraction.		CO3
UNIT - IV	**Lexical Analysis and Syntax Analysis**	**Periods:09**
Compilers: The Phases of compiler – Lexical analysis – The role of the lexical analyser – Input buffering – Parser: Top-Down Parser – Predictive Parser, Bottom up Parser – Shift Reduce Parser - Operator Precedence Parser-SLR Parser.		CO4
UNIT - V	**Intermediate Code Generation, Code Optimization and Code Generation**	**Periods:09**
Intermediate Code Generation: Intermediate Languages. Code Optimization: Principle sources of optimization – Loop Optimization. Code Generation: Issues in the design of code generator – Simple code generator – Basic blocks and flow graphs – The DAG representation of Basic Block - Generating code form DAGs - Peephole optimization.		CO5

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

Text Books

1. Hopcroft, 'Introduction to Automata Theory, Languages, and Computation", Pearson, 3rd Edition, 2008.
2. Alfred Aho, V. Ravi Sethi, and D. Jeffery Ullman, "Compilers Principles, Techniques and Tools", Addison-Wesley, 2nd Edition, 2007.
3. John C. Martin, "Introduction to Languages and the Theory of Computations", McGraw Hill, 3rd Edition, 2007.

Reference Books

1. Kamala Krithivasan, Rama R, "Introduction to Formal languages Automata Theory and Computation", Pearson, 2019.
2. Peter Linz, "An Introduction to Formal Languages and Automata", Jones & Bartlett, 6th Edition, 2016.
3. Anil Malviya, Malabika Datta, "Theory of Computation & Applications - Automata Theory Formal Languages", BPB publications, 2015.
4. Charles N. Fischer and Richard J. Leblanc, "Crafting a Compiler with C", Benjamin Cummings, 2009.
5. Mishra K.L.P, "Theory of Computer Science: Automata, Languages and Computation", Prentice Hall India Learning, 1st Edition, 2006.

Web References

1. https://www.cse.iitb.ac.in/~akg/courses/2019-cs310/index.html
2. https://www.cse.iitm.ac.in/~krishna/cs3300/
3. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/
4. https://www.javatpoint.com/automata-tutorial
5. https://www.tutorialspoint.com/automata_theory/index.htm

* TE – Theory Exam, LE – Lab Exam

9.A.3.33

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	2	3	3	1	1	-	2	-	-	-	3	2	2
2	3	3	3	2	3	1	2	-	2	1	-	2	3	2	2
3	2	3	2	3	2	2	-	-	3	-	-	-	3	2	2
4	3	3	2	3	3	1	-	-	2	-	-	-	3	2	2
5	2	3	3	2	2	2	1	-	2	-	-	-	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		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 34

Department	Computer Science and Engineering			Programme: B.Tech.				
Semester	III			Course Category Code: PC			*End Semester Exam Type: TE	
Course Code	U23CST303	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Computer Networks	3	-	-	3	25	75	100

Prerequisite	Nil	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe the functions of each layer in OSI and TCP/IP model use to communicate over a network for network communications	K2
	CO2 Explain the techniques of Data-link layer for implementation of point-to-point flow and error control mechanism	K2
	CO3 Identify the various network layer techniques and analyse the packet flow on basis of routing algorithms	K3
	CO4 Demonstrate the transport layer protocols for reliable communications using end-to-end solution	K3
	CO5 Analyze the functional working of different protocols of application layer and Network Security	K4

UNIT-I	Introduction and Physical Layer	Periods: 9	
Introduction - Uses of Computer Networks - Network hardware - Network software - Reference Models: OSI, TCP/IP Reference models - Example Networks: ARPANET, Internet - Physical Layer: Guided Transmission media: Twisted pairs, coaxial cable, fiber optics - Wireless transmission.			CO1
UNIT-II	**Data Link Layer**	**Periods: 9**	
Design link layer design issues - Error detection and correction - Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel - Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat.			CO2
UNIT-III	**Network Layer**	**Periods: 9**	
Network Layer Design issues - Routing algorithms: Shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing - Congestion Control Algorithms -Internetworking - The Network layer in the internet: IPV4 vs IPV6.			CO3
UNIT-IV	**Transport Layer**	**Periods: 9**	
The Transport Service - Elements of Transport protocols – Connection management: The TCP Segment header, TCP Connection Establishment, TCP Connection release - UDP protocols: Remote Procedure call.			CO4
UNIT-V	**Application Layer and Network Security**	**Periods: 9**	
Domain name system - Electronic Mail – HTTP - World Wide Web – Cryptography -Public Key Algorithm: RSA			CO5

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

Text Books

1. Andrew S. Tanenbaum, Nickolas Feamster, " Computer Networks ", Pearson Education,2019.
2. Gifford, "Computer Networks", Crabtree Publishing Company,1st Edition,2015.
3. Larry L. Peterson and Bruce S.Davie, "Computer Networks "Elsevier Science,5th Edition,2011.
4. Andrew S. Tanenbaum, David.J. Wetherall, "Computer Networks", Prentice-Hall, 5th Edition, 2010
5. Behrouz A.Forouzan, "Data Communications and Networking",MCGraw-Hill,4th Edition,2007

Reference Books

1. Chwan-Hwa Wu, Irwin," Introduction to Computer Networks and Cyber Security", CRC publications, 2014.
2. Behrouz A. Forouzan, Firouz Mosharraf," Computer Networks", McGraw-Hill,2012
3. Douglas E. Comer," Internet working with TCP/IP", Prentice-Hall, 5thEdition,2011.
4. Peterson, Davie, Elsevier,"Computer Networks",5 thEdition,2011
5. Comer," Computer Networks and Internets with Internet Applications",4thEdition,2004.

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1. http://computer.howstuffworks.com/computer-networking-channel.htm
2. https://www.geeksforgeeks.org/layers-osi-model/
3. https://www.wikilectures.eu/w/Computer_Network
4. https://technet.microsoft.com/en-us/network/default.aspx
5. http://www.freebookcentre.net/networking-books-download/Introduction-to-Computer Networks.html

2.A.3.35

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	3	-	-	-	-	-	-	-	-	3	-	2
2	-	1	-	2	-	-	-	-	-	-	-	-	3	-	1
3	-	-	1	2	3	-	-	-	-	-	-	-	3	-	1
4	-	1	-	2	-	-	-	-	-	-	-	-	3	-	2
5	1	1	-	2	2	-	-	-	-	-	-	-	3	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		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 36

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSBC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Design and Analysis of Algorithms	2	-	2	3	25	75	100

(COMMON TO CSE, CCE and AI&DS)

Prerequisite	Problem Solving Approaches	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Analyze and improve the efficiency of algorithms and estimate the performance of algorithm and Divide and Conquer.	K2
	CO2 Determine the Greedy paradigms, Dynamic Programming and explain when an algorithmic design situation calls for it.	K3
	CO3 Interpret the Backtracking paradigms, Branch and Bound, NP-Hard paradigms and explain when an algorithmic design situation calls for it.	K3
	CO4 Demonstrate programs using Divide and Conquer, Greedy paradigms.	K3
	CO5 Build the programs using Dynamic Programming, Backtracking and Branch and Bound.	K2

UNIT - I	Introduction To Algorithm and Divide and Conquer	Periods:10
Introduction – Algorithm – Pseudo code for expressing algorithms – Performance Analysis – Time complexity – Space complexity – Asymptotic Notation – Big oh notation – Omega notation – Theta notation and Little oh notation. **Divide and Conquer method**: Binary search – Merge sort – Quick sort		CO1

UNIT - II	Greedy Method and Dynamic Programming	Periods:10
Greedy method: General method – applications– Knapsack problem – Minimum cost spanning trees –Single source shortest path problem. **Dynamic Programming**: Applications – Multistage graphs – 0/1 knapsack problem, All pairs shortest path problem – Traveling sales person problem		CO2

UNIT - III	Backtracking and Branch and Bound	Periods:10
Backtracking: General method. Applications – N – queen problem – Sum of subsets problem – Graph coloring – Hamiltonian cycle – 0/1 Knapsack Problem. **Branch and Bound**: General method – Applications – Traveling sales person problem – 0/1 knapsack problem – LC Branch and Bound solution –FIFO Branch and Bound solution		CO3

UNIT - IV	Laboratory Exercises	Periods:15
• Implementation of binary search using Divide-and-Conquer technique • Implementation of Finding Maximum and Minimum using Divide-and-Conquer technique. • Implementation of Knapsack using Greedy technique. • Implementation of Minimum Spanning Tree using Prim's and Kruskal's Algorithm using Greedy technique. • Implementation of Single-Source Shortest Paths algorithms using Greedy technique.		CO4

UNIT - V	Laboratory Exercises	Periods:15
• Implementation of All Pairs Shortest Paths using Dynamic Programming technique. • Implementation of Traveling Salesman Problem using Dynamic Programming technique. • Implementation of 8 Queens Problem with the approach of Backtracking. • Implementation of sum of subsets with the approach of Backtracking. • Implementation of Traveling Salesman problem with Branch-and-Bound technique.		CO5

Lecture Periods:30	Tutorial Periods: -	Practical Periods: 30	Total Periods:60

Text Books

1. Levitin Anany," Introduction to the Design and Analysis of Algorithms", Pearson Education India,1st Edition,2019.
2. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", Galgotia Publications, 2nd Edition, 2010.
3. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms", PHI/Pearson Education, 3rdEdition,2009.

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1. Aho Alfred V.,"Design & Analysis of Computer Algorithms", Pearson Education India,2nd Edition,2018
2. Basu S. K.," Design Methods and Analysis of Algorithms", PHI Learning,3rd Edition, 2018.
3. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, Third Edition, 2012.
4. E. Horowitz and S.Sahni, "Fundamentals of Algorithms", 2nd Edition, Galgotia Publications, 2010.
5. T.H.Cormen, C.E.Leiserson, R.L.Rivest, and C.Stein, "Introduction to Algorithms, 3rd Edition, PHI/Pearson Education, 2009.

2.A.3.37

Web References
1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
2. https://www.javatpoint.com/daa-tutorial
3. https://www.guru99.com/design-analysis-algorithms-tutorial.html
4. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
5. https://swayam.gov.in/nd1_noc20_cs71/preview

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	1	1	2	-	2	1	1
2	3	3	2	2	2	-	-	-	1	1	2	-	2	1	1
3	3	3	2	2	2	-	-	-	1	1	2	-	2	1	1
4	3	3	3	3	2	-	-	-	2	1	2	-	2	1	2
5	3	3	3	3	2	-	-	-	3	1	2	-	2	1	2

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									#End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)					
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical-Internal Evaluation)	
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	100
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	

Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	English	Programme: B.Tech.						
Semester	III	Course Category Code: HS			*End Semester Exam Type: P			
Course Code	U23ENPC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	General Proficiency- I	0	0	2	1	50	50	100

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret meaning and apply reading strategies in technical and non-technical context	K3
	CO2 Develop interpersonal communication skills professionally	K4
	CO3 Demonstrate various forms of formal writing	K3
	CO4 Decode graphical data coherently	K2
	CO5 Apply the techniques of verbal aptitude in competitive exams	K3

UNIT- I	**Comprehension Analysis**	**Periods:6**
Listening: Dialogue based on social contexts (IELTS based) - Speaking: Break the iceberg (IELTS based) Submitting Video Recording - Reading: Reading technical passage (IELTS based) - Writing: Writing Task: 2 (IELTS Academic) - Vocabulary: Synonyms (IELTS)		**CO1**
UNIT- II	**Personality Development**	**Periods:6**
Listening: Monologue about the everyday social issues (IELTS based) - Interview Videos - Speaking: Speak about the topic in the Flash Card (IELTS based) - Reading: British & American Vocabulary - Writing: SWOT Analysis - Vocabulary: Idioms and Phrases (IELTS)		**CO2**
UNIT- III	**Inferential Learning**	**Periods:6**
Listening: Conversation between 4 people regarding education (IELTS based), Anecdotes - Speaking: Structure Discussion (IELTS based) - Reading: Distinguish between facts & opinions (IELTS based), - Writing: Writing Conversation to different context - Vocabulary: Phrasal Verbs (IELTS)		**CO3**
UNIT- IV	**Interpretation and Functional Writing**	**Periods:6**
Listening: Monologue on an academic subject (IELTS based), Group Discussion videos - Speaking: Group Discussion Practice - Reading: Read and review (Books, Magazines) - Writing: Writing Task 1: (IELTS Academic: Graph/ chart/tables description) - Vocabulary: Collocations (IELTS)		**CO4**
UNIT-V	**Verbal Aptitude - I**	**Periods:6**
Language Enhancement: Articles, Preposition, Conjunction **Verbal Ability Enhancement:** Ordering of sentences, Blood Relation, Completing Statements- Cloze test, Spotting Errors - Sentence Improvement, Word Analogy, Word Groups **(GATE)**		**CO5**

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

Reference Books

1.Lewis, Norman, "Word Power Made Easy".Goyal Publishers and Distributors Pvt.Ltd., Latest Edition, 2020.
2.Patterson, Kerry, Joseph Grenny,Ron McMillan, Al Switzler, "Crucial Conversation Tools for talking when Stakes are High", Kindle Publication,2nd Edition, 2011.
3.Comfort, Jeremy,et.al. "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.
4.Agarwal, R. S. "A Modern Approach to Verbal & Non Verbal Reasoning". S. Chand, 2010.
5.Wren, Percival Christopher, and Wren Martin. "High School English Grammar and Composition". S Chand, 2005.

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1.https://www.ielts-exam.net/grammar/
2.https://ieltsfocus.com/2017/08/02/collocations-ielts/
3.https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4.https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5.https://www.examsbook.com/word-analogy-test-questions-with-answers

* TE – Theory Exam, LE – Lab Exam

2.A.3.39

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
5	1	-	-	-	-	-	-	1	-	3	-	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		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 40

Department	Mathematics			Programme: B.Tech.				
Semester	III			Course Category Code: BS			*End Semester Exam Type: LE	
Course Code	U23MAPC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Engineering Mathematics Laboratory	0	0	2	1	50	50	100

(Common to all Branches Except CSBS)

Prerequisite	Matrices, Fourier Transforms, Laplace Transforms

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Perform and evaluate Matrix Operations	K3
CO2	Solve Differential and Integral Equations	K3
CO3	Construct Fourier series and Fourier Transforms of the given function	K3
CO4	Find the Measures of Central tendency	K3
CO5	Analyze Correlation and Regression lines	K3

List of Experiments:

1. Find the Inverse, Rank, Eigen values and Eigen Vectors of the matrix.
2. Solve the first order differential equation.
3. Find the integration of $\int_a^b f(x)dx$.
4. Find the Fourier series of f(x).
5. Find the Fourier Transform of f(x).
6. Find the Laplace Transform of f(x).
7. Find the Mean, Median and Mode.
8. Construct the Pie and Bar Diagram.
9. Find the Correlation coefficient.
10. Find the Regression lines.

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

Reference Books

1. T. Veerarajan, "Engineering Mathematics, Tata McGraw Hill Education (India) Private Limited Chennai 2nd Edition Paperback – 1 January 2018.
2. M.K. Venkataraman, "Engineering Mathematics, The National Publishing Company, Madras, 2016.
3. Dr. A. Singaravelu, "Probability and Statistics", Meenakshi Agency, Paperback – 1, 2019.

Web References

1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
2. https://www.nrigroupindia.com/niist/wp-content/uploads/sites/6/2022/02/lab-manual-it406matlab.pdf
3. https://www.studocu.com/row/document/comsats-university-islamabad/signals-and-systems/lab-lab-manual/38332410.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1

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

2.A.3.41

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

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 42

Department	Computer Science and Engineering			Programme: **B.Tech.**			
Semester	III			Course Category Code: **PC**		*End Semester Exam Type: **LE**	
Course Code	**U23CSP301**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Embedded System Architecture and Interfacing Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Digital Design and System Architecture	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Acquire knowledge on operations of 8085 microprocessor set of instruction.	**K3**
	CO2 Familiarize the basic concepts of 8086 instructions.	**K3**
	CO3 Learn the Interface modules using assembly language program.	**K3**
	CO4 Attain knowledge on 8051 microcontroller instructions.	**K3**
	CO5 Apply the concepts on real time applications	**K4**

List of Exercises

Assembly Language Program Exercises Using 8086 Microprocessor Trainer Module.

1. Execute 16-bit Addition, Subtraction, Multiplication and Division using 8086 Trainer module.
2. Write a program to find the largest number in a data array using 8086 Trainer module.
3. Write a code to transfer a block of data without overlap using 8086 Trainer module.

Assembly Language Program for Interfacing Peripheral Devices Using 8086 Trainer Module.

4. To perform Bulk memory operations using DMA controller interfacing through 8086.
5. To perform interfacing with 8251 USART or RS232C.

Assembly Language Program Exercises Using 8051 Microcontroller Trainer Module

6. To perform Bit Manipulations using Boolean and Logical operations.
7. To find the largest / smallest number in an array of numbers.
8. Write a program to generate a delay using timer / counter.

Interfacing Exercises Using 8051 Microcontroller Trainer Kit and interfacing Modules

9. Interface ADC Module to 8051 Microcontroller Trainer kit.
10. Generate different waveforms (sine, square, Triangular, Ramp, etc.,) by interfacing DAC Module to 8051 **Microcontroller Trainer kit.**
11. Interface stepper motor / DC Motor Module with 8051 Microcontroller Trainer Kit.
12. Interface Traffic Light controller Module with 8051 Microcontroller Trainer Kit.

Programming / Interfacing using RTOS

13. Flashing of LEDs using RTOS.
14. Measure Temperature using sensor and write to display using RTOS.

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

Reference Books

1. "Embedded Systems Architecture, Programming and Design", Rajkamal, TATA McGraw-Hill, 2nd edition 2015.
2. "Arduino for beginners: Essential Skills Every Maker Needs", John Baichtal, Person Education, Inc., 1st Edition, 2013.
3. "8085 Microprocessors Architecture Application and Programming", Ramesh S. Goankar, Penram International, 5th Edition.2002.
4. "Microcontroller Projects in C for the 8051", Dogan Ibrahim, Elsevier Science, 2000.
5. "The 8051 Microcontroller", Kenneth J. Ayala, Cangage learning, 3rd Edition, 1991.

Web References

1. Web based 8085 Microprocessor Simulator (web8085.appspot.com)
2. https://exploreembedded.com
3. https://www.udemy.com/course/8051-microcontroller-embedded-c-and-assembly-language/
4. https://www.elprocus.com/peripherals-interfacing-to-the-microcontroller-8051-in-electronics/
5. https://developer.arm.com/products/architecture/cpu-architecture

*TE – Theory Exam, LE – Lab Exam

2. A. 3. 43

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3	2	2	-	-	1	-	-	1	3	2	2
2	2	2	2	3	2	2	-	-	1	-	-	1	3	2	2
3	2	2	2	3	3	1	-	-	1	-	-	1	3	2	2
4	2	2	2	3	2	2	-	-	1	-	-	1	3	2	2
5	3	2	3	3	3	2	-	1	2	1	2	2	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
	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: B.Tech.					
Semester	III	Course Category: PC			End Semester Exam Type: LE		
Course Code	U23CSP302	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Software Engineering and Testing Laboratory	0	0	2	1	50	50	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply and practice test on websites using Selenium.	K3
	CO2 Apply and practice different tests on websites using JMeter.	K3
	CO3 Build test reports using Beautiful Soup.	K3
	CO4 Apply Unit testing on software module	K3
	CO5 Apply Integration testing on software modules	K3

List of Exercises

1. Introducing Selenium Browser Automation Tool, environmental setup and web page navigation on browser.
2. Use Selenium to Check Functionality of Web Page's User Login and Registration
3. Use Selenium to Check Any Functionality of Web Page and Generate a Report Document.
4. Select a Website to write test plans for the website and to design Test cases using Selenium.
5. Test and Provide test reports for the given website using Selenium.
6. Select any 5 options in the website and test them using Selenium.
7. Introduction to JMeter and Setup JMeter Environment for Testing.
8. Use JMeter to perform Load Testing.
9. Use JMeter to perform Stress Testing.
10. Introduction to Timers in JMeter and Generate a Load using Timers.
11. Introduction to JMeter Response Assertion and Assert Response from Web Page.
12. Test and provide the results for the given API using postman.
13. Introduction to Unit Testing Framework and Unit Testing.
14. Manipulate Unit tests and Integration Tests.

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

Reference Books

1. Glenford J Myers, Corey Sandler, Tom Badgett," The Art of Software Testing", Wiley, Third edition, 2015.
2. Rahul Shende "Software Automation Testing Tools for Beginners", Arizona Business Alliance, 2012
3. Elfriede Dustin, Thom Garrett, and Bernie Gauf, "Implementing Automated Software Testing: How to Save Time and Lower Costs While Raising Quality", Addison-Wesley Professional, 1st Edition, 2009.
4. Lisa Crispin, Janet Gregory" Agile Testing: A Practice Guide for Testers and Agile Teams", Addison-Wesley Professional, 1st Edition, 2008.
5. Lee Copeland, "A practitioner's guide to Software Test Design", Artech House Publishers, 2003

Web References

1. https://www.youtube.com/watch?v=5FUdrBq-WFo
2. https://intellipaat.com/blog/tutorial/selenium-tutorial/
3. https://www.youtube.com/watch?v=mXGcBvWYI-U
4. https://octoperf.com/blog/2018/03/29/jmeter-tutorial/
5. https://www.youtube.com/watch?v=87Gx3U0BDlo
6. https://www.guru99.com/unit-testing-guide.html
7. https://www.youtube.com/watch?v=4_Ik8eb2In0

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 45

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	3	-	-	1	3	2	3
2	3	3	3	2	3	-	-	-	3	-	-	1	3	2	3
3	3	3	3	2	3	-	-	-	3	-	-	1	3	2	3
4	3	3	3	2	3	-	-	-	3	-	-	1	3	2	3
5	3	3	3	2	3	-	-	-	3	-	-	1	3	2	3

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

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

2. A. 3. 46

Department	Computer Science and Engineering	Programme: **B.Tech.**						
Semester	III	Course Category: **AEC**			End Semester Exam Type: -			
Course Code	U23CSC3XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course – III**	-	-	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.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 50	Total Periods: 50

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category: AEC			*End Semester Exam Type: -			
Course Code	U23CSS301	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Aptitude - I	0	0	2	0	-	-	100

Prerequisite	NIL

Course Contents

- Number System - Basics, Properties & Type of Numbers - Divisibility Rules.
- LCM & HCF - Unit Digit Concept [Cyclicity Method].
- Decimals, Simplification. Ratio & Proportion - Compounded & Duplicate Ratio - Inverse Ratio - Shortcut to Find Ratio - Continuous Proportion - Mean & Divisibility Proportion.
- Ages - Both Data is in Ratio or Time Format - One Data in Ratio or Time Format & Other Data in Sum, Difference or Product.
- Logical [Puzzles] Method.
- Average - Basics & Finding Average in Complex - Replacement & Alteration Method - Average Speed Finding Problems.
- Allegation & Mixtures.
- Ratio of Mixture - Finding the Kilogram through Ratio.
- Mean Value Method.
- Ratio Mixture [Fraction Method] - Iteration Method.

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

2. A. 3. 90

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	III	Course Category Code: MC			*End Semester Exam Type: -			
Course Code	U23CSM303	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Climate Change	2	0	0	-	100	-	100
Prerequisite	-							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Inspect the characteristics and Temperature profile of the atmosphere	K2
CO2	Analyze past climate, human influence on global warming, and predict future climates	K3
CO3	Analyze the impact of climate change and the risk of Irreversible Changes	K3
CO4	Outline the carbon credits and evidences of changes in Environment	K2
CO5	Acquire knowledge on clean development mechanism and mitigation technologies	K2

UNIT- I	ATMOSPHERE AND ITS COMPONENTS	Periods:06
Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere - Composition of the atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Lapse rates - Temperature inversion - effects of inversion on pollution dispersion.		CO1
UNIT- II	**GLOBAL CLIMATE**	**Periods:06**
Account of past climate - Environmental indicators and instrumental records - Human Footprints on global warming - Predicting future climates - Temperature regime - Extreme climate events.		CO2
UNIT- III	**IMPACTS OF CLIMATE CHANGE**	**Periods:06**
Causes of Climate change : Change of Temperature in the environment - Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors - Agriculture, Forestry and Ecosystem - Water Resources - Human Health - Industry, Settlement and Society - Methods and Scenarios - Projected Impacts for Different Regions - Uncertainties in the Projected Impacts of Climate Change - Risk of Irreversible Changes.		CO3
UNIT- IV	**OBSERVED CHANGES AND ITS CAUSES**	**Periods:06**
Climate change and Carbon credits - Initiatives in India-Kyoto Protocol – Inter government Panel on Climate change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCC - IPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India.		CO4
UNIT- V	**CLIMATE CHANGE AND MITIGATION MEASURES**	**Periods:06**
Clean Development Mechanism - Carbon Trading- examples of future Clean Technology - Biodiesel - Natural Compost - Eco-Friendly Plastic - Alternate Energy - Hydrogen - Bio-fuels - Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices - Carbon sequestration - Carbon capture and storage (CCS) - International and Regional cooperation - Remedial measures.		CO5

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

Text Books

1. Joan Fitzgerald, "Greenovation: Urban Leadership on Climate Change", Oxford University Press, 2020.
2. Andrew Dessler and Edward A. Parson, "The Science and Politics of Global Climate Change", Cambridge University press, 3rd Edition, 2019.
3. J. David Neelin, "Climate change and climate modelling", Cambridge University press, 2011.
4. Robin Moilveen, "Fundamentals of weather and climate", Oxford University Press, 2nd Edition, 2010.
5. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill McKibben, "The Global Warming Reader: A Century of writing about Climate Change", Penguin, 2012.
2. Jason Smerdon, "Climate Change: The Science of Global Warming and our Energy Future", Columbia University, 2009
3. Adaptation and mitigation of climate change-Scientific Technical Analysis, Cambridge University Press, 2006.
4. J.M. Wallace and P.V. Hobbs, "Atmospheric Science", Elsevier/ Academic Press, 2006.
5. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

Web References

1. https://nptel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage

2.A.3.51

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	3	3	-	-	-	-	2	1	1	1
2	3	3	2	2	-	3	3	-	-	-	-	2	1	1	1
3	3	3	2	2	-	3	3	-	-	-	-	2	1	1	1
4	3	3	2	2	-	3	3	-	-	-	-	2	1	1	1
5	3	3	2	2	-	3	3	-	-	-	-	2	1	1	1

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

2.A.3.52

SEMESTER IV

Department	Mathematics	Programme : B.Tech.						
Semester	IV	Course Category Code: BS			*End Semester Exam Type: TE			
Course Code	U23MATC05	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	DISCRETE MATHEMATICS AND GRAPH THEORY	3	1	-	4	25	75	100

(Common to CSE, IT, AI&DS and CCE)

Prerequisite	Basic Mathematics	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Construct Mathematical arguments using logical connectives and truth tables.	K3
	CO2 Verify the correctness of an argument predicate logic and quantifiers.	K3
	CO3 Solve problems using counting techniques in Lattices.	K3
	CO4 Familiarize the different types of Graphs.	K3
	CO5 Understand the Applications of Shortest path algorithms.	K3

UNIT – I	LOGICS AND PROOFS	Periods:12
Introduction – Connectives – Statement formulae – Truth table – Tautologies – Equivalence of Statement formulae – NAND and NOR Connectives – Implications – Principal conjunctive and disjunctive normal forms.		CO1
UNIT – II	**PREDICATE AND QUANTIFIERS**	**Periods:12**
Predicate and Quantifiers – Rules of Inference theory – Conditional proof – Indirect method of proof.		CO2
UNIT – III	**LATTICES**	**Periods:12**
Partially Ordering – Posets – Hasse Diagram – Lattices as Posets – Properties of Lattices – Sub lattices – Complemented and Distributive lattices.		CO3
UNIT – IV	**GRAPH THEORY**	**Periods:12**
Graphs and types of Graphs – Matrix representation of graphs – Isomorphism – Connected graphs – Euler graphs – Hamilton paths and circuits.		CO4
UNIT – V	**TREES**	**Periods:12**
Trees – Properties of Trees – Algorithm – Kruskal's algorithm.		CO5

LecturePeriods:45	TutorialPeriods:15	Practical Periods:-	TotalPeriods:60

Text Books

1. P. Tremblay and R. Manohar, "Discrete Mathematical structures with Applications to computer Science", 13th reprint, Tata McGraw - Hill publishers, 2002.
2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publications New York, First Edition, 2016.
3. Dr G. Balaji "Discrete Mathematics", G. Balaji Publishers – 14th Edition 2021.

Reference Books

1. C.L. Liu, "Elements of Discrete Mathematics", Tata McGraw - Hill Education Pvt. Ltd., 3rd Edition, 2008.
2. F. Harary, "Graph theory", Narosa publishing house, New Delhi, 1988.
3. Douglas B. West, "Introduction to Graph theory", Pearson Education, second edition, 2002.
4. Oscar Levin, "Discrete Mathematics An Open Introduction", 3rd Edition, 4th Printing: 2019 ISBN: 978-1792901690
5. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw - Hill PublishingCompany, Pvt. Ltd., New Delhi, Fifth edition, 2003.

Web References

1. https://www.researchgate.net/publication/1922282_Discrete_Mathematics_for_Computer_Science_Some_Notes
2. https://nptel.ac.in/courses/111/107/111107058/
3. https://nptel.ac.in/courses/106/106/106106183/
4. https://www.pdfdrive.com/discrete-mathematics-for-computer-science-e17017833.html
5. https://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf

* TE – Theory Exam, LE – Lab Exam

2.A.3.55

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	-	-	-	-	1	1	-	1
2	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
3	3	3	2	1	-	-	-	-	-	-	-	1	1	-	-
4	3	3	2	1	-	1	-	-	-	1	1	1	1	-	-
5	3	3	2	1	-	1	-	-	-	1	1	1	1	-	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		5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2.A.3.56

Department	Information Technology	Programme: B.Tech.					
Semester	IV	Course Category Code: ES			*End Semester Exam Type: TE		
Course Code	U23ITTC02	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in Java	3	0	0	3	25	75	100

(Common to All Branches)

Prerequisite	Basic knowledge of Object-Oriented Programming Principles	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Articulate the concept of Java fundamentals, OOPs and Strings	K2
	CO2 Demonstrate the principles of inheritance, packages and interfaces with real time applications	K2
	CO3 Create real time applications using exception handling and thread programming.	K3
	CO4 Build distributed applications using Collections and IO streams	K3
	CO5 Design and build simple GUI programs using AWT, Swings and build database applications	K3

Unit- I	**Introduction**	**Periods: 09**

Introduction: Java: History – Features – JVM - JRE - JDK – Data Types - Variables, Types, Expressions, Assignment Statements, Conditional and Iterative Control Structures – Arrays.

OOPs with Java: Class – Objects – Methods - Access Modifiers – Abstraction – Encapsulation - Constructors - this – static - Garbage Collection – Nested Classes.

String: String Class– Built-in Methods – StringBuilder – StringBuffer. **CO1**

Unit- II	**Inheritance, Interfaces and Packages**	**Periods: 09**

Inheritance: Types of Inheritance – is-a Relationship, has-a Relationship – super keyword – final keyword – Polymorphism -Method overloading and Method overriding – Abstract Class

Interfaces: Define – Extend – Implement – Access - Interfaces vs Abstract classes

Packages: Define – Create – Access – Import – Autoboxing and Auto unboxing **CO2**

Unit- III	**Exception Handling and Multithreading**	**Periods: 09**

Exception Handling: Exception Hierarchy – Checked and Unchecked Exceptions – try, catch, throws, throw and finally – User Defined Exceptions.

Multithreading: Thread – Life cycle – Defining and Running – Implementation Types – Thread Priorities – Thread Synchronization - Inter-Thread Communication **CO3**

Unit- IV	**Collections and I/O Streams**	**Periods: 09**

Collections: List: ArrayList and LinkedList. Set: HashSet and TreeSet. Map: HashMap – Stack – Queue. Lambda Expressions.

I/O Streams: Streams – Byte Streams and Character Streams – FileInputStream and FileOutputStream – FileReader and FileWriter. **CO4**

Unit- V	**GUI and JDBC**	**Periods: 09**

AWT: Components – Controls – Event Handling

SWING: Swing Components – Layout Management.

JDBC: JDBC Architecture – JDBC Driver Types – Implementation of JDBC. **CO5**

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

Text Books

1. Allen B. Downey and Chris Mayeld, "Think Java - How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2020.
2. Herbert Schildt, "Java: The Complete Reference", TMH Publishing Company Ltd, 11th Edition, 2018.
3. H.M.Dietel and P.J.Dietel, "Java How to Program", 11th Edition, Pearson Education/PHI, 2017
4. Cay S. Horstmann, Gary Cornell, "Core Java Volume - I Fundamentals", 9th Edition, Prentice Hall, 2013.

Reference Books

1. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018.
2. Poaul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
3. P.J. Dietel and H.M Dietel, "Java for Programmers", Pearson Education, 9th Edition, 2011.
4. Steven Holzner, "Java 2 Black book", Dreamtech Press, 2011.

2.4.3.57

Web References

1. https://www.javatpoint.com/java-tutorial
2. https://docs.oracle.com/en/java/
3. https://www.studytonight.com/java/
4. https://onlinecourses.nptel.ac.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	2	3	2	1
2	3	3	3	-	3	-	-	-	-	-	-	2	3	2	1
3	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	3	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	3	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		5	5	5	75	100

Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A.3. 58

Department	Computer Science and Engineering	Programme: B.Tech						
Semester	IV	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSTC04	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Database Management Systems	3	-	-	3	25	75	100
(Common to CSE, IT and CCE)								
Prerequisite	Computer Programming and Data Structures							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the concepts of Database Management System and develop Entity Relationship model and Relational Models for a given application	K2
	CO2 Manipulate and build database queries using Structured Query Language and relational algebra	K3
	CO3 Use data normalization principles to develop a normalized database for a given application	K3
	CO4 Illustrate various transactions and recovery techniques	K2
	CO5 Apply tools like NoSQL, MongoDB, Cassandra on real time applications	K3

UNIT - I	Introduction	Periods:09	
Database Systems - Data Models – System Structure-Database System Architecture - Entity-Relationship Model - ER Diagram - Extended ER Model - ER into Relational Model - Relational Model: Structure of Relational Databases, Database Schema, Keys, Tables.			CO1
UNIT - II	**Database Languages**	**Periods:09**	
Relational Algebra - Extended-Relational Algebra - Relational Calculus - SQL: Introduction - DDL - DML - Integrity Constraints - Set Operations - Joins - Nested Queries - View- Trigger - Stored Procedures.			CO2
UNIT - III	**Relational-Database Design and Data Storage**	**Periods:09**	
Relational Database Design: Domain and Data Dependency - Lossless Design - Armstrong's axioms - Functional Dependencies - Normal Forms - 1NF, 2NF, 3NF, BCNF and 4NF. **Data Storage:** RAID - File Organization - Indexing: Types of Indexing.			CO3
UNIT - IV	**Transactions**	**Periods:09**	
Transaction concepts and states- Concurrent Execution - Serializability -Query Processing- Concurrency Control: Lock based Protocol - Timestamp based Protocol - Recovery System: - Log-Based Recovery - Shadow Paging.			CO4
UNIT - V	**NoSQL Databases**	**Periods:09**	
NoSQL - Document Database: MongoDB - Multi-dimensional: Cassandra.			CO5

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

Text Books

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition - McGraw-Hill Higher Education, International Edition, 2019.
2. Ramez Elmasri, and Shamkant B. Navathe, Fundamentals of Database Systems (7th edition), Publisher: Pearson,2016.
3. Raghu Ramakrishnan, —Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.

Reference Books

1. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015.
2. Date C J, Kannan A and Swamynathan S, "An Introduction to Database Systems", 8th Edition, Pearson Education, New Delhi, 2006.
3. Alan Beaulieu, "Mastering SQL Fundamentals", Second Edition, O'Reilly,2009
4. Kristina Chodorow; Shannon Bradshaw, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, Inc., 2018.
5. Pramod J. Sadalage (Author), Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1stEdition, Kindle Edition.

2.A.3.59

Web References

1. http://www.database.com/
2. http://cassandra.apache.org/
3. https://www.mongodb.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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
2	1	-	-	-	-	-	-	-	-	-	-	-	3	3	2
3	2	1	1	3	-	-	-	-	-	-	-	-	3	3	2
3	2	1	1	-	-	-	-	-	-	-	-	-	3	3	2
2	1	-	-	-	-	-	-	-	-	-	-	-	3	3	2
3	2	1	1	3	-	-	-	-	-	-	-	-	3	3	2

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2 · A · 3 · 60

Department	Computer Science and Engineering	Programme: B.Tech.					
Semester	IV	Course Category Code: PC *End Semester Exam Type: TE					
Course Code	U23CSTC05	Periods / Week			Credit	Maximum Marks	
Course Name	Operating Systems	L	T	P	C	CAM	ESE	TM
		3	0	0	3	25	75	100

(Common to CSE and IT)

Prerequisite	Nil	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the various OS functionalities, structures, and layers	**K2**
	CO2 Usage of system calls related to OS management and interpreting different stages of various process states and process scheduling	**K4**
	CO3 Apply and explore the communication between inter process and Deadlock avoidance.	**K3**
	CO4 Implement page replacement algorithms, memory management problems and segmentation	**K2**
	CO5 Apply various disk scheduling algorithms and I/O Hardware	**K4**

Unit- I	**Introduction to Operating Systems**	**Periods: 09**	
Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.			**CO1**
Unit- II	**Process Management and Scheduling Algorithms**	**Periods: 09**	
Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Process Scheduling**: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time. **Scheduling algorithms**: Pre-emptive and non-pre-emptive, FCFS, SJF, RR.			**CO2**
Unit- III	**Process Synchronization, Threads and Deadlocks**	**Periods: 09**	
Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem. **Concurrent Programming**: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection, and recovery. **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention and **Deadlock Avoidance:** Banker's algorithm, Deadlock detection and Recovery.			**CO3**
Unit- IV	**Memory Management**	**Periods: 09**	
Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction. **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First In First Out (FIFO, Not Recently Used (NRU) and Least Recently Used (LRU).			**CO4**
Unit- V	**File, I/O and Device Management**	**Periods: 09**	
File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **I/O Hardware:** I/O devices, Device controllers, Direct Memory Access, Principles of I/O. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN.			**CO5**

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

2.A.3.61

Text Books

1.Abraham Silberschatz, Peter B. Galvin, "Greg Gagne-Operating System Concepts", Wiley, 10th Edition, 2019.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson, 9th Edition, 2018.
3. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition,2016.
4. Tanenbaum, Andrew S., and Albert S. Woodhull. "Operating systems: design and implementation", Vol. 68. Englewood Cliffs: Prentice Hall, 1997.

Reference Books

1.Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", Arpaci-Dusseau Books, Inc 2015.
2. Thomas Anderson and Michael Dahlin, "Operating Systems principles and practicell", Wiley, 2nd Edition, 2014.
3. Gary Nutt," Operating System, A modern perspective", 3rd Edition, Addison Wesley, 2004.
4. B.L. Stuart, "Principles of Operating Systems Cengage learning", India Edition, 2004.
5. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes, "Operating systems", Delhi. Pearson Education: Dorling Kindersley, 2004.

Web References

1. https://nptel.ac.in/courses/106108101/
2. http://www.tcyonline.com/tests/operating-system-concepts
3. http://www.galvin.info/history-of-operating-system-concepts-textbook
4. https://www.cse.iitb.ac.in/~mythili/teaching/cs347_autumn2016/index.html
5. https://www.cse.iitk.ac.in/pages/CS330.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	-	1	1	1	1	-	-	-	-	-	2	1	2
2	-	2	-	2	2	2	2	-	-	-	-	2	2	1	2
3	2	2	2	2	2	-	-	-	-	-	2	-	2	1	2
4	3	3	-	3	3	3	3	3	-	-	3	3	2	1	2
5	3	3	3	3	3	3	3	3	-	3	-	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		5	5	5	75	100

*Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 62

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	II / VI	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSB401	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Android Programming	2	-	2	3	25	75	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 To Learn about Android Operating System and its tools	K2
	CO2 Discuss and analyze about various Android UI	K2
	CO3 Know the concepts of API Storing, sharing and retrieving data in Android applications using SQLite Database.	K3
	CO4 Create the designs for software development using Android SDK	K4
	CO5 Design software applications with files and database connectivity	K4

UNIT – I	Introduction to Android Operating System	Periods:10
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Android Development Tools, Android Architecture.		CO1
UNIT - II	**User Interface Architecture**	**Periods:10**
Application context, intents, Activity life cycle, multiple screen sizes. **User Interface Design:** Form widgets, Text Fields, Layouts, Button control, toggle buttons, Spinners(Combo boxes),Images, Menu, Dialog		CO2
UNIT - III	**Android API and Database**	**Periods:10**
Using Common Android APIs: Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World. **DataBase:** Understanding of SQLite database, connecting with the database.		CO3
UNIT - IV	**Android Programming: List Of Experiments**	**Periods:15**
1. Create —Hello Worldll application. That will display —Hello Worldll in the middle of the screen in the emulator. Also display —Hello World in the middle of the screen in the Android Phone. 2. Create an application with login module. (Check username and password). 3. Create spinner with strings taken from resource folder (res >> value folder) and on changing the spinner value, Image will change. 4. Create a menu with 5 options and and selected option should appear in text box.		CO4
UNIT - V	**Android Programming: List Of Experiments**	**Periods:15**
1.Create a list of all courses in your college and on selecting a particular course teacher incharge of that course should appear at the bottom of the screen. 2 Create an application with three option buttons, on selecting a button colour of the screen will change. 3. Create and Login application as above. On successful login, pop up the message. 4. Create an application to Create, Insert, update, Delete and retrieve operation on the database		CO5

Lecture Periods:30	Tutorial Periods: -	Practical Periods: 30	Total Periods:60

Text Books

1.Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Manning Publications Co., 2012.
2.Reto Meier, —Professional Android 2 Application Developmentll, Wrox Wiley, 2010.

Reference Books

1.Android Notes for Professionals. GoalKicker.com, Free Programming Books.
2.The Android Developer's Cookbook: Building Applications with the Android SDK by James Steele, Nelson To, Addison-Wesley Professional; 2010
3,Wei – Meng Lee, Beginning Android Application Development, Wiley publications

Web References

1. http://www.developer.android.com
2. http://developer.android.com/about/versions/index.html
3. http://developer.android.com/training/basics/firstapp/index.html
4. http://docs.oracle.com/javase/tutorial/index.html
5. http://developer.android.com/guide/components/activities.html
6. http://developer.android.com/guide/components/fundamentals.html

2.A.3.63

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	3	2	1	-	-	-	-	-	-	-	-	3	2	3
5	3	3	2	1	-	-	-	-	-	-	-	-	3	2	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									#End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)					
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical-Internal Evaluation)	
Marks	5	5	5	5	20*	15	10	5	30*	30	75**	100
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10		*To be weighted for 50 Marks	

Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 64

Department	English	Programme: B.Tech.					
Semester	II/IV	Course Category Code: HS			*End Semester Exam Type:P		
Course Code	U23ENPC02	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	General Proficiency- II	0	0	2	1	50	50	100

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Infer ideas to attend international standardized test by broadening receptive and productive skills	K2
CO2	Interpret the types of writing in different state of affairs	K3
CO3	Acquire meticulous exposure in speaking and get rid of performance anxiety	K2
CO4	Articulate the ideas and opinions effectively and coherently	K2
CO5	Progress the skills to compete in various competitive exams like GATE, GRE, UPSC, etc.	K4

UNIT- I	CAREER SKILLS	Periods:6	
Listening: Listening at specific contexts - Speaking: Demonstrative speaking practice using visual aids (charts, graphs, maps) - Reading: Read and Review -Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) - Writing: Integrated Writing Task (TOEFL) - Vocabulary: Synonyms and Antonyms (IELTS)			CO1
UNIT- II	**CORPORATE SKILLS**	**Periods:6**	
Listening: Listening English news and reproducing in own words - Speaking: Team Presentation - Reading: Short texts and Longer Passages (cloze reading) - Writing: Analytical Writing: Analyzing an issue and Argument task (GRE based) - Vocabulary: Prefix and Suffix			CO2
UNIT- III	**FUNCTIONAL SKILLS**	**Periods:6**	
Listening: Listening TED Talks - Speaking: Brainstorming & Individual Presentation - Reading: Text Completion (GRE Based) - Writing: Picture Inference - Vocabulary: Word Formation			CO3
UNIT- IV	**TRANSFERRABLE SKILLS**	**Periods:6**	
Listening: Listening Documentaries and making notes - Speaking: Mock Interview - Reading: Read texts on emerging trends - Writing: Agreeing & Disagreeing Essay (IELTS) - Vocabulary: Euphemism, Redundancy, Clichés and Intensifiers.			CO4
UNIT-V	**VERBAL APTITUDE - II**	**Periods:6**	
Transformational Grammar: Tenses, Change of Voice, Concord **Verbal Ability Enhancement:** Letter Series, Coding &Decoding, Sentence Equivalence (GRE)Analytical Reasoning and Logical Reasoning (GATE), Syllogism, One-word Substitution, Jumbled Sentences			CO5
Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Cullen, Pauline, Amanda French, and Vanessa Jakeman. "The official Cambridge guide to IELTS for academic & general training", Cambridge, 2014.
2. Prasad, Hari Mohan, Sinha, Uma Rani, "Objective English for Competitive Examinations", Tata Mc Graw Hill: Noida,2010.
3. Lougheed, Lin. "Barron's Writing for the TOEFL IBT: With Audio CD". Barron's Educational series, 2008.
4. Grussendorf, Marion, "English for Presentations", Oxford University Press, Oxford, 2007.
5. Murphy, Raymond English Grammar in Use with answers: Reference and Practice for Intermediate students, Cambridge: CUP,2004.

Web References

1.https://www.englishclub.com/grammar/nouns-compound.htm
2.https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3.https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4.https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5.http://www.englishvocabularyexercises.com/general-vocabulary/

2.A.3.65

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
2	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
3	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
4	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-
5	1	-	-	-	-	-	-	1	-	3	-	2	-	-	-

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

2. A·3·66

Department	Information Technology	Programme: B.Tech					
Semester	IV	Course Category Code: ES			*End Semester Exam Type: LE		
Course Code	U23ITPC02	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in Java Laboratory	0	0	2	1	50	50	100

(Common to All Branches)

Prerequisite	Basic concepts of Object-Oriented Programming Principles	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply and practice logical formulations to solve simple problems leading to specific applications.	K3
	CO2 Demonstrate the use of inheritance, interface and package in relevant applications	K3
	CO3 Implement robust application programs in Java using exception handling and multithreading	K3
	CO4 Build java distributed applications using Collections and IO streams.	K3
	CO5 Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.	K3

List of Exercises

1. Develop simple programs using java
2. Develop a java program that implements class and object.
3. Write a java program to find the frequency of a given character in a string
4. Write a java program to demonstrate inheritance and interfaces.
5. Develop a java program that implements the Packages.
6. Create java applications using Exception Handling for error handling.
7. Develop a simple real life application program to illustrate the use of Multi-Threads.
8. Implement simple applications using Collections.
9. Develop application using the concept of I/O Streams
10. Write a Java Program to demonstrate AWT and Swing Components
11. Develop a simple application and use JDBC to connect to a back-end database.

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

Reference Books

1. Allen B. Downey and Chris Mayeld, "Think Java - How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2020
2. Sagayaraj, Denis, Karthik, Gajalakshmi, "JAVA Programming for core and advanced learners", Universities Press Private Limited, 2018
3. Cay.S.Horstmann and Gary Cornell, "Core Java 2", Vol 2, Advanced Features, Pearson Education, 7th Edition, 2010

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM's tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog.
5. https://www.geeksforgeeks.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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

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

2.A.3.67.

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

2. A. 3. 68

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: PC				End Semester Exam Type: P		
Course Code	U23CSPC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Database Management Systems Laboratory	0	0	2	1	50	50	100

(Common to CSE and CCE)

Prerequisite	Data Structures and Algorithms	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Implement relational database systems using SQL statements.	K3
	CO2 Use typical data definitions and manipulation commands in various applications.	K3
	CO3 Demonstrate applications using Nested and Join Queries	K3
	CO4 Execute various advance SQL queries related to Transaction Processing.	K3
	CO5 Build commercial relational database systems using trigger and cursor concept.	K3

List of Exercises

Structured Query Language:

1. Data Definition Language
2. Data Manipulation Language
3. Data Selection and Projection statements
4. Aggregate Functions
5. Joins
6. Built in Functions
7. Nested Queries
8. Set Operations
9. View
10. Transaction Control Language
11. Data Control Language

PL/SQL:

12. Simple Pl/SQL Programs
13. Trigger

Cursor : Implicit Cursor and Explicit Cursor

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

Reference Books

1. Oracle Developer Handbook.
2. SQL/PL/SQL for Oracle by P.S. Deshpande, IIT Madras, Dream Tech Press.
3. Alan Beaulieu, Mastering SQL Fundamentals, 2nd Edition, O"Reilly,2009
4. Silberschatz, Korth, Sudarshan, Database System Concepts, 7thEdition - McGraw-Hill Higher Education, 2019

Web References

1. www.oracle-developer.net
2. www.oracle.com/DBA

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	2	1	-	2	1	-	2	2	3	2
2	3	2	3	3	2	2	1	-	2	1	-	-	3	3	3
3	3	3	3	3	2	2	2	-	2	1	-	-	3	2	3
4	3	2	3	3	2	2	1	-	2	1	-	-	3	3	3
5	3	3	3	3	2	2	2	-	2	1	-	-	3	2	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

2.A.3.69

Department	Computer Science and Engineering			Programme: B.Tech.					
Semester	IV			Course Category: PC			End Semester Exam Type: LE		
Course Code	U23CSPC04	Periods/Week			Credit	Maximum Marks			
		L	T	P	C	CAM	ESE	TM	
Course Name	OPERATING SYSTEMS LABORATORY	0	0	2	1	50	50	100	
Prerequisite	NIL								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the basic commands for Linux.	K2
	CO2 Develop simple shell programs.	K2
	CO3 Implement different Scheduling Algorithms	K5
	CO4 Apply the basic concepts of Deadlock Handling procedures.	K4
	CO5 Simulate Disk Scheduling Algorithms.	K4

List of Exercises

1. Study of Basic commands to understand the system and working of Linux.
2. Shell scripting (I/O, decision making, looping)
3. Creating Child process (using fork), Zombie, Orphan. Displaying system information using C.
4. Write C programs to simulate the following CPU Scheduling algorithms
   a) FCFS b) SJF c) Round Robin d) priority
5. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance and Prevention.
6. IPC (Threads, Pipes)
7. Process synchronization (Producer Consumer / Reader Writer/Dining Philosopher using semaphores)
8. Dynamic Memory Allocation Algorithms (First fit, Best fit, Worst fit)
9. Page Replacement Algorithms. (FIFO, LRU, Optimal)
10. Disk Scheduling Algorithms.

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

Reference Books

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Advanced programming in the Unix environment, W.R.Stevens, Pearson education.
3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces, Arpaci- Dusseau Books, Inc, 2015.
4. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
5. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes. Operating systems. Delhi. Pearson Education: Dorling Kindersley, 2004.

Web References

1. https://www.geeksforgeeks.org
2. http://avanthioslab.blogspot.com/2016/08/file-organization-techniques.html
3. https://www.programming.com/programs/c-programs/285-page-replacement-programs-in-c

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	-	1	1	1	1	-	-	-	-		-	-	2
2	-	2	-	2	2	2	2	-	-	-	-	2	-	-	2
3	2	2	2	2	2	2	-	-	-	-	2	-	-	-	2
4	2	2	2	2	3	2	-	-	-	-	2	-	-	-	2
5	2	2	2	2	3	2	-	-	-	-	2	-	-	-	2

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

Evaluation Method

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

2.A.3.70

Department	Computer Science and Engineering	Programme: **B.Tech.**						
Semester	IV	Course Category: **AEC**			End Semester Exam Type: -			
Course Code	U23CSC4XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course – IV**	-	-	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.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 50	Total Periods: 50

2.A.3.72

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: AEC			*End Semester Exam Type: -			
Course Code	U23CSS402	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Aptitude – II	0	0	2	0	-	-	100

Prerequisite	NIL

Course Contents

- Number System – II [Advanced Level].
- Factors [Sum, Product, odd, Even].
- Remainder Theorem - No of Zeros at End -Highest Power - Finding the Last two Digits.
- Time & Work, Chain Rule - Working Together.
- Combination Method - Before, After & Alternative Method.
- Men & Days - Men, Days & Work - Efficiency & Wages.
- Equation Method.
- Profit & Loss - Basics & Short Cuts - Passing Through Successive Hands.
- Purchase & Selling - Dishonest Shopkeeper.
- Successive Discount into Single Equivalent Discount - Dealing with two or more Parts.
- Percentage - Conversion & Shortcuts - Population, Depreciation Methods.
- Percentage Savings & Expenditure - Reduction in Consumption - Percentage Relationship.
- Time, Speed & Distance, Trains, Boats - Relationship between T/S/D.
- Train in same Direction - Opposite Direction.
- Boats along with Streams - Against the Streams.

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

2.A.3.73

Department	Computer Science and Engineering			Programme: B.Tech.			
Semester	IV			Course Category: MC		End Semester Exam Type:TE	
Course Code	U23CSM404	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Right to Information Law and Good Governance	2	-	-	-	100	-	100

(Common to ALL Branches except CSBS)

Prerequisite	-	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe and analyze concept and legislative provisions related to RTI	K2
	CO2 Develop critical thinking skills to identify instances where public authorities have failed to meet their obligations	K3
	CO3 Critically assess the challenges and limitations faced by Central and State Information Commissions	K2
	CO4 Analyze the structure and functioning of the judiciary at different levels - local, regional, national.	K2
	CO5 Analyze the impact of the RTI Act on promoting transparency, accountability, and citizen empowerment in India	K2

UNIT-I	Introduction	Periods:06
Conceptual background – Right to know – Open Government – Transparency in governance and accountability – Right to information under the Indian Constitution – Article 19(1)(a) and Article 21 of the Constitution – Role of NGOs and movement for right to information – Right to Information Act, 2005- Scope and objectives.		CO1
UNIT-II	**Obligation of Public Authorities**	**Periods:06**
Obligations of public authorities: Section 4 - Designation of Public Information Officers: Section 5 - Disposal of request: Section 7 - Exemption from disclosure of information: Section 8 - Grounds for rejection to access in certain cases: Section 9 - Severability: Section 10 - Third party information: Section 11		CO2
UNIT-III	**Central and State Information Commission**	**Periods:06**
Constitution of Central and State Information Commissions - Terms of office and conditions of service - Removal of Chief Information Commissioner or Information Commissioner - Powers and functions of Information Commissions.		CO3
UNIT-IV	**Judiciary and Right to Information Act**	**Periods:06**
Protection of right to access the information- Role of the Supreme Court and High Courts – Recent attempts of dilution of the right to information Law		CO4
UNIT-V	**Right to Information Act, 2005 and its relevance to other laws**	**Periods:06**
Public Records Act, 1993 - Whistle Blowers Protection Act, 2014 - Official Secrets Act, 1923		CO5

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

Text Books

1. Virender Negi, Monika Negi," Right to Information: Key to Good Governance", Indu Book Services Pvt. Limited, 2019
2. R. M. Pal, Somen Chakraborty "Human Rights Education in India" Indian Social Institute, 2000
3. Sairam Bhat," Right to Information and Good Governance - Volume 3 of NLSIU book series" National Law School of India University, 2016

Reference Books

1. Sairam Bhat [ed], Right to Information and Good Governance, NLSIU Book Series-3, 2016. [ISBN-9789383363452]
2. Sairam Bhat, Right to Information, Eastern Book House, 2012. [ISBN-978838021553]
3. Praveen Dala; Consumer Protection and Right to Information; Central Information Commission, 2007.

Web References

1. https://archive.nptel.ac.in/courses/129/106/129106001/
2. https://onlinecourses.nptel.ac.in/noc20_lw01/preview
3. https://www.classcentral.com/course/swayam-right-to-information-and-good-governance-19988

2.A.3.75

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

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

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	-	-	-	-	-	100
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

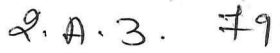
- **LRW components of Practical can be evaluated through Language Lab Software**

2.A.3.76

PROFESSIONAL ELECTIVES

PROFESSIONAL ELECTIVE COURSES

Professional Elective –I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE401	Programming in C++
2.	U23CSE402	Computer Graphics
3.	U23CSE403	Distributed Systems
4.	U23CSE404	IoT Design Protocols
5.	U23CSE405	UI / UX Development
Professional Elective –II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE506	Programming in C#
2.	U23CSE507	Image Processing
3.	U23CSE508	Cloud Tools and Techniques
4.	U23CSE509	IOT challenges and Future
5.	U23CSE510	Front-End development
Professional Elective –III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE611	Haskell Programming
2.	U23CSE612	Game Design and Development
3.	U23CSE613	Azure Cloud
4.	U23CSE614	Open Source Programming for IOT
5.	U23CSE615	Server Side Scripting Languages
Professional Elective –IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSEC01	Go Programming
2.	U23CSE716	Augmented Reality
3.	U23CSE717	Software Defined Networks
4.	U23CSE718	Internet Cryptography
5.	U23CSE719	Back-end Development
Professional Elective –V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE820	Redux Programming
2.	U23CSE821	Virtual Reality
3.	U23CSE822	Cloud Data Management
4.	U23CSE823	Introduction to Industry 4.0
5.	U23CSE824	Testing and Automation
Professional Elective –VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE825	Kotlin Programming
2.	U23CSE826	Metaverse Technology
3.	U23CSE827	Cloud Security
4.	U23CSE828	IOT Security
5.	U23CSE829	Cloud and Devops



2. A. 3. 80

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23CSE401	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in C++	3	-	-	3	25	75	100

Prerequisite	Basics of C Programs	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Comprehend the basics of Computers.	K2
	CO2 Illustrate the concepts of control structures and looping.	K2
	CO3 Implement programs using arrays and functions.	K3
	CO4 Demonstrate programs using Structure and Pointers.	K3
	CO5 Build the programs using Union and File management Operations.	K3

UNIT - I	Introduction to C++	Periods:09
Introduction to C++ - Basic components of a C++, Data types Compiling and Executing C++ Program. Expression Program and program structure - Control statements - Iteration statements in C++ - Introduction to Arrays Type casting - Array its types - Multidimensional– Passing Data - Functions.		CO1
UNIT - II	**Principles of Object Oriented Programming and Constructors**	**Periods:09**
Basic Concepts of Object-Oriented Programming: Benefits of OOP - Object Oriented Languages Classes and Objects: Data members - Programming using class - Member functions – THIS Pointer - Applications of OOP. Classes and Objects: Data members Constructors and Destructors - Constructors and Destructors - Friends Functions - Static variables and Functions in class - Operator Overloading in C++.		CO2
UNIT - III	**Real Time Examples in Oops**	**Periods:09**
Introduction to Inheritance in C++ – Types of Inheritance - Single and Multiple - Multilevel Inheritance - Hybrid - Pointers - Objects and Pointers - Virtual Functions - Polymorphism - Function overloading - Abstract classes..		CO3
UNIT - IV	**Files and Streams**	**Periods:09**
Introduction to Exception Handling: Exception – Basics - Exception Handling Mechanism – Throwing Mechanism – Catching - Standard input and output operations: C++ iostream hierarchy - Standard Input/output Stream Library – Organization Elements of the iostream - Programming using Streams – Basic Stream Concepts. File input and output: Reading a File - Managing I/O Streams – Opening a File – Different Methods.		CO4
UNIT - V	**Emplates and STL**	**Periods:09**
Introduction Class templates - Implementing a class template - Implementing class template member functions - Using a class template – Function templates - Implementing function templates – Using template functions - Template instantiation – Class template specialization - Template class partial specialization – Template - function specialization – Template parameters - Static members and variables – Templates and friends.		CO5

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

Text Books

1. Yashavant Kanetkar , " Let Us C++ ",BPB Publications, 2020.
2. E.Balagurusamy,"ObjectOrientedProgrammingwithC++",McGrawHill,7thEdition,2018.
3. HerbertSchildt,"C++-TheCompleteReference",McGrawHillEducation,4thedition,2017.

Reference Books

1. BjarneStroustrup,"A Tour of C++ ",Addison-Wesley Professional; 2ndEdition,2018.
2. Scott Meyers "Effective Modern C++", Shroff/O'Reilly; First Edition,2014.
3. Stanley Lippman, JoséeLajoie , Barbara Moo , "C++ Primer", 5thEdition, 2012.
4. BjarneStroustrup, "The Design and Evolution of C++", Addison-Wesley , 2005.
5. Alexanderscu "Modern C++ Design" Pearson; 1stEdition, 2004.

Web References

1. https://www.tutorialspoint.com/cplusplus/index.htm
2. http://www.cplusplus.com/doc/tutorial/
3. https://www.w3schools.com/cpp/
4. https://www.javatpoint.com/cpp-tutorial
5. https://www.geeksforgeeks.org/cpp-tutorial/

* TE – Theory Exam, LE – Lab Exam

2.A.3.81

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	3	-	-	-	-	-	-	-	3	-	2
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	2
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	2
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	2
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	2

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

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2.A.3.82

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: PE				End Semester Exam Type: TE		
Course Code	U23CSTE402	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Computer Graphics	3	-	-	3	25	75	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Comprehend the basics of Computer Graphics.	K2
CO2	Understand the Line Drawing and Circle Drawing algorithms.	K2
CO3	Illustrate Two Dimensional and Three-Dimensional Transformations.	K3
CO4	Demonstrate Line Clipping Algorithms.	K3
CO5	Realize Hidden Surface Removal algorithms.	K3

UNIT - I	Basics of Computer Graphics	Periods:09
Introduction to Computer Graphics - Area of Computer Graphics - Design and Drawing - Animation Multimedia applications - Difficulties for displaying pictures - Cathode Ray Tube, Quality of Phosphors, CRTs for Color Display, Beam Penetration CRT, The Shadow - Mask CRT, Direct View Storage Tube, Tablets, The light Pen, Three Dimensional Devices.		CO1

UNIT - II	Line Drawing and Circle Drawing algorithms	Periods:09
Point Plotting Techniques - Qualities of good line drawing algorithms, The Digital Differential Analyzer (DDA) Algorithm, Bresenham's line drawing Algorithm, Circle Drawing Algorithms.		CO2

UNIT - III	Transformations	Periods:09
Introduction to 2D Transformations - Translation - Rotation - Scaling - Shearing - Reflection - Homogeneous Coordinates - Matrix Representation - Composite Transformations. Introduction to 3D Transformations - Translation - Rotation - Scaling - Shearing - Reflection - Perspective Projection - Parallel Projection - Euler Angles - Quaternion Rotation - Homogeneous Coordinates - Matrix Representation - Composite Transformations.		CO3

UNIT - IV	Line Clipping Algorithms	Periods:09
Introduction to Line clipping - Cohen-Sutherland algorithm - Liang-Barsky algorithm - Cyrus-Beck algorithm - Sutherland-Hodgman algorithm - Weiler-Atherton algorithm.		CO4

UNIT - V	Hidden Surface Removal algorithms	Periods:09
Introduction to Hidden Surface Removal - Z-buffering (depth buffering) - Painter's algorithm - Binary space partitioning (BSP) trees - Scanline algorithm.		CO5

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

Text Books

1. Peter Shirley, Steve Marschner, "Fundamentals of Computer Graphics", CRC Press, 2019.
2. Edward Angel and Dave Shreiner, "Interactive Computer Graphics: A Top-Down Approach with OpenGL", Pearson, 2018
3. Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, "Real-Time Rendering", CRC Press, 2018.
4. Donald Hearn and M. Pauline Baker, "Computer Graphics: C Version", Pearson, 2013.
5. Foley, van Dam, Feiner, Hughes, "Computer Graphics: Principles and Practice", Addison-Wesley, 2013.

Reference Books

1. Edward Angel and Dave Shreiner, "Interactive Computer Graphics: A Top-Down Approach with OpenGL", Pearson, 2024.
2. Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, "Real-Time Rendering", CRC Press, 2023.
3. John M. Hughes, Andries van Dam, Morgan McGuire, "Computer Graphics: Principles and Practice", Addison-Wesley, 4. 2022.
5. avid F. Rogers, "Procedural Elements for Computer Graphics", McGraw-Hill, 2021.
6. Peter Shirley, Steve Marschner, "Fundamentals of Computer Graphics", CRC Press, 2020.

2.A.3.83

Web References

1. Computer Graphics Tutorial - javatpoint
2. Visual Effects | Computer Graphics World | 3D Modeling | Animation | CGI (cgw.com)
3. Introduction to Computer Graphics - Open Textbook Library (umn.edu)

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	2	-	-	-	-	-	-	-	2	-	3
2	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
3	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	-	3
5	3	2	3	2	3	-	-	-	-	-	-	-	3	-	3

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

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2. A. 3. 84

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: PE				End Semester Exam Type: TE		
Course Code	U23CSE403	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Distributed Systems	3	-	-	3	25	75	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the Architecture to design distributed System.	K2
	CO2 Understand various Interprocess communication techniques.	K2
	CO3 Understand and Build Various File system.	K3
	CO4 Design distributed system using various communication models	K4
	CO5 Design application using various distributed algorithm.	K4

UNIT - I	Basic Concepts	Periods:09
Definition of a distributed systems, Examples, Resource sharing and the Web, Challenges, System models, Architectural and fundamental models, Networking Interprocess communication, External data representation and marshalling, Client-server, and Group communication.		CO1

UNIT - II	Communication in Distributed System	Periods:09
System Model – Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request-reply protocols – Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish-subscribe systems – Message queues – Shared memory approaches -Distributed objects.		CO2

UNIT - III	File System and Peer to Peer Service	Periods:09
Distributed file systems - File service architecture – Andrew File system. File System: Features-File model -File accessing models – File sharing semantics Naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP- Peer-to-peer Systems – Introduction – Napster and its legacy – Peer-to-peer – Middleware – Routing overlays. Overlay case studies: Pastry, Tapestry		CO3

UNIT - IV	Synchronization and Replication	Periods:09
Introduction – Clocks, events and process states – Synchronizing physical clocks- Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections – Transactions and Concurrency Control– Transactions -Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.		CO4

UNIT - V	Process& Resource Management	Periods:09
Process Management: Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction- Features of Scheduling Algorithms –Task Assignment Approach		CO5

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

Text Books

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Andrew S. Tanenbaum, Maartenvan Steen, "Distributed Systems Principles and Paradigms", 2nd ed., Pearson Education, 2006.
3. Nancy A. Lynch, "Distributed Algorithms", Hardcourt Asia Pvt. Ltd., Morgan Kaufmann, 2000.
4. Distributed Systems, S.Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, 2010.

Reference Books

1. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani and Mukesh Singhal, Cambridge, rp 2010
2. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A.S., Van Steen M., "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.
4. Liu M.L., "Distributed Computing, Principles and Applications", Pearson Education, 2004.

Web References

1. https://www.geeksforgeeks.org/distributed systems
2. www.tutorialspoint.com/distributed systems
3. www.splunk.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	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	2	1	2	-	-	1	1	2	2	3
2	3	2	1	1	1	2	1	2	-	-	1	1	2	2	3
3	3	2	1	2	2	2	1	2	-	-	3	3	2	3	3
4	3	2	2	2	3	2	1	2	-	-	3	3	2	3	3
5	3	2	2	2	3	2	1	2	-	-	3	3	2	3	3

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

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2.A.3.86

Department	Computer Science and Engineering	Programme: **B.Tech.**					
Semester	IV	Course Category: **PE**			End Semester Exam Type: **TE**		
Course Code	U23CSE404	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	IoT Design Protocols	3	-	-	3	25	75	100

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Architectural Overview of IoT.	**K2**
	CO2 Recognize the IoT Reference Architecture and Real-World Design Constraints	**K2**
	CO3 Understand the various IoT Protocols.	**K3**
	CO4 Design application using various IoT Protocols.	**K4**
	CO5 Solve the various Real-World Design Constraints	**K4**

UNIT - I	**IoT-An Architectural Overview**	**Periods:09**
Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.		**CO1**
UNIT - II	**Reference Architecture**	**Periods:09**
IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints hardware is popular again, Data representation and visualization, Interaction and remote control.		**CO2**
UNIT - III	**IOT Data Link Layer & Network Layer Protocols**	**Periods:09**
PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP.		**CO3**
UNIT - IV	**Transport & Session Layer Protocols**	**Periods:09**
Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP,. MQTT.		**CO4**
UNIT - V	**Service Layer Protocols & Security**	**Periods:09**
Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer.		**CO5**

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

Text Books

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
2. Internet of Things: Architecture, Design Principles and Applications, Rajkamal, McGraw Hill Higher Education
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Aves and, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press,2014.
4. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM –MUMBAI.

Reference Books

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e ISBN 978-3-642-19157-2, Springer.
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.
3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
4. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications.

Web References

1. https://www.javatpoint.com/iot-internet-of-things
2. https://www.tutorialspoint.com/iot-network-protocols
3. https://www.tutorialspoint.com/iot-network-protocols
4. https://techvidvan.com/tutorials/iot-protocols/
5. http://www.steves-internet-guide.com/iot-messaging-protocols/

* TE – Theory Exam, LE – Lab Exam

2.A.3.87

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	2	1	2	-	-	1	1	2	2	3
2	3	2	1	1	1	2	1	2	-	-	1	1	2	2	3
3	3	2	1	2	2	2	1	2	-	-	3	3	2	3	3
4	3	2	2	2	3	2	1	2	-	-	3	3	2	3	3
5	3	2	2	2	3	2	1	2	-	-	3	3	2	3	3

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

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2.A.3.88

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	IV	Course Category: PE			End Semester Exam Type: TE			
Course Code	U23CSE405	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	UI and UX Design	3	-	-	3	25	75	100

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Build UI for user Applications.	K2
	CO2 Evaluate UX design of any product or application.	K2
	CO3 Demonstrate UX Skills in product development.	K3
	CO4 Demonstrate UX Skills in product development models.	K4
	CO5 Create Wireframe and Prototype.	K4

UNIT - I	Foundations of Design	Periods:09
UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.		CO1
UNIT - II	**Foundations of UI Design**	**Periods:09**
Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.		CO2
UNIT - III	**Foundations of UX Design**	**Periods:09**
Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.		CO3
UNIT - IV	**Wireframing, Prototyping and Testing**	**Periods:09**
Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.		CO4
UNIT - V	**Research, Designing, Ideating, & Information Architecture**	**Periods:09**
Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture.		CO5

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

Text Books

1. Joel Marsh, "UX for Beginners", O'Reilly, 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021.

Reference Books

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3rd Edition, O'Reilly 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
3	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
4	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3
5	3	2	1	1	3	-	-	-	-	-	-	-	3	-	3

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

9.A.3.89

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

2.A.3.90

ANNEXURE II

2.A.3.91

HONORS DEGREE

B.Tech.(Honors) in Computer Science & Engineering (with Specialization in Artificial Intelligence and Data science)

SEMESTER – VIII											
Sl. No.	Semester	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
					L	T	P		CAM	ESM	Total
Theory											
1	IV	U23CSH401	Data Mining and Warehousing: Principles and Practices	PC	3	1	0	4	25	75	100
2	V	U23CSH502	Data Science Efficiency: Exploring Optimization Methods	PC	3	1	0	4	25	75	100
3	VI	U23CSH603	Data Science: Navigating the Moral Landscape of AI	PC	3	1	0	4	25	75	100
4	VII	U23CSH704	Techniques for Data Visualization	PC	3	1	0	4	25	75	100
5	VIII	U23CSH805	Neural networks and Deep Learning	PC	3	1	0	4	25	75	100
Total								20	**125**	**375**	**500**
Equivalent NPTEL courses##											
1	IV to VIII	U23CSHN01	Introduction to Artificial Intelligence					3	**12 Weeks Course**		
2			Artificial Intelligence Search Methods for Problem Solving					3			
3			Data Mining-Introduction					4			
4			Deep Learning					3			
			Machine learning and Deep Learning					3			
5			Big Data Computing					3			
			Reinforcement Learning					3			

The student shall be given an option to earn 3 credits through one 12 week NPTEL course (equivalent) instead of any one course listed for honours degree programme and shall be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

2.A.3.93

2.A.3.94

Department	Computer Science and Engineering	Programme:B.Tech.						
Semester	IV	Course Category Code: PC				*End Semester Exam Type: TE		
CourseCode	U23CSH401	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Data Mining and Warehousing: Principles and Practices	3	1	-	4	25	75	100

Prerequisite	Database, DBMS	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Relate the Database with Data Mining concepts.	K2
	CO2 Apply Data Preprocessing and Classification Techniques	K3
	CO3 Analyze the Data Clusters	K3
	CO4 Understand the Association of Mining and Rules of Mining.	K3
	CO5 Use of Data Warehousing for the data storages.	K4

UNIT-I	INTRODUCTION TO DATA MINING	Periods: 9
Introduction to Data Mining - Need of Data Mining - Data Mining Applications - Data Mining Process - Data Mining Techniques - Difference between Data Mining and Machine Learning.		CO1

UNIT-II	DATA PREPROCESSING AND CLASSIFICATION	Periods: 9
Need for Data Preprocessing - Data Preprocessing Methods. Introduction to Classification - Types of Classification - Input and Output Attributes - Working of Classification - Guidelines for Size and Quality of the Training Dataset - Introduction to the Decision Tree Classifier. Naïve Bayes Method -Understanding Metrics to Assess the Quality of Classifiers.		CO2

UNIT-III	CLUSTER ANALYSIS	Periods: 9
Introduction to Cluster Analysis - Applications of Cluster Analysis - Desired Features of Clustering - Distance Metrics - Major Clustering Methods/Algorithms - Partitioning Clustering - Hierarchical Clustering Algorithms (HCA).		CO3

UNIT-IV	ASSOCIATION MINING	Periods: 9
Introduction to Association Rule Mining - Defining Association Rule Mining - Representations of Items for Association Mining - The Metrics to Evaluate the Strength of Association Rules - The Naïve Algorithm for Finding Association Rules - Approaches for Transaction Database Storage - The Apriori Algorithm - Direct Hashing and Pruning (DHP) - Dynamic Itemset Counting (DIC) - Mining Frequent Patterns without Candidate Generation.		CO4

UNIT-V	DATA WAREHOUSE	Periods: 9
The Need for an Operational Data Store (ODS) - Operational Data Store - Data Warehouse - Data Mart - Comparative Study of Data Warehouse with OLTP and ODS - Introduction to Data Warehouse Schema - Star Schema - Snowflake Schema - Fact Constellation Schema (Galaxy Schema - Comparison among Star, Snowflake and Fact Constellation Schema.		CO5

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

TextBooks

1. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press, 2019.
2. Jiawei Han, "Data Mining Concepts And Techniques", Elsevier Standard Edition, 4th Edition, 2022.
3. Daniel T. Larose, "Data Mining and Predictive Analytics", Wiley, 2015.
4. Paulraj Ponniah, "Data Warehousing: Fundamentals for IT Professionals", 2nd Edition, 2012.
5. Ralph Kimball, Margy Ross, "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling 3rd Edition", Wiley, 2013.

ReferenceBooks

1. Daniel Linstedt, Michael Olschimke, "Building a Scalable Data Warehouse with Data Vault 2.0", Morgan Kau publications, 1st edition, 2015.
2. Ralph Hughes, "Agile Data Warehousing for the Enterprise: A Guide for Solution Architects and Project Leaders", M Kaufmann publications, 1st edition, 2015.
3. Vincent Rainardi, "Building a Data Warehouse: With Examples in SQL Server", Apress Publications, 1st ed, 2008.
4. Robert Laberge, "The Data Warehouse Mentor: Practical Data Warehouse and Business Intelligence Insights", 2011.
5. Krish Krishnan, "Data Warehousing in the Age of Big Data", Morgan Kaufmann publications, 4th Edition, 2013.

2.A.3.25

Web References

1. https://www.javatpoint.com/data-mining
2. https://www.geeksforgeeks.org/data-mining/
3. https://www.guru99.com/data-mining-tutorial.html
4. https://www.softwaretestinghelp.com/data-warehousing-fundamentals/
5. https://learn.microsoft.com/en-us/fabric/data-warehouse/tutorial-introduction

ASSESSMENT PATTERN - THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100

* ±3% may be varied

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	3	3	3	3	1	2	3	3	3	3	3	3	3
2	3	3	2	2	3	3	1	2	3	3	3	2	3	3	3
3	2	3	2	2	2	2	2	1	3	3	3	2	3	3	3
4	3	2	2	2	3	2	2	2	3	3	3	2	3	3	3
5	3	2	2	3	3	2	2	2	3	2	3	2	3	3	3

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

2.A.3.96

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	V	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSH502	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Data Science Efficiency: Exploring Optimization Methods	3	1	-	4	25	75	100

-

Prerequisite	Artificial Intelligence, Data Science	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the importance of optimization for data science and apply basic concepts of mathematics to formulate	K2
	CO2 Illustrate the analytical methods for solving constrained optimization problems and unconstrained optimization problems.	K2
	CO3 Implement the Equality constrained and Newtons method	K3
	CO4 Demonstrate the barrier function and barrier method.	K3
	CO5 Demonstrate various applications arising in different scientific domains such as control, signal processing, machine learning and communications.	K3

UNIT - I	Introduction to Optimization	Periods:09
Introduction - mathematical optimization, least-squares and linear programming, convex and nonlinear optimization. convex sets, Convex optimization problems - optimization problem in standard form, convex optimization problems, quasi-convex optimization, linear optimization, quadratic optimization, generalized inequality constraints, semi definite programming, vector optimization.		CO1
UNIT - II	**Unconstrained optimization problems**	**Periods:09**
Duality, approximation and fitting, statistical estimation, geometric problems, Unconstrained minimization- gradient descent method, steepest descent method, Newton's method.		CO2
UNIT - III	**Equality constrained and Newtons method**	**Periods:09**
Equality constrained minimization, eliminating equality constraints, Newton's method with equality constraints, infeasible start Newton method and implementation.		CO3
UNIT - IV	**Inequality Constrained Minimization and Logarithmic Barrier Function**	**Periods:09**
Interior-point methods -inequality constrained minimization, logarithmic barrier function and central path, barrier method, L1 Norm optimization methods.		CO4
UNIT - V	**Neural Networks and ADMM**	**Periods:09**
Introduction to Neural Networks - Alternating direction method of multipliers (ADMM) and applications		CO5

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

Text Books

1. Kalyanmoy, Deb. Optimization for engineering design: Algorithms and examples. Prentice-Hall of India Pvt. Limited, 2nd Edition 2012.
2. Chong, Edwin KP, and Stanislaw H. Zak. An introduction to optimization. John Wiley & Sons, 2004. Bhatti, M. Asghar. Practical Optimization Methods: With Mathematica® Applications. Springer Science & Business Media, 2012.
3. Stephen P. Boyd, and Lieven Vandenberghe. Convex optimization. Cambridge university press, 2004.

Reference Books

1. S.D. Sharma, Operations Research, Kedar Nath Ram Nath & Co, Meerut. 2014
2. Kanti Swarup, P.K.Gupta, Manmohn, Operations Research, Sultan Chand and sons, New Delhi. 2017

2.A.3.97

3. GassS.I: Linear Programming. Mc Graw Hill. 2012
4. HadlyG :Linear programming. Addison-Wesley. 2021
5. Taha H.M: Operations Research: An Introduction : Mac Millan. Tenth Edition. August 2019

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1. https://www.educative.io
2. https://www.greeksforgreeks.org/optimization-for-data-science/
3. https://towardsdatascience.com
4. https://www.acceldata.io

* TE – Theory Exam, LE – Lab Exam

ASSESSMENT PATTERN-THEORY							
Test / Bloom's Category*	Remembering (K1)%	Understanding (K2)%	Applying (K3)%	Analyzing (K4)%	Evaluating (K5)%	Creating (K6)%	Total %
CAT-01	10	20	70	-	-	-	100
CAT-02	10	20	70	-	-	-	100
ESE	10	20	60	-	-	-	100
*+3% may be varied							

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	3	3	3	3	-	-	-	-	-	-	3	2	3
2	3	3	3	3	3	3	-	-	-	-	-	-	2	3	3
3	2	3	3	3	3	3	-	-	-	-	-	-	2	2	3
4	3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
5	3	3	3	3	3	3	-	-	-	-	-	-	2	3	3

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

2.A.3.98

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	VI	Course Category:PC			End Semester Exam Type:			
Course Code	U23CSH603	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	DATA SCIENCE: NAVIGATING THE MORAL LANDSCAPE OF AI	3	1	-	4	25	75	100

Prerequisite	Mathematics, Programming	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply the Artificial Intelligence concepts for solving problems	K2
	CO2 Represent knowledge for problem solving and game playing using various logics	K2
	CO3 Gain knowledge on data science process.	K3
	CO4 Perform data manipulation functions using Numpy and Pandas.	K3
	CO5 Understand different types of machine learning approaches.	K3

UNIT-I	INTRODUCTION AND PROBLEM SOLVING	Periods:09
Introduction – Foundations of AI – History of AI – Intelligent agent – Types of agents - Structure – Problem solving agents – Uninformed search strategies – Breadth first search – Uniform cost search – Depth first search – Depth limited search – Bidirectional search – Searching with partial Information..		CO1
UNIT-II	**INFORMED SEARCH AND GAME PLAYING**	**Periods:09**
Informed search – Strategies – A* Heuristic function – Hill Climbing – Simulated Annealing – Constraint Specification problem – Local Search in continuous space – Genetic algorithm – Optimal decisions in games - Pruning - Imperfect decisions –Alpha-Beta pruning – Games that include an element of chance.		CO2
UNIT-III	**MACHINE LEARNING**	**Periods:09**
The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis.		CO3
UNIT-IV	**INTRODUCTION TO DATA SCIENCE**	**Periods:09**
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data.		CO4
UNIT-V	**DATA MANIPULATION**	**Periods:09**
Python Shell - Jupyter Notebook - IPython Magic Commands - NumPy Arrays-Universal Functions – Aggregations – Computation on Arrays – Fancy Indexing – Sorting arrays – Structured data – Data manipulation with Pandas – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – String operations – Working with time series – High performance		CO5

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

Text Books

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE) ", McGraw Hill – 2010.
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
3. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
4. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

Reference Books

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearsson Education, 2007.
2. Stuart Russell and Peter Norvig, " AI – A Modern Approach", 3rd Edition, Pearson Education, 2010.
3. Deepak Khemani, " Artificial Intelligence", Tata McGraw Hill Education, 2013.

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4. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
5. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press,2014.

Web References

1. https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/what-is-artificial-intelligence
2. https://www.datacamp.com/tutorial/category/ai
3. https://www.simplilearn.com/tutorials/data-science-tutorial
4. https://intellipaat.com/blog/tutorial/data-science-tutorial/
5. https://data-flair.training/blogs/data-science-tutorials-home/

*TE–TheoryExam,LE–LabExam

COs/POs/PSOsMapping

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	2	3	1	3	2	3	3	-	2	3	-	3	3	3
CO 2	2	2	2	2	-	2	-	3	-	2	-	2	2	2	-
CO 3	2	1	2	3	2	3	3	3	-	3	3	-	2	3	3
CO 4	2	2	3	3	2	3	-	3	-	3	-	3	3	3	-
CO 5	2	2	2	2	-	2	-	2	-	2	-	2	2	2	-

CorrelationLevel:1-Low,2-Medium,3–High Evaluation Methods

Assessment	ContinuousAssessmentMarks(CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks							

*Applicationoriented/Problemsolving/Design/Analyticalincontentbeyondthe syllabus

2. A-3. 100

Department	Computer Science and Engineering	Programme: B. Tech.						
Semester	VII	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23CSH704	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Techniques for Data Visualization	3	1	-	4	25	75	100

Prerequisite		
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Analyze the different data types, visualization types to bring out the insight.	K2
	CO2 Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large dataset.	K3
	CO3 To introduce visual perception and core skills for visual analysis	K3
	CO4 Apply visualization techniques for time-series data and ranking patterns	K3
	CO5 Demonstrate the analysis of large dataset using various visualization techniques and tools.	K4

UNIT-I	INTRODUCTION TO DATA VISUALIZATION	Periods:9
Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis: Four Levels for Validation. Statistical charts: Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart - Frequency Polygon - Box plot - Scatter plot - Regression curves.		CO1

UNIT-II	VISUALIZATION TECHNIQUES	Periods:9
Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques - multidimensional techniques - visualizing cluster analysis – K-means and Hierarchical Cluster techniques.		CO2

UNIT-III	BUILDING CORE SKILLS FOR VISUAL ANALYSIS	Periods:9
Information Visualization - Prerequisites for Enlightening Analysis: Aptitudes and attitudes of effective Analysts - Traits of meaningful data; Power of Visual Perception - How Visual Perception Works - Making Abstract Data Visible - Analytical Interaction - Analytical Navigation - Optimal Quantitative Scales - Reference Lines and Regions - Trellises and Crosstabs - Multiple Concurrent Views - Focus and Context - Details on Demand - Over-plotting reduction.		CO3

UNIT-IV	TIME-SERIES, RANKING, AND DEVIATION ANALYSIS	Periods:9
Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.		CO4

UNIT-V	DATA VISUALIZATION TOOLS	Periods:9
Tableau functions and logics: Marks and Channels-Arrange Tables- Arrange Spatial Data- Facets into multiple views		CO5

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

Text Books

1. Tamara Munzer, "Visualization Analysis and Design", 1st edition, CRC Press, United States, 2015
2. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013
3. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
4. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
5. Stephen Few, "Information dashboard design: The effective visual communication of data", O'Reilly, 2006.

Reference Books

1. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with South-Western College Publishing, 2021.
2. Dr. Chun-hauh Chen, W. K. Hardle, A. Unwin, Handbook of Data Visualization, 1st edition, Springer publication, Germany, 2008.
3. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
4. Alexandru Telea,"Data Visualization", Principles and Practice, Second Edition,2015
5. Hardik A. Gohel, S. Margret Anouncia, Subbiah Vairamuthu,"Data VisualizationTrends and Challenges T Multidisciplinary Perception",Springer Nature Singapore,2020.

Web References

9.A.3.101

1. https://online.hbs.edu/blog/post/data-visualization-techniques
2. https://www.xenonstack.com/blog/data-visualization-techniques
3. https://www.tableau.com/learn/articles/data-visualization
4. https://coolinfographics.com/dataviz-guides
5. https://www.geeksforgeeks.org/data-visualization-and-its-importance/

ASSESSMENT PATTERN - THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	20	70	-	-	-	100
CAT2	10	20	70	-	-	-	100
ESE	10	30	60	-	-	-	100
* ±3% may be varied							

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	3
4	3	2	2	2	3	2	3	3	3	3	3	2	3	3	3
5	3	2	2	3	3	2	2	2	3	2	3	2	3	3	3

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

2.A.3.102

Department	Computer Science and Engineering	Programme: **B.Tech.**						
Semester	VIII	Course Category:**PC**			End Semester Exam Type: **TE**			
CourseCode	U23CSH805	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
CourseName	**Neural Networks and Deep Learning**	**3**	**1**	**-**	**4**	**25**	**75**	**100**

Prerequisite	Artificial Intelligence	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (HighestLevel)
	CO1 Distinguish different types of NN architectures	**K2**
	CO2 Design Feed Forward Neural Network architecture for research problems.	**K2**
	CO3 Apply deep learning techniques to practical problems	**K3**
	CO4 Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.	**K3**
	CO5 Apply CNN and its variants for suitable applications.	**K3**

UNIT-I	**Introduction to Deep Learning**	**Periods:09**
Evolution of AI, Machine Learning vs Deep Learning, Deep Learning types, Stages in ML/DL project, Applications of Deep Learning.		**CO1**

UNIT-II	**Fundamentals of Neural Networks**	**Periods:09**
Introduction to Neural Network, Model of Artificial Neuron, Learning rules and various activation functions. Neural Network Architecture: Single layer Feed-forward networks. Multi-layer Feed-forward networks. Recurrent Networks.		**CO2**

UNIT-III	**Back Propagation Networks**	**Periods:09**
Back Propagation networks, Architecture of Back-propagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation algorithms.		**CO3**

UNIT-IV	**Deep Neural Networks**	**Periods:09**
Introduction to Deep Neural Networks, training deep models, Training Deep Neural Networks using Back Propagation-Setup and initialization issues, Gradient- Descent Strategies, vanishing and exploding Gradient problems, regularizations, dropouts.		**CO4**

UNIT-V	**Convolutional Neural Networks**	**Periods:09**
Basic structure of Convolutional Network, Convolutions for Images, Padding and Stride, Multiple Input and Multiple Output Channels, Pooling, FCNN Case study: Image classification using CNN.		**CO5**

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

Text Books

1. S.Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithms", PHI Learning Pvt. Ltd., 2003.
2. Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", Amazon Science, 2021
3. Charu C. Aggarwal, "Neural Networks and Deep Learning ",Springer, July 2023
4. Mukesh Madanan," Neural Network and Deep Learning",Bluerose Publishers Pvt. Ltd. 26 August 2022

Reference Books

1. Jacek M. Zurada,"Introduction to artificial neural systems", West Publishing Co., 1992.
2. Goodfellow I., BengioY., and Courville A., "Deep Learning", MIT Press, 2016.
3. Yegnanarayana," Artificial Neural Networks" PHI Learning Pvt. Ltd, 2009.
4. Simon Haykin ," Neural Networks And Learning Machines", Pearson (2016)
5. I.A.Dhotre ," ," Neural Networks & Deep Learning",Technical Publications 2023

Web References

1. https://www.datacamp.com/tutorial/introduction-to-deep-neural-networks
2. https://www.analyticsvidhya.com/blog/2015/11/free-resources-beginners-deep-learning-neural-network/
3. https://www.linkedin.com/pulse/what-best-resources-learn-deep-learning-brecht-corbeel
4. https://cs.stanford.edu/people/karpathy/convnetjs/index.html
5. https://aqsazafar81.medium.com/7-best-neural-network-resources-you-must-know-4f2d4bbc2923

*TE–TheoryExam,LE–LabExam

2.A.3.103

COs/POs/PSOsMapping

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	3	3	3	3	3	3	-	2	3	-	3	3	3
CO 2	3	3	3	3	-	3	-	3	-	2	-	2	2	2	-
CO 3	3	3	3	3	3	3	3	3	-	3	3	-	3	3	3
CO 4	3	3	3	3	3	3	-	3	-	3	-	3	3	3	-
CO 5	2	2	2	2	-	2	-	2	-	2	-	2	2	2	-

CorrelationLevel:1-Low,2-Medium,3–High Evaluation Methods

Assessment	ContinuousAssessmentMarks(CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks							

*Applicationoriented/Problemsolving/Design/Analyticalincontentbeyondthe syllabus

2. A. 3. 104

ANNEXURE III

2. A-3. 105

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
Puducherry - 605 107

Panel of Examiners for Valuation of End Semester Examinations May-June 2024

Department of Computer Science and Engineering

SMVEC/ Dept/ Exam-Cell/Valuation/2023-2024/0051

Date:25.03.2024

Sl.No	Name of the Examiner	Specialization	Designation, Department and Institution in which currently working	Contact number and mail id	Experience
External Examiners					
1	**Dr. L.Arun raj**	Wireless Networks, Theory of Computation, Multimedia Applications, Python	Associate Professor Department of Computer Science and Engineering B.S. AbdurRahman Crescent Institute of Science and Technology |Vandalur |Chennai-48	**E-Mail ID:**arunraj@crescent.education **Contact No:**9941169805	**15Years**
2	**Dr. S. Thamizharasan**	Design and Analysis of Algorithms, Artificial Intelligence	**Assistant Professor / CSE RGCET, Puducherry.**	**E-Mail ID:**thamizharasans@rgcetpdy.ac.in, **Contact No:**9500211888	**17 Years**
3	**Dr. N. Manjunathan**	DBMS, Data Structures	Associate Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	**E-Mail ID:**nmanjunathan@veltech.edu.in **Contact No:**9791060024	**16 Years**
4	**Dr T SENTHIL KUMAR**	DBMS, Computer Graphics	Associate Professor/ CSE, SRM Institute of Science and Technology Chennai	**E-Mail ID:**senthilt2@srmist.edu.in **Contact No:**9787565565	**15 Years**
5	**Dr.G.Balamurugan**	AI, Deep Learning	Assistant Professor Department of Computing	**E-Mail ID:** balamurg1@srmist.edu.in **Contact No:9629308990**	**6 Years**

2.A.3.107

			Technologies SRM Institute of Science and Technology Kattankulathur Campus Chengalpattu-603203		
6	**Dr. KISHORE KUMAR K**	DBMS, Data Structures	Assistant Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	**E-Mail ID:**kisorekumar@veltech.edu.in **Contact No:**9092330191	**15 Years**
7	**Dr. A.PUNITHA**	Wireless communication Networks, Network Security	Associate Professor Dept. of CSE Annamalai University	**E-Mail ID:**12charuka17@gmail.com **Contact No:**9487379388	**18 Years**
8	**Dr. S. SATHIYA**	Artificial Intelligence, Operating Systems, Programming in Python	Associate Professor Dept. of CSE Annamalai University	**Contact No:**9865032026 **E-Mail ID:**Sathiya.sep05@gmail.com	**18 Years**
9	**Dr. K. T. MEENAABARNA**	Design and Analysis of Algorithms, Artificial Intelligence	Associate Professor Dept. of CSE Annamalai University	**Contact No:**9489229350 **E-Mail ID:**abarnakt@gmail.com	**18 Years**
10	**Dr. P. Seenuvasan**	Design and Analysis of Algorithm Java Programming	HOD / Assistant professor (SR), Anna university college of engineering, Villupuram	**Contact No:** 9894122253 **E-Mail ID:** psvasanucev@gmail.com	**15 Years**
11	**DR.S.SENTHILKUMAR**	Data Science Object oriented Analysis	Associate Professor Department of Computer Science and Engineering University College of Engineering Pattukottai	**Email ID:** senthilucepkt@gmail.com **Contact No :8838497277**	**18 Years**

8.4.3.108

12	**Dr S. Sivanesh**	Data Structures Python Programming	Assistant Professor Department of Computer Science and Engineering University College of Engineering, Panruti	**Email ID:** sivanesh.s@gmail.com **Contact No :** 95788 99988	**16 Years**
13	**Dr. K. Selvakumar**	Design and Analysis of Algorithm Java Programming	Professor and Head./CSE, Annamalai University	**Email ID:** kskaucse@gmail.com **Contact No :** 9443185363	**25 years**
14	**Dr. N. Sivakumar**	Python Programming Artificial Intelligence	Professor / CSE Pondicherry Technological University	**Email ID:** sivakumar@ptuniv.edu.in **Contact No :** 9840901054	**18 years**
Board Chairman					
1	**Dr. K. Premkumar**	Data Structures, Object Oriented Programming, Mobile Computing	Professor and Head /CSE, Sri ManakulaVinayagar Engineering College,	**Email ID:** hodcse@smvec.ac.in **Contact No.:** 9842127679	**23 Years**
Chief Examiners					
1	**Dr. M. GANESAN**	Software Engineering, IoT, Deep Learning	Associate Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	**Email ID:**ganesan@smvec.ac.in **Contact No**:9486341535	**15 Years**
2	**Dr. T. MEGALA**	Database Management	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering	**E-Mail ID:** megalacse@smvec.ac.in **Contact No**:9789722271	**8 Years**
Internal Valuators					
1	**Dr. J. Raja**	Database management Systems	Associate Professor, CSE, Sri Manakula Vinayagar Engineering College, Puducherry	**E-Mail ID**:rajacse@smvec.ac.in **Contact No:**9677430406	12 Years

2.4.3.109

2	**Mr. M.SHANMUGAM**	Microprocessors and Microcontrollers Artificial Intelligence	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	9444370963 shanmugam.mm@smvec.ac.in	**15 Years**
3	**Mr. P.KARTHIKEYAN**	DBMS Mobile Computing	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	**E-Mail ID:** mails2karthy@gmail.com **Contact No:**9791553404	**14 Years**
4	**Mr. B. THIYAGARAJAN**	Artificial Intelligence, Programming in C	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	**E-Mail ID:**thiyagarajan@smvec.ac.in **Contact No:**9791857984	**12 Years**
5	**Mr. D. RAJESH**	OOPS, Programming in Python	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	**E-Mail ID:** successraju06@gmail.com **Contact No:**9600551422	**12 Years**
6	**Mrs. R. DEEPA**	Software Engineering	Assistant Professor, CSE, Sri ManakulaVinayagar Engineering College, Puducherry	**E-Mail ID:** deepa.cse@smvec.ac.in ***Contact No:***:6380 547 250	**10 Years**

2.A.3.110

Exam Coordinator
(Mr.B.Thiyagarajan)

HOD/CSE
Dr,K. Premkumar