SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)
Puducherry - 605107

Department of Information Technology

BOARD OF STUDIES - EIGHTH MEETING

MINUTES

Date and Time
04.09.2024 at 02.00 PM

2.A.4.1

2. A. 4. 2

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(AN AUTONOMOUS INSTITUTION)

Department of Information Technology

Minutes of Board of Studies

The Board of Studies Eighth meeting of Department of Information Technology was held on 04th September 2024 from 2:00 P.M to 5:00 P.M in the Application Programming Laboratory, Department of Information Technology with the Head of the Department as the Chair.

The following members were present for the BoS meeting.

Sl.No	Name of the Member with Designation and official Address	Members as Per University norms
1	**Dr. R. Raju, M.Tech, Ph.D** Professor & Head Department of IT, SMVEC	Chairperson
2	**Dr. S. Kanmani** Professor, Department of Information Technology Puducherry Technological University, Puducherry	Subject Expert (University Nominee)
3	**Dr.R.Manoharan, M. Tech., Ph.D** Professor, Department of CSE Puducherry Technological University, Puducherry	Subject Expert (Academic Council Nominee)
4	**Dr.N.Pughazendi,** Professor and Head, School of Science and Computer Studies CMR University, Chennai	Subject Expert (Academic Council Nominee)
5	**Mr.Ashin Antony,** CTO,IGNITHO Technologies, Chennai-600018	Representative from Industry
6	**Dr. P. Victer Paul,** Senior Assistant Professor, Department of Computer Science and Engineering, IIIT, Kottayam	Post Graduate Alumnus (nominated by Principal)
7	**Dr. S. Balaji** Associate Professor/IT	Member Secretary
8	**Dr. K. Lakshmi** Professor	Member
9	**Dr. R. Saravanan** Professor	Member
10	**Dr. N. Thilagavathi** Associate Professor	Member
11	**Dr. B. Vijayakumar** Associate Professor	Member
12	**Dr. Puspita Dash** Associate Professor	Member
13	**Dr. R. Anandkumar** Assistant Professor	Member

14	**Mr. R. Suresh** Associate Professor	Member
15	**Mrs. V. Padmapriya** Associate Professor	Member
16	**Mrs. N. Kalaiselvi** Assistant Professor	Member
17	**Mrs. M. Lakshmiprabha** Assistant Professor	Member
18	**Mrs. E. Valarmathi** Assistant Professor	Member
19	**Mr. P. Praveenkumar** Assistant Professor	Member
20	**Mr. G. Prabu** Assistant Professor	Member
21	**Mrs. C. Vanaja** Assistant Professor	Member
22	**Ms. L. Durgadevi** Assistant Professor	Member
23	**Mr. T. Periasamy** Assistant Professor	Member
24	**Ms. K. Poornambigai** Assistant Professor	Member
25	**Mr. T. Maheswaran** Assistant Professor	Member
26	**Mr. R. Vijayaprabhu** Assistant Professor	Member
27	**Mr. D. Prabhu** Assistant Professor	Member
28	**Ms. M. Madhumitha** Assistant Professor	Member
29	**Ms. A. Sowbarnika** Assistant Professor	Member
30	**Mr. A. Chandrapragash** Assistant Professor	Member
31	**Mr. A. Ranjeeth** Assistant Professor	Member
32	**Ms. V. Keerthana** Assistant Professor	Member
33	**Dr.N.S.N. Cailassame** Dean Placement & Professor Department of Management Studies	Member
34	**Dr. K. Karthikeyan** Associate Professor Department of Chemistry	Member
35	**Prof. M. Devanathan** Assistant Professor Department of Mathematics	Member
36	**Dr. P. Jaichitra** Professor and Head Department of English	Member
37	**Dr.T.Jayavarthanan** Professor Department. of Physics	Member

Agenda of the Meeting	
Item:2024.8.1	To welcome the members and apprise about the college
Item:2024.8.2	To Confirm the minutes of the Seventh BoS meeting held on 04.3.2024
Item:2024.8.3	To discuss the Syllabi of V and VI semesters, under Autonomous Regulations R-2023 for the B.Tech - Information Technology students admitted from the Academic Year 2023-24.
Item:2024.8.4	To discuss the admission eligibility criteria for the Honors and Minors Degree
Item:2024.8.5	To discuss the Syllabus of courses offered for Honors and Minor Degree programme
Item:2024.8.6	To Approve the Certificate Courses offered to the students
Item:2024.8.7	To discuss about the Modifications/Updations carried in Course Name/ Syllabi/ Course Code
Item:2024.8.8	To Apprise about the Department Research Activities
Item:2024.8.9	To Apprise about the End Semester Examination Results
Item:2024.8.10	To discuss about the remarkable Achievements of Faculty and Students
Item:2024.8.11	Any other items to be discussed with the permission of the Chair

Minutes of the Meeting
Dr. R. Raju, Chairperson, BoS / B.Tech Information Technology officially announced the opening of the meeting and welcomed the members. He also thanked them for accepting the invitation and giving us their valuable time. The meeting thereafter deliberated on agenda items that had been approved by the Chairperson.

Item:2024.8.1 — **To welcome the members and apprise about the college**

The Chairperson Dr.R.Raju welcomed the members of Board of Studies and apprised about the successful functioning of the college

Item:2024.8.2 — **To Confirm the minutes of the Seventh BoS meeting held on 04.3.2024**

As per the suggestions given during 7th BoS meeting the following changes have been carried out in the curriculum and syllabus.

Details of Changes carried in the Courses

S.No.	Existing Course Name	Course Existed in Semester	Corrected/Retained with Course Name	Course Currently in Semester
1.	Data Communication and Computer Networks	III	Data Communication and Computer Networks	IV
	Data Communication and Computer Networks Laboratory `		Data Communication and Computer Networks Laboratory	
2.	Automata and Compiler Design	III	Automata Languages and Computation	IV
3.	Design and Analysis of Algorithms (T+P)	III	Algorithms Design and Analysis (T)	IV
			Algorithms Design and Analysis Laboratory (P)	
4.	Microprocessors and Embedded Systems (T)	III	Microcontrollers and its Interfacing (T+P)	III
	Microprocessors and Embedded Systems (P)			
5.	Operating Systems (T)	IV	Operating Systems (T)	III
	Operating Systems Laboratory (P)		Operating Systems Laboratory `	
6.	Database Management Systems (T)	IV	Database Management Systems(T)	III
	Database Management Systems Laboratory (P)		Database Management Systems Laboratory (P)`	

Professional Elective List

Professional Elective - I (Offered in Semester IV)		
Sl. No.	**Existing Course Titles**	**After 7th BoS – Approved Course Titles**
1	Object Oriented Analysis and Design	Object Oriented Analysis and Design
2	Web Application Development	Web Application Development
3	Information Coding Techniques	Information Coding Techniques

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4	Agile Methodologies	Agile Methodologies
5	Mobile Adhoc Network	Data Warehousing and Data Mining

Professional Elective - II (Offered in Semester V)

Sl. No.	Existing Course Titles	After 7th BoS – Approved Course Titles
1	Parallel and Distributed Computing	Theory of Compiler Design
2	Data Warehousing and Data Mining	Information Visualization
3	Business Intelligence and Applications	Parallel and Distributed Computing
4	Software Testing	Software Testing
5	Wireless and Mobile Communication	Automation Techniques and Tools

Professional Elective - III (Offered in Semester VI)

Sl. No.	Existing Course Titles	After 7th BoS – Approved Course Titles
1	Distributed Databases	Quantum Computing
2	Bio-Inspired Computing	Full Stack Development
3	Software Defined Networks	Software Defined Networks
4	Natural Language Processing	Natural Language Processing
5	Edge and Fog Computing	Edge and Fog Computing

Professional Elective - IV (Offered in Semester VII)

Sl. No.	Existing Course Titles	After 7th BoS – Approved Course Titles
1	Full Stack Development	Six Sigma
2	Cyber Security and Forensics	Cyber Security and Forensics
3	Robotic Process Automation	Robotic Process Automation
4	Digital Image Processing	Digital Image Processing
5	Intrusion Detection System	Intrusion Detection System

Professional Elective – V (Offered in Semester VIII)

Sl. No.	Existing Course Titles	After 7th BoS – Approved Course Titles
1	Quantum Computing	Cloud Services Management
2	Human Computer Interaction	Human Computer Interaction
3	GPU Computing	Bio-Inspired Computing
4	Automation Techniques and Tools	Storage Technologies
5	Augmented Reality and Virtual Reality	Augmented Reality and Virtual Reality

Professional Elective – VI (Offered in Semester VIII)

Sl. No.	Existing Course Titles	After 7th BoS – Approved Course Titles
1	Green Computing	Green Computing
2	Social Network Analysis	Generative AI
3	Wireless Sensor Networks	Wireless Sensor Networks
4	Computer Vision	Game Development
5	E-Commerce	E-Commerce

All the Changes carried as per suggestion of the members and the same has been confirmed.

Item:2024.8.3	**To discuss the Syllabi of V and VI semesters, under Autonomous Regulations R-2023 for the B.Tech. - Information Technology students admitted from the Academic Year 2023-24.**
	The BoS Members recommended to carry out the following changes in the V and VI Semester of Regulation 2023. • The BoS members suggested to do the following

S.No.	Course Title	Category	Suggestion Provided	Changes Carried
1.	Artificial Intelligence	PC	Reframe the syllabus, since irrelevant contents of Machine Learning is in Unit III	Syllabus reframed as per the suggestion provided, without including Machine Learning
2.	Information Visualization	PE	Ellaborate the contents given in each Unit	Syllabus reframed with Elaborated Contents
3.	Quantum Computing	PE	Ellaborate the contents given in Unit II	Ellaborated the contents with qubit Gates and Quantum Error Correction

The details of the courses are given in **Annexure I**

Item:2024.8.4	**To discuss the admission eligibility criteria for the Honors and Minors Degree**
	The Chairperson discussed in detail about the admission eligibility criteria, specifically to earn an honours degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0.
Item:2024.8.5	**To discuss the Syllabus of courses offered for Honors and Minor Degree Programme**
	The Chairperson discussed about the Honors/Minor Degree (Advanced Web Development) to be floated by the department and showcased the syllabus of the subject listed under Honors Degree.

COURSE DETAILS											
Sl. No.	**Sem**	**Course Code**	**Course Title**	**Category**	**Periods**			**Credits**	**Max. Marks**		
					L	**T**	**P**		**CAM**	**ESM**	**Total**
Theory											
1	IV	U23ITX401	Frontend Development	PC	3	1	0	4	25	75	100
2	V	U23ITX502	Advanced Databases	PC	3	1	0	4	25	75	100

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3	VI	U23ITX603	Microservices and Spring-Boot	PC	3	1	0	4	25	75	100
4	VII	U23ITX704	Container Orchestration and Security	PC	3	1	0	4	25	75	100
5	VIII	U23ITX805	Cloud Management	PC	3	1	0	4	25	75	100
	Total							20*	125	375	500
## Equivalent NPTEL courses											
1	IV to VII	U23ITXN01	Web Development Equivalent NPTEL Courses					3	12 WEEK Course		

Details of Honors/Minor Degree and Syllabus in **Annexure III**

Item:2024.8.6	**To Approve the Certificate Courses offered to the students**
	The Certification Courses list to be offered to the students has been discussed and the same has been approved.
Item:2024.8.7	**To discuss about the Modifications/Updations carried in Course Name/ Syllabi/ Course Code**
	The Chairperson listed the courses in which modifications/updations carried out, the details are listed below • The course **Business Intelligence and Applications (U23CBEC01)** has been removed from the elective List instead of which the Course Parallel and **Distributed Computing (U23ITE510)** has been included. • The course Name **Data Visualization** has been modified has **Information Visualization** • The Honors/Minor Degree Course **Advanced Web Development** opted instead of **Network Security** • The ratification sorted for the courses **Digital Design and System Architecture Laboratory** and **Automata Language and Computation** The updated syllabus of the courses for which ratification sorted given in **Annexure II**
Item:2024.8.8	**To Apprise about the Department Research Activities**
	The Chairperson apprised about the recent research activities carried through Journal, Conference, Books/Chapters Publications, Patents and Consultancy work carried by the Faculties
Item:2024.8.9	**To Apprise about the End Semester Examination Results**
	The Chairperson proudly stated that we are continuously maintaining 100% pass percentage in the previous years and the same has been continued this year also.
Item:2024.8.10	**To discuss about the remarkable Achievements of Faculty and Students**
	The Board of Studies Chairperson briefed the recent achievements of the College, Department Faculty and Students, along with the Placement track of the year 2024
Item:2024.8.11	**Any other items to be discussed with the permission of the Chair**
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The meeting for the above Agenda regarding B.Tech - Information Technology was concluded by 5:00 pm by **Dr. R.Raju**, Chairperson-BoS and Head of Department, Department of Information Technology, Sri Manakula Vinayagar Engineering College.

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Members Present

S.NO.	Name of the Member	Designation	Signature
1.Head of the Department Concern (Chairperson)			
1	**Dr. R. Raju** Professor & Head	Chairperson	
2.All faculty members of the Department			
2	**Dr. S. Balaji** Associate Professor	Member Secretary	
3	**Dr. K. Lakshmi** Professor	Member	
4	**Dr. R. Saravanan** Professor	Member	
5	**Dr. N. Thilagavathi** Associate Professor	Member	
6	**Dr. B. Vijayakumar** Associate Professor	Member	
7	**Dr. Puspita Dash** Associate Professor	Member	
8	**Dr. R. Anandkumar** Assistant Professor	Member	
9	**Mr. R. Suresh** Associate Professor	Member	
10	**Mrs. V. Padmapriya** Associate Professor	Member	
11	**Mrs. N. Kalaiselvi** Assistant Professor	Member	
12	**Mrs. M. Lakshmiprabha** Assistant Professor	Member	
13	**Mrs. E. Valarmathi** Assistant Professor	Member	
14	**Mr. P. Praveenkumar** Assistant Professor	Member	
15	**Mr. G. Prabu** Assistant Professor	Member	
16	**Mrs. C. Vanaja** Assistant Professor	Member	
17	**Ms. L. Durgadevi** Assistant Professor	Member	
18	**Mr. T. Periasamy** Assistant Professor	Member	
19	**Ms. K. Poornambigai** Assistant Professor	Member	
20	**Mr. T. Maheswaran** Assistant Professor	Member	
21	**Mr. R. Vijayaprabhu** Assistant Professor	Member	
22	**Mr. D. Prabhu** Assistant Professor	Member	
23	**Ms. M. Madhumitha** Assistant Professor	Member	

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24	**Ms. A. Sowbarnika** Assistant Professor	Member	
25	**Mr. A. Chandrapragash** Assistant Professor	Member	
26	**Mr. A. Ranjeeth** Assistant Professor	Member	
27	**Ms. V. Keerthana** Assistant Professor	Member	
28	**Mr. M. Devanathan** Assistant Professor Department of Mathematics, SMVEC	Member	
29	**Dr. P. Jaichitra** Professor and Head Department of English, SMVEC	Member	
30	**Dr. K. Karthikeyan** Associate Professor Department of Chemistry, SMVEC	Member	
31	**Dr. T. Jayavarthanan** Professor and Head Department of Physics, SMVEC	Member	
32	**Dr. N.S.N. Cailassame** Dean Placement, Professor - MBA, SMVEC	Member	
3. Two subject experts from outside the Parent University			
33	**Dr. R. Manoharan, M. Tech., Ph.D.** Professor, Department of CSE Puducherry Technological University, Puducherry rmanoharan@pec.edu, 9443468480	Subject Expert	
34	**Dr. N. Pughazendi,** Professor and Head, School of Science and Computer Studies, CMR University, Bangalore, pughazendi.n@cmr.edu.in,_9962969429	Subject Expert	
4. Expert nominated by the Vice-Chancellor recommended by the Autonomous college Principal as a University Nominee			
35	**Dr. S. Kanmani** Professor, Department of Information Technology Puducherry Technological University, Puducherry kanmani@ptuniv.edu.in , 9443206299	Subject Expert	
5. One representative from industry areas to nominated by the Principal			
36	**Mr. Ashin Antony**, CTO, IGNITHO Technologies, Chennai-600018 ashin.antony@ignitho.com, 9444150791	Member	
6. One member of the College Alumni to be nominated by the principal			
37	**Dr. P. Victer Paul,** Senior Assistant Professor, Department of Computer Science and Engineering, Indian Institute of Information Technology, Kottayam victerpaul@iiitkottayam.ac.in , 9944913170 Specialization: Bio-Inspired Optimization, Data Analytics	Member	

Dr. R. Raju
Chairperson - BoS (IT)

Dr. V.S.K. Venkatachalapathy
Director cum Principal
Chairperson - Academic Council

2.A.4.12

ANNEXURE I:

Curriculum (1 – 8 Semester, PE, OE, Certification)

2.A.4.13

2.D.4.14

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B. TECH. INFORMATION TECHNOLOGY

ACADEMIC REGULATIONS 2023
(R-2023)

CURRICULUM & SYLLABI

2.04.15

2.A.4.16

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society

Mission

M1 :	**Quality Education**	:	To provide comprehensive academic system that amalgamates the cutting-edge technologies with best practices
M2 :	**Research and Innovation**	:	To foster value-based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues
M3:	**Employability and Entrepreneurship**	:	To inculcate the employability and entrepreneurial skills through value and skill-based training
M4 :	**Ethical Values**	:	To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society

DEPARTMENT VISION AND MISSION

Vision

To be a pioneer in the field of Information Technology by achieving academic excellence, involving in research & development and promoting technical & professional expertise

Mission

M1: Expertise: To impart quality education and create excellent engineers with strong analytical, Programming and Problem solving Skills to meet the ever changing demands of IT industry

M2: Eminence: To kindle creative thinking, innovation and foster value-based research in the field of information technology

M3: Complaisant: To enrich the employability skills, inculcate entrepreneurial ideology and promote professional expertise

M4: Exemplar: To instil human values, ethical responsibilities and empowering graduates to be socially responsible and technically competent

2.A.4.B.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis:

Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions:

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society:

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability:

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8: Ethics:

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance:

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning:

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Fortify

To prepare the students with fundamental knowledge in programming languages and in developing applications.

PEO2: Equip

To develop skill in understanding the complexity in networking, security, data mining, web technology and mobile communication so as to develop innovative applications and projects in these areas for the betterment of society, as well as to enable them to pursue higher education

PEO3: Endow

To enable the students as full-fledged professionals by providing opportunities to enhance their analytical, communication skills and problem solving skills along with organizing abilities

PEO4: Conventional

To familiarize the students with the ethical issues in engineering profession, issues related to the World-wide economy, nurturing of current job related skills and emerging technologies

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

PSO1: Establishment of Mathematical and computer systems concepts

To use mathematical and system concepts to solve multidisciplinary problems using appropriate mathematical analysis, system and programming concepts on various computing environments.

PSO2: Establishment of applications and information concepts

To inculcate good breadth of knowledge to create applications and enhance informatics with cutting edge technologies

PSO3: Establishment of Business, Technological concepts

The ability to interpret and respond to business agility with relevant software tools and skills and provide newer ideas and innovations in information technology research

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2.A.4.22

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Breakdown of Credits
1.	Humanities, Social Sciences and Management Courses (HS)	**15**
2.	Basic Science Courses (BS)	**20**
3.	Engineering Science including Workshop, Drawing, Basics of Electrical/Mechanical/Computer etc., (ES)	**18**
4.	Professional Core Courses(PC)	**77**
5.	Professional Elective Courses (PE)	**18**
6.	Open Electives Courses (PE)	**9**
7.	Project Work and Internship (PA)	**13**
8.	Ability Enhancement Courses (AEC*)	-
9.	Mandatory Courses (MC*)	-
	Total	**170**

**** AEC and MC are not included for CGPA calculation***

HONOURS/MINOR DEGREE PROGRAMME:

Sl.No	Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences (HS)	5	3	1	1	2	-	-	3	15
2.	Basic Sciences (BS)	4	7	5	4	-	-	-	-	20
3.	Engineering Sciences (ES)	9	5	-	4	-	-	-	-	18
4.	Professional Core (PC)	3	8	17	11	12	15	11	-	77
5.	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6.	Open Electives (OE)	-	-	-	-	3	3	3	-	9
7.	Project Work (PA)	-	-	-	-	1	1	2	8	12
8.	Internship (PA)	-	-	-	-	-	-	1	-	1
9.	Ability Enhancement Courses (AEC*)	-	-	-	-	-	-	-	-	-
10.	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**21**	**23**	**23**	**23**	**21**	**22**	**20**	**17**	**170**

The student is permitted to opt for earning an *honours/minor degree* in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an honours/minor degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0. The prescribed courses offered for Honours degree are given in **Annexure - III**

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2.A.4.24

SEMESTER – I										
Sl. No.	Course Code	Course Title	Cate-gory	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics - I	BS	3	1	0	4	25	75	100
2	U23ESTC03	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
3	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
4	U23ITT101	IT Essentials	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values - II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English - I	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC01	Basics of Electrical and Electronics Engineering Laboratory	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23ITC1XX	Certification Course - I **	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23ITM101	Induction Programme	MC	2 Weeks			-	-	-	-
							21	425	575	1000

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SEMESTER – II										
Sl. No.	Course Code	Course Title	Cate-gory	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics - II	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
4	U23CSTC03	Data Structures	PC	3	0	0	3	25	75	100
5	U23ITTC01	Digital Design and System Architecture	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
8	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC02	Data Structures Laboratory	PC	0	0	2	1	50	50	100
10	U23ITPC01	Digital Design and System Architecture Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ITC2XX	Certification Course - II **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ITM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							23	575	625	1200

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SEMESTER – III										
Sl. No.	Course Code	Course Title	Cate-gory	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	U23CSTC04	Database Management Systems	PC	3	0	0	3	25	75	100
3	U23CSTC05	Operating Systems	PC	3	0	0	3	25	75	100
4	U23ITT302	Automata Languages and Computation	PC	3	0	0	3	25	75	100
5	U23ITT303	Software Engineering and Project Management	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ITB301	Microcontrollers and its Interfacing	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	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	U23ITC3XX	Certification Course - III **	AEC	0	0	4	-	100	-	100
12	U23ITS301	Skill Enhancement Course - I *	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ITM303	Climate Change	MC	2	0	0	-	100	-	100
							23	675	625	1300

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

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SEMESTER – IV										
Sl. No.	Course Code	Course Title	Cate-gory	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	U23ITT404	Algorithms Design and Analysis	PC	3	0	0	3	25	75	100
4	U23ITT405	Data Communication and Computer Networks	PC	3	0	0	3	25	75	100
5	U23ITE4XX	Professional Elective I #	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ITB402	Internet 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	U23ITP401	Algorithms Design and Analysis Laboratory	PC	0	0	2	1	50	50	100
10	U23ITP402	Data Communication and Computer Networks Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23ITC4XX	Certification Course - IV **	AEC	0	0	4	-	100	-	100
12	U23ITS402	Skill Enhancement Course - II *	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23ITM404	Right to Information and Good Governance	MC	2	0	0	-	100	-	100
							23	675	625	1300

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

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SEMESTER – V										
Sl. No.	Course Code	Course Title	Cate-gory	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23CSTC06	Artificial Intelligence	PC	3	0	0	3	25	75	100
3	U23ITT506	Information and Network Security	PC	3	0	0	3	25	75	100
4	U23ITT507	Data Analytics	PC	3	0	0	3	25	75	100
5	U23ITE5XX	Professional Elective II #	PE	3	0	0	3	25	75	100
6	U23XXOCXX	Open Elective I $	OE	3	0	0	3	25	75	100
Practical										
7	U23CSPC05	Artificial Intelligence Laboratory	PC	0	0	2	1	50	50	100
8	U23ITP503	Information and Network Security Laboratory	PC	0	0	2	1	50	50	100
9	U23ITP504	Data Analytics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23ITW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ITC5XX	Certification Course - V **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ITM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	600	600	1200

$ Open electives are to be selected from the list given in Annexure II

SEMESTER – VI										
Sl. No.	Course Code	Course Title	Cate-gory	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ITTC03	Machine Learning	PC	3	0	0	3	25	75	100
2	U23ITT608	Mobile Application Development	PC	3	0	0	3	25	75	100
3	U23ITT609	Blockchain Technology	PC	3	0	0	3	25	75	100
4	U23ITE6XX	Professional Elective III #	PE	3	0	0	3	25	75	100
5	U23XXOCXX	Open Elective II $	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ITB603	IoT Programming	PC	2	0	2	3	50	50	100
Practical										
7	U23ITPC03	Machine Learning Laboratory	PC	0	0	2	1	50	50	100
8	U23ITP605	Mobile Application Development Laboratory	PC	0	0	2	1	50	50	100
9	U23ITP606	Blockchain Technology Laboratory	PC	0	0	2	1	50	50	100
Project										
10	U23ITW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23ITC6XX	Certification Course - VI **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23ITM606	Gender Equality	MC	2	0	0	-	100	-	100
							22	625	575	1200

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SEMESTER – VII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ITT710	Neural Network and Deep Learning	PC	3	0	0	3	25	75	100
2	U23ITT711	Cloud Computing and Virtualization	PC	3	0	0	3	25	75	100
3	U23ITT712	IT Operations and Management	PC	3	0	0	3	25	75	100
4	U23ITE7XX	Professional Elective IV #	PE	3	0	0	3	25	75	100
5	U23XXOCXX	Open Elective III $	OE	3	0	0	3	25	75	100
Practical										
6	U23ITP707	Neural Network and Deep Learning Laboratory	PC	0	0	2	1	50	50	100
7	U23ITP708	Cloud Computing and Virtualization Laboratory	PC	0	0	2	1	50	50	100
Project										
8	U23ITW703	Project Phase - I	PA	0	0	4	2	50	50	100
9	U23ITW704	Internship / Inplant Training	PA	0	0	2	1	100	-	100
							20	375	525	900

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Cate-gory	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23ITE8XX	Professional Elective V #	PE	3	0	0	3	25	75	100
3	U23ITE8XX	Professional Elective VI #	PE	3	0	0	3	25	75	100
Project										
8	U23ITW805	Project Phase - II	PA	0	0	16	8	50	100	150
							17	125	325	450

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PROFESSIONAL ELECTIVE COURSES (18 CREDITS)

Professional Elective - I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE401	Object Oriented Analysis and Design
2	U23ITE402	Web Application Development
3	U23ITE403	Information Coding Techniques
4	U23ITE404	Agile Methodologies
5	U23ITE405	Data Warehousing and Data Mining
Professional Elective - II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE506	Theory of Compiler Design
2	U23ITE507	Information Visualization
3	U23ITE508	Software Testing
4	U23ITE509	Automation Techniques and Tools
5	U23ITE510	Parallel and Distributed Computing
Professional Elective - III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE611	Quantum Computing
2	U23ITE612	Full Stack Development
3	U23ITE613	Edge and Fog Computing
4	U23ITEC01	Software Defined Networks
5	U23ITEC02	Natural Language Processing
Professional Elective - IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE714	Six Sigma
2	U23ITE715	Cyber Security and Forensics
3	U23ECEC01	Digital Image Processing
4	U23ITE716	Intrusion Detection System
5	U23ITEC03	Robotic Process Automation
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE817	Cloud Services Management
2	U23ITE818	Bio-Inspired Computing
3	U23ITE819	Storage Technologies
4	U23ITEC04	Human Computer Interaction
5	U23ITEC05	Augmented Reality and Virtual Reality
Professional Elective - VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23ITE820	Green Computing
2	U23ITE821	Generative AI
3	U23ITE822	Game Development
4	U23ITE823	E-Commerce
5	U23ECEC02	Wireless Sensor Networks

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DEPARTMENT OF IT

OPEN ELECTIVE COURSES

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective (Offered in Semester V/VI)				
1	U23HSOC01	Intellectual Property Rights	MBA	Common to all Branches
2	U23HSOC02	New Product Development	MBA	
3	U23HSOC03	Finance for Engineers	MBA	
4	U23HSOC04	Economics for Engineers	MBA	
5	U23HSOC05	Marketing Management	MBA	

S. No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective (Offered in Semester V/VI)				
1	U23ITOC01	Database System: Design & Development	IT	EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS
2	U23ITOC02	Computer Hardware and Troubleshooting	IT	EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS
Open Elective (Offered in Semester VII)				
1	U23ITOC03	Essentials of Data Science	IT	EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS
2	U23ITOC04	Big Data Technologies	IT	EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
Puducherry – 605 107
TRAIN LAB ACADEMY

The following courses are provided by Trainlab Academy for Regulation 2023:

ABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

S. No	Course Code	Course Title	Certified By
1	U23XXCX01	Adobe Photoshop	Adobe
2	U23XXCX02	Adobe Animate	Adobe
3	U23XXCX03	Adobe Dreamweaver	Adobe
4	U23XXCX04	Adobe After Effects	Adobe
5	U23XXCX05	Adobe Illustrator	Adobe
6	U23XXCX06	Adobe InDesign	Adobe
7	U23XXCX07	Autodesk AutoCAD -ACU	Autodesk
8	U23XXCX08	Autodesk Inventor - ACU	Autodesk
9	U23XXCX09	Autodesk Revit - ACU	Autodesk
10	U23XXCX10	Autodesk Fusion 360 - ACU	Autodesk
11	U23XXCX11	Autodesk 3ds Max - ACU	Autodesk
12	U23XXCX12	Autodesk Maya - ACU	Autodesk
13	U23XXCX13	Cloud Security Foundations	AWS
14	U23XXCX14	Cloud Computing Architecture	AWS
15	U23XXCX15	Cloud Foundation	AWS
16	U23XXCX16	Cloud Practitioner	AWS
17	U23XXCX17	Cloud Solution Architect	AWS
18	U23XXCX18	Data Engineering	AWS
19	U23XXCX19	Machine Learning Foundation	AWS
20	U23XXCX20	Robotic Process Automation / Medical Robotics	Blue Prism
21	U23XXCX21	Advance Programming Using C	CISCO
22	U23XXCX22	Advance Programming Using C ++	CISCO
23	U23XXCX23	C Programming	CISCO
24	U23XXCX24	C++ Programming	CISCO
25	U23XXCX25	CCNP Enterprise: Advanced Routing	CISCO
26	U23XXCX26	CCNP Enterprise: Core Networking	CISCO
27	U23XXCX27	Cisco Certified Network Associate - Level 2	CISCO
28	U23XXCX28	Cisco Certified Network Associate- Level 1	CISCO
29	U23XXCX29	Cisco Certified Network Associate- Level 3	CISCO
30	U23XXCX30	Fundamentals Of Internet of Things	CISCO

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31	U23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT	CISCO
32	U23XXCX32	Java Script Programming	CISCO
33	U23XXCX33	NGD Linux Essentials	CISCO
34	U23XXCX34	NGD Linux I	CISCO
35	U23XXCX35	NGD Linux II	CISCO
36	U23XXCX36	Advance Java Programming	Ethnotech
37	U23XXCX37	Android Programming / Android Medical App Development	Ethnotech
38	U23XXCX38	Angular JS	Ethnotech
39	U23XXCX39	Catia	Ethnotech
40	U23XXCX40	Communication Skills for Business	Ethnotech
41	U23XXCX41	Coral Draw	Ethnotech
42	U23XXCX42	Data Science Using R	Ethnotech
43	U23XXCX43	Digital Marketing	Ethnotech
44	U23XXCX44	Embedded System Using C	Ethnotech
45	U23XXCX45	Embedded System with IOT / Arduino	Ethnotech
46	U23XXCX46	English For IT	Ethnotech
47	U23XXCX47	Plaxis	Ethnotech
48	U23XXCX48	Sketch Up	Ethnotech
49	U23XXCX49	Financial Planning, Banking and Investment Management	Ethnotech
50	U23XXCX50	Foundation Of Stock Market Investing	Ethnotech
51	U23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis	Ethnotech
52	U23XXCX52	IOT Using Python	Ethnotech
53	U23XXCX53	Creo (Modelling & Simulation)	Ethnotech
54	U23XXCX54	Soft Skills, Verbal, Aptitude	Ethnotech
55	U23XXCX55	Software Testing	Ethnotech
56	U23XXCX56	MX-Road	Ethnotech
57	U23XXCX57	CLO 3D	Ethnotech
58	U23XXCX58	Solid works	Ethnotech
59	U23XXCX59	Staad Pro	Ethnotech
60	U23XXCX60	Total Station	Ethnotech
61	U23XXCX61	Hydraulic Automation	Festo
62	U23XXCX62	Industrial Automation	Festo
63	U23XXCX63	Pneumatics Automation	Festo
64	U23XXCX64	Agile Methodologies	IBM
65	U23XXCX65	Block Chain	IBM
66	U23XXCX66	Devops	IBM
67	U23XXCX67	Artificial Intelligence	ITS
68	U23XXCX68	Cloud Computing	ITS
69	U23XXCX69	Computational Thinking	ITS
70	U23XXCX70	Cyber Security	ITS
71	U23XXCX71	Data Analytics	ITS
72	U23XXCX72	Databases	ITS
73	U23XXCX73	Java Programming	ITS
74	U23XXCX74	Networking	ITS
75	U23XXCX75	Python Programming	ITS
76	U23XXCX76	Web Application Development (HTML, CSS, JS)	ITS
77	U23XXCX77	Network Security	ITS & Palo alto
78	U23XXCX78	MATLAB	MathWorks

79	U23XXCX79	Azure Fundamentals	Microsoft
80	U23XXCX80	Azure AI (AI-900)	Microsoft
81	U23XXCX81	Azure Data (DP -900)	Microsoft
82	U23XXCX82	Microsoft 365 Fundamentals (SS-900)	Microsoft
83	U23XXCX83	Microsoft Security, Compliance and Identity (SC-900)	Microsoft
84	U23XXCX84	Microsoft Power Platform (PI-900)	Microsoft
85	U23XXCX85	Microsoft Dynamics Fundamentals 365 - CRM	Microsoft
86	U23XXCX86	Microsoft Excel	Microsoft
87	U23XXCX87	Microsoft Excel Expert	Microsoft
88	U23XXCX88	Securities Market Foundation	NISM
89	U23XXCX89	Derivatives Equinity	NISM
90	U23XXCX90	Research Analyst	NISM
91	U23XXCX91	Portfolio Management Services	NISM
92	U23XXCX92	Cyber Security	Palo alto
93	U23XXCX93	Cloud Security	Palo alto
94	U23XXCX94	PMI - Ready	PMI
95	U23XXCX95	Tally - GST & TDS	Tally
96	U23XXCX96	Advance Tally	Tally
97	U23XXCX97	Associate Artist	Unity
98	U23XXCX98	Certified Unity Programming	Unity
99	U23XXCX99	VR Development	Unity

DineshKumar A
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Trainlab Academy

Dr.A. Vijayalakshmi
Professor and Head,
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Trainlab – Coordinator

Dr J. Madhusudanan
Professor and Head,
Department of AI & DS &
Trainlab – Coordinator

Dean Academic (Core)
(Dr. Arivalagar.AA)

Dean Academic (Circuit)
(Dr.S. Anbumalar)

Director Cum Principal
(Dr.V.S.K. Venkatachalapathy)

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ANNEXURE I

R23 CURRICULUM

SYLLABUS - V and VI SEMESTER

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Department	Management Studies	Programme: B.Tech						
Semester	V	Course Category Code: HS			*End Semester Exam Type: TE			
Course Code	U23HSTC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Research Methodology	2	0	0	2	25	75	100

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	*On completion of the course, the students will be able to*	BT Mapping (Highest Level)
	CO1 Interpret the different types of research and explain how research methods can be used to address engineering problems.	K2
	CO2 Discuss the research problems, conduct comprehensive literature reviews, and utilize tools and services for effective information retrieval.	K2
	CO3 Apply appropriate methods to design experiments, analyze data, and interpret results using both numerical and graphical techniques.	K3
	CO4 Analyze and apply ethical guidelines to structure and write research papers and dissertations, ensuring academic integrity and avoiding plagiarism.	K4
	CO5 Examine the fundamentals of intellectual property rights to protect and enforce them, with emphasis on their role in fostering innovation and entrepreneurship in engineering.	K3

Unit-I	Introduction to Research	Periods: 6
Meaning and Importance of Research, Types of Research: Overview of Basic, Applied, and Developmental Research, Overview of the Research Process, Defining a Research Problem: Key Considerations, Setting Research Objectives and Research Questions, Introduction to Research Design: Basic Concepts, Approaches to Research: Quantitative vs. Qualitative.		CO1
Unit-II	**Problem Formulation and Literature Review**	**Periods: 6**
Identifying and Formulating Research Problems, conducting a Literature Review: Essential Steps, Referencing and Citation Methods: Basic Techniques. Sources of Information: Overview of Libraries and Online Databases.		CO2
Unit-III	**Research Methods and Data Analysis**	**Periods: 6**
Introduction to Experimental Research, Developing Hypotheses: Basic Approach. Data Collection Methods: Sampling and Surveys, Basics of Data Analysis: Numerical and Graphical Analysis, Introduction to Inferential Statistics.		CO3
Unit-IV	**Writing and Presenting Research**	**Periods: 6**
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, Conclusion). Referencing and Citation: Brief Overview.		CO4
Unit-V	**Ethics and Intellectual Property in Research**	**Periods: 6**
Ethical Considerations in Research: Introduction to Scientific Misconduct. Basics of Intellectual Property Rights - Introduction to Patents, Copyrights, and Trademarks – Case studies on ethical dilemmas in research.		CO5

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

Text Books

1. Kumar, R. Research Methodology: A Step-by-Step Guide for Beginners, 5th Edition, SAGE Publications, 2019.
2. Ram Ahuja, *Research methods*, Rawat Publications, 2nd edition, 2022
3. Creswell, J. W., and Creswell, J. D. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th Edition, SAGE Publications, 2018.

Reference Books

1. Thiel DV. Research methods for engineers. Cambridge: Cambridge University Press; 2014.
2. Ganesan R. Research methodology for engineers. Chennai: MJP Publishers; 2024.
3. Agarwal C, Sharma V. Research methodology in sociology. New Delhi: Commonwealth Publishers; 2012.
4. Thody A. Writing and presenting research. 2nd edition, London: SAGE Publications; 2006.
5. Kothari CR. Research methodology – methods and techniques. 5th edition, New Delhi: New Age International Publishers; 2023.

Web References

1. https://conjointly.com/kb/
2. https://owl.purdue.edu/owl/research_and_citation/conducting_research/writing_a_literature_review.html
3. https://files.eric.ed.gov/fulltext/ED536788.pdf
4. https://researcheracademy.elsevier.com/
5. https://www.wipo.int/
6. https://www.scholastic.com /7-steps-to-successful-research-report.html
7. https://www.futurelearn.com/info/courses/business-research-methods- investigation.
8. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India

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COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	2	-	-	2	2	3			
CO2	3	1	1	3	1	-	2	-	-	1	2	-			
CO3	1	3	3	1	3	-	2	-	-	2	2	-			
CO4	-	-	1	2	-	-	2	3	2	2	-	2			
CO5	2	2	2	2	2	2	3	3	2	2	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	5	5	5	5	5	75	100

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

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Department	Computer Science and Engineering	Programme: B.Tech						
Semester	V	Course Category: PC			End Semester Exam Type: TE			
Course Code	U23CSTC06	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Artificial Intelligence	3	0	0	3	25	75	100
(Common CSE, IT and CCE)								
Prerequisite	Basics of Algorithms and Probability							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Understand AI fundamentals and apply search strategies to solve complex problems	K2
CO2	Understand the fundamentals of knowledge representation	K3
CO3	Understand and Apply Fuzzy logic and Predicate logic.	K3
CO4	Design model and manage uncertainty using probabilistic reasoning techniques.	K3
CO5	Explore the benefits of AI in different fields	K3

UNIT - I	INTRODUCTION TO AI AND PROBLEM SOLVING	Periods:09
Overview of AI - Foundations of AI - History of AI - Agents Structure and its types. Problem Solving by Searching: Uninformed search - BFS - DFS - Informed search - Greedy Best First Search - A* Search - AO* Search - Constraint Satisfaction Problem(CSP) - Backtracking search for CSP.		CO1

UNIT - II	KNOWLEDGE REPRESENTATION	Periods:09
Introduction to Knowledge Representation: Types - Approaches - Knowledge representation using Semantic Network – Extended semantic networks - Frames – Conceptual dependencies – Scripts.		CO2

UNIT - III	FUZZY AND PREDICATE LOGIC	Periods:09
Basic Concepts of Fuzzy Set Theory – Operations of Fuzzy Sets – Properties of Fuzzy Sets – Crisp Relations – Fuzzy Relational Equations – Operations on Fuzzy Relations – Fuzzy Systems – Logical Agents, Predicate Logic – First-Order Logic, Inference in First-Order Logic, Forward and Backward Chaining.		CO3

UNIT - IV	PROBABILISTIC REASONING	Periods:09
Probabilistic Notations - Bayes rule - Bayesian Network - Probabilistic reasoning over time: Time and Uncertainty - Understanding Partially Observable Environments - Inference in Temporal Models - Hidden Markov Models - Kalman Filters - Dempster and Shafer Theory.		CO4

UNIT - V	APPLICATIONS OF AI	Periods:09
AI in healthcare: Disease Diagnosis and Prediction.AI In Finance: Automated trading and Portfolio Management – AI in Education: Adaptive Learning and Assessment – AI in Customer service: Chatbot and Virtual Assistance.		CO5

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

Text Books

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017.
3. S. Rajasekaran,G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms synthesis and applications",15th Edition, PHI Learning Private Limited,2011

Reference Books

1. Cherry Bhargava,"Artificial Intelligence Fundamentals and Applications", First Edition,CRC Press,2021.
2. S. Kanimozhi Suguna, M.Dhivya,Sra Paiva,"Artificial Intelligence Recent Trends and Applications, First Edition, "CRC Press,2021.
3. Wolfgang Ertel,"Introduction to Artificial Intelligence,"2nd Edition,Springer,2018.
4. David Poole and Alan Mackworth," Artificial Intelligence: Foundations of Computational Agents", 2nd Edition, Cambridge University Press, 2017.
5. Chris Thornton, Benedict Du Boulay, "Artificial Intelligence through Search",4th Edition, Springer Netherlands,2012.

Web References

1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.geeksforgeeks.org/artificial-intelligence/
4. https://towardsdatascience.com/
5. https://www.coursera.org/

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

CO's	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	-	-	-	2	2	2	3	3	2	3
2	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3
3	3	2	3	3	3	-	-	-	2	3	3	3	3	3	3
4	3	3	3	3	3	2	2	-	2	3	3	3	3	3	3
5	3	3	2	3	3	2	2	-	2	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.D.4.46

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23ITT506	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Information and Network Security	3	0	0	3	25	75	100
IT								

Prerequisite	Data Communication and Computer Networks	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Articulate the importance of professional practice, Law and Ethics in the Information Security.	K2
	CO2 Identify and model information security risks.	K3
	CO3 Apply the different cryptographic operations using public and private key cryptography.	K3
	CO4 Identify and use appropriate algorithms for assuring System security and authentication.	K3
	CO5 Examine the security requirements and solutions for wireless networks and distributed systems.	K4

Unit- I	Introduction to Information Security	Periods: 09
Introduction: History - Information Security - Critical Characteristics of Information - CNSS Security Model -Components of an Information System - The Security in the Systems Life Cycle. The need for Security: Business Needs - Threats and attacks. Legal, Ethical and Professional issues in Information Security.		CO1
Unit- II	**Security Analysis and Design**	**Periods: 09**
Planning for Security: Information Security Policy, Standards and Practices - Information Security Blueprint: The ISO 27000 series - NIST Security Models. Risk Management: Overview - Risk Identification, Risk Assessment - Risk Control.		CO2
Unit- III	**Symmetric Ciphers and Asymmetric Ciphers**	**Periods: 09**
Introduction: Computer Security Concepts - Security attacks - Security Services - Security Mechanisms. Symmetric Ciphers: Classical Encryption Techniques - Block Cipher Structure - DES - AES - Triple DES – Blowfish - RC5 - IDEA. Asymmetric Ciphers: Principles of Public Key Cryptosystems - RSA - Diffie Hellman Key Exchange - Elgamal Cryptographic System.		CO3
Unit- IV	**Integrity and Authentication Algorithms**	**Periods: 09**
Cryptographic hash functions: Secure Hash Algorithm (SHA-512) - MAC: Authentication Requirements -Authentication Functions - HMAC - CMAC. Digital Signatures: Elgamal Digital Signature Scheme - PSS Digital Signature Algorithms. Key Management and Distribution: Symmetric Key Distribution using Symmetric and Asymmetric Encryption - Distribution of Public Keys - X.509 - Public Key Infrastructure - Kerberos.		CO4
Unit- V	**Internet and Network Security**	**Periods: 09**
Internet Security: Electronic Mail Security-S/MIME, Pretty Good Privacy. Network security: SSL - Transport Layer Security-Secure Electronic Transaction - Firewalls - IP Security - VPN - Intrusion.		CO5

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

Text Books

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Publishers, 8th Edition, 2023.
2. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", Cengage Learning, 5th Edition, 2015.
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 4th Edition, 2019.

Reference Books

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Harold F. Tipton, Micki Krause, "Information Security Management Handbook", 6th Edition, 2007.
3. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", 5th Edition, Prentice Hall, New Delhi, 2015.

Web References

1. https://www.coursera.org/learn/-network-security
2. https://www.mitel.com/articles/web-communication-cryptography-and-network-security
3. http://williamstallings.com/Cryptography/Crypto7e-Student/
4. https://www.imperva.com/learn/data-security/information-security-infosec/
5. https://www.udemy.com/course/infosec-fundamentals/
6. https://archive.nptel.ac.in/courses/106/106/106106129/

2.A.4.47

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	1	1	-	-	-	2	-	-	-	2	3	2	2
2	3	3	2	1	-	-	-	-	-	-	-	1	3	2	2
3	3	3	2	1	-	-	-	-	-	-	-	2	3	2	2
4	3	3	1	1	-	-	-	-	-	-	-	1	3	2	2
5	3	3	1	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	5	5	5	5	5	75	100

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

2.A.4.48

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PC			*End Semester Exam Type:TE			
Course Code	U23ITT507	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Data Analytics	3	0	0	3	25	75	100
IT								

Prerequisite	Probability and Statistics, Programming in Python	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain Data Analytics and its significance in modern data-driven decision-making processes	K2
	CO2 Develop skills to collect and preprocess data from various sources	K3
	CO3 Identify and utilizing statistical summaries and visualization techniques	K3
	CO4 Apply predictive modeling techniques with machine learning contexts	K3
	CO5 Explore Big data and advanced analytics techniques	K4

Unit- I	Introduction to Data Analytics	Periods: 09
Data Analytics - Definition and Importance of Data Analytics - Types of Data Analytics - Data Analytics Life Cycle - Analytics platforms Jupyter, RStudio		CO1
Unit- II	**Data Collection and Preprocessing**	**Periods: 09**
Data Collection Methods - Sources of Data: Structured, Semi-Structured, Unstructured - Techniques for Data Collection - Data Quality and Data Cleaning - Handling Missing Data - Outlier Detection and Treatment - Data Normalization and Standardization		CO2
Unit- III	**Statistical Analysis and Data Visualization**	**Periods: 09**
Introduction to EDA - Importance and Objectives of EDA - Statistical Summaries Data Visualization - Visualization Techniques: Histograms, Bar Charts, Box Plots, Scatter Plots - Tools for Visualization: Matplotlib, Tableau		CO3
Unit- IV	**Machine Learning for Data Analytics**	**Periods: 09**
Introduction to Predictive Analytics - Modeling Techniques - Supervised and Unsupervised Learning - Regression Techniques - Linear Regression - Logistic Regression - Evaluation Metrics for Regression Models - Classification Techniques: Decision Trees, Support Vector Machines		CO4
Unit- V	**Big Data and Advanced Topics**	**Periods: 09**
Introduction to Big Data: Characteristics of Big Data - Time Series Analysis - Text Analytics and Natural Language Processing: Text mining and sentiment Analysis - Clustering Techniques: K-Means, Hierarchical - Ethical Considerations in Data Analytics		CO5

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

Text Books

1.. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 3rd Edition 2022
2. Peter Bruce, Andrew Bruce, Peter Gedeck, "Practical Statistics for Data Scientists", O'Reilly Media, 2nd Edition, 2020
3. Foster Provost and Tom Fawcett, "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking", O'Reilly Media, 2013

Reference Books

1. Dr. Gaurav Aroraa, Chitra Lele, Dr. Munish Jindal ," Data Analytics: Principles, Tools, and Practices: A Complete Guide for Advanced Data Analytics Using the Latest Trends, Tools, and Technologies ", 1st Edition, bpb, 2022
2. Dr. Bharti Motwani, "Data Analytics with R",Wiley, 2019
3. Anil Maheswari, "Data Analytics", McGraw Hill, 2nd edition, 2023

Web References

1. https://careerfoundry.com/en/blog/data-analytics/what-is-data-analytics/
2. https://www.geeksforgeeks.org/data-analytics-and-its-type/
3. https://www.geeksforgeeks.org/r-programming-language-introduction/
4. https://www.datacamp.com/blog/jupyter-and-r-markdown-notebooks-with-r
5. https://www.turing.com/kb/how-data-collection-and-data-preprocessing-in-python-help-in-machine-learning

2.A.4.49

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	-	-	1	-	2	-	2	2	2	-
2	3	3	2	3	2	-	-	1	-	2	-	2	2	2	1
3	3	3	2	3	2	-	-	1	-	2	-	2	2	2	1
4	3	3	3	3	3	-	-	1	-	2	-	2	3	2	2
5	3	3	3	3	3	-	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
	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-4.50

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PE				*End Semester Exam Type:TE		
Course Code	U23ITE506	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Theory of Compiler Design	3	0	0	3	25	75	100
IT								

Prerequisite	Automata Languages and Computation	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain various phase of compiler and sketch a lexical analyzer for sample language	K2
	CO2 Apply different parsing techniques to build top down and bottom parser	K3
	CO3 Demonstrate the use of SDT in code generation	K3
	CO4 Explain the design of simple code generator	K2
	CO5 Apply code optimization techniques to create efficient target code	K3

Unit- I	Introduction to Compilers and Lexical Analysis	Periods: 09
Introduction - Translators - Compilation and Interpretation - Language processors - The Phases of Compiler - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Expressing tokens by Regular Expression - Recognition of Tokens - Finite Automata - Regular Expressions to Automata NFA, DFA - Minimizing DFA - Language for Specifying Lexical Analyzers - LEX tool.		CO1
Unit- II	**Syntax Analysis**	**Periods: 09**
Role of Parser - Grammars - Context-free grammars - Writing a grammar - Top Down Parsing: General Strategies - Recursive Descent Parser Predictive Parser - LL(1) - Bottom Up Parsing: Operator Precedence parser - LR Parser: SLR - CLR and LALR - Error Handling and Recovery in Syntax Analyzer - YACC tool - Design of a Syntax Analyzer for a Sample Language		CO2
Unit- III	**Syntax Directed Translation and Intermediate Code Generation**	**Periods: 09**
Syntax directed Definitions - Construction of Syntax Trees - Bottom -Up evaluation of S-attributed definitions - Top Down translation. Type Checking - Type Systems - Specification of a simple type Checker - Equivalence of Type Expressions - Type Conversions. Intermediate Code generation - Intermediate languages: Postfix notation - Syntax Tree - Three Address Code - Declaration - Assignment Statements - Boolean Expression - Back patching		CO3
Unit- IV	**Run-Time Environment and Code Generation**	**Periods: 09**
Runtime Environments - Source language issues - Storage organization - Storage Allocation Strategies: Static, Stack and Heap allocation - Parameter Passing-Symbol Tables - Dynamic Storage Allocation - Issues in the Design of a code generator - Basic Blocks and Flow graphs - Design of a simple Code Generator - Optimal Code Generation for Expressions - Dynamic Programming Code Generation.		CO4
Unit- V	**Code Optimization**	**Periods: 09**
Principal Sources of Optimization - Peep-hole optimization - DAG - Optimization of Basic Blocks - Global Data Flow Analysis - Efficient Data Flow Algorithm - Recent trends in Compiler Design		CO5

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

Text Books

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools",2nd Edition, Pearson Education, 2023
2. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002
3. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993

Reference Books

1. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.
2. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
3. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.

Web References

1. https://onlinecourses.nptel.ac.in/noc21_cs07/preview
2. https://www.geeksforgeeks.org/compiler-design-tutorials/
3. https://www.wikitechy.com/tutorials/compiler-design/type-expression-in-compiler-design
4. https://www.javatpoint.com/compiler-tutorial

9.A.4.51

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	2	1	2	2	-	-	-	-	2	-	1	3	2	-
2	3	3	2	3	3	-	-	-	1	2	-	2	3	3	1
3	3	3	2	3	3	-	-	-	1	2	-	2	3	3	2
4	3	2	1	2	2	-	-	-	1	2	-	1	3	2	-
5	3	3	2	3	3	-	1	-	1	2	-	2	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.4.52

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PE			*End Semester Exam Type: TE			
Course Code	U23ITE507	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Information Visualization	3	0	0	3	25	75	100
IT								

Prerequisite	Probability and Statistics, Programming in Python, Data Analytics	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify and recognize visual perception and representation of data	K2
	CO2 Explain various Visualization Techniques	K2
	CO3 Represent text and Document Visualization	K3
	CO4 Analyze various interaction concepts and Techniques	K4
	CO5 Evaluate visualizations for various applications	K4

Unit- I	Introduction	Periods: 09
Introduction - Visualization Process - Role of Cognition - Scatterplot - Role of User - Data Foundations - Types of Data - Data Preprocessing - Human Perception and Information Processing - Perception - Perceptual processing - Perception in Visualization		CO1
Unit- II	**Visual Foundation and Techniques**	**Periods: 09**
Visualization Process - Semiology of Graphical Symbols - Eight Visual Variables, Visual Techniques for Spatial Data: One Dimensional Data - Two-Dimensional Data - Three-Dimensional Data - Dynamic Data - Combining Techniques, Visual Techniques for Geospatial Data: Point, Line and Area Data, Visualization Technique for Time Oriented Data – Multivariate Data		CO2
Unit- III	**Text and Document Visualization**	**Periods: 09**
Introduction - Levels of Text Representations - Vector Space Model - Single Document Visualization - Document Collection - Extended Text Visualization		CO3
Unit- IV	**Interaction Concepts and Techniques**	**Periods: 09**
Interaction: Operation - Operands and Spaces - Unified Framework, Interaction Techniques: Screen Space - Object Space - Data Space - Attribute Space - Data Structure Space - Visualization Structure Space - Animating Transformations		CO4
Unit- V	**Designing and Evaluating Visualization Techniques**	**Periods: 09**
Steps in Designing Visualization - Problems in Designing, evaluating: User Tasks - Characteristics: User, Data, Visualization, Structures for Evaluating Visualizations - Benchmark Procedures		CO5

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

Text Books

1. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", Natick, 2nd Edition, CRC Press, 2015
2. Aragues, Anthony," Visualizing Streaming Data: Interactive Analysis Beyond Static Limits", O'Reilly Media Inc., 2018
3. Colin Ware, "Information Visualization Perception for Design", Elsevier Science,2019

Reference Books

1. Tamara Munzner," Visualization Analysis & Design" ,1st Edition, AK Peters Visualization Series, 2014
2. Scott Murray, "Interactive Data Visualization for the Web ",2nd Edition, 2017
3. Dr. Chun-hauh Chen, W.K. Hardle, A. Unwin, "Handbook of Data Visualization", Springer publication, 2016
4. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020

Web References

1. https://www.tableau.com/learn/articles/data-visualization
2. https://www.ibm.com/topics/data-visualization
3. https://www.coursera.org/learn/ball-state-university-data-visualization-open

2. A. 4. 53

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	2	2	-
2	3	2	1	2	2	-	-	-	-	-	-	2	2	2	-
3	3	3	2	3	3	-	-	-	-	-	-	2	3	2	2
4	3	3	2	3	3	-	-	-	-	-	-	2	3	3	2
5	3	3	2	3	3	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.4.54

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23ITE508**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Software Testing**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		IT						
Prerequisite	Software Engineering and Project Management							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Articulate the basic concepts of software testing and the need for software testing.	K2
CO2	Design Test planning and different activities involved in test planning.	K3
CO3	Design effective test cases that can uncover critical defects in the application	K3
CO4	Demonstrate various advanced testing tools to test real time applications.	K3
CO5	Demonstrate various automation tools to test real time applications.	K3

Unit- I	**Foundations of Software Testing**	**Periods: 09**
Fundamental of Software Testing - Black-Box Testing and White-Box Testing - Software Testing Life Cycle - V- model of Software Testing - Program Correctness and Verification - Reliability versus Safety – Failures - Errors and Faults (Defects) - Software Testing Principles - Program Inspections - Stages of Testing: Unit Testing - Integration Testing - System Testing		CO1

Unit- II	**Test Planning**	**Periods: 09**
The Goal of Test Planning - High Level Expectations - Intergroup Responsibilities - Test Phases - Test Strategy - Resource Requirements - Tester Assignments - Test Schedule - Test Cases - Bug Reporting - Metrics and Statistics.		CO2

Unit- III	**Test Design and Execution**	**Periods: 09**
Test Objective Identification - Test Design Factors - Requirement identification - Testable Requirements - Modeling a Test Design Process - Modeling Test Results - Boundary Value Testing - Equivalence Class Testing - Path Testing - Data Flow Testing - Test Design Preparedness Metrics - Test Case Design Effectiveness - Model-Driven Test Design - Test Procedures - Test Case Organization and Tracking - Bug Reporting - Bug Life Cycle.		CO3

Unit- IV	**Advanced Testing Concepts**	**Periods: 09**
Performance Testing: Load Testing - Stress Testing - Volume Testing - Fail-Over Testing - Recovery Testing - Configuration Testing - Compatibility Testing - Usability Testing - Testing the Documentation - Security testing - Testing in the Agile Environment - Testing Web and Mobile Applications.		CO4

Unit- V	**Testing Tools and Software Test Automation**	**Periods: 09**
Selenium - J-Meter - Software test automation - Skills needed for automation - Scope of automation - Design and architecture for automation - Requirements for a test tool - Challenges in automation - Test metrics and measurements - Project, Progress and Productivity Metrics.		CO5

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

Text Books

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
2. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Taylor & Francis Group, 4th Edition, 2014
3. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" ,2nd Edition 2018.

Reference Books

1. Ron Patton, "Software testing", Sams Publishing, 2nd Edition, 2006
2. Elfriede Dustin, Thom Garrett, Bernie Gaurf, "Implementing Automated Software Testing", Pearson Education, 2009
3. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of Software Testing", John Wiley & Sons ,3rd Edition, 2012
4. Varun Menon, "TestNg Beginner's Guide", Packt Publishing, 2013
5. Satya Avasarala, "Selenium WebDriver Practical Guide", Packt Publishing. 2014
6. Carl Cocchiaro, "Selenium Framework Design in Data-Driven Testing", Packt Publishing, 2018

Web References

1. https://onlinecourses.nptel.ac.in/noc24_cs47/preview
2. https://www.geeksforgeeks.org/software-testing-tutorial/
3. https://www.javatpoint.com/software-testing-tutorial
4. https://www.geeksforgeeks.org/software-engineering-selenium-an-automation-tool/

2.A.4.55

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	2	2	1	2	-	-	-	-	2	-	1	2	2	-
2	3	3	3	2	3	-	-	-	1	2	2	2	3	3	1
3	3	3	3	3	3	-	-	-	1	2	2	2	3	3	2
4	3	3	3	3	3	-	-	-	1	2	2	2	3	3	2
5	3	3	3	3	3	-	-	-	1	2	2	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. 4. 5b

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PE**			*End Semester Exam Type:**TE**			
Course Code	**U23ITE509**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Automation Techniques and Tools**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
IT								
Prerequisite	Software Engineering and Project Management							

Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Illustrate the basics of automation.	**K2**
	CO2 Apply the different automation techniques in various applications.	**K3**
	CO3 Empathize and analyze various Software tools.	**K4**
	CO4 Develop application using Katalon	**K3**
	CO5 Demonstrate the various testing level automation.	**K3**

Unit- I	**Introduction to Automation**	**Periods: 09**	
Introduction and Importance of Automation - Types of Automation - Applications of Automation in Various Industries - History and Evolution of Automation - Future Trends in Automation - Benefits and Challenges of Automation - Role of Automation in Industry 4.0 - Ethics and Social Aspects of Automation.			**CO1**
Unit- II	**Automation Techniques**	**Periods: 09**	
Understanding the Concept of Automation Techniques - Different Types of Automation Techniques - Applications and Use Cases of Automation Techniques - Hands-on: Implementing Automation Techniques - Automation Techniques in Software Development - Automation Techniques in Manufacturing - Automation Techniques in Data Analysis - Emerging Automation Techniques.			**CO2**
Unit- III	**Automation Tools - Selenium**	**Periods: 09**	
Introduction to Selenium - Installation of Selenium - Features of Selenium - Use Cases of Selenium - Hands-on: Creating Test Cases using Selenium - Introduction to Automation Frameworks			**CO3**
Unit- IV	**Automation Tools - Katalon**	**Periods: 09**	
Introduction to Katalon - Installation of Katalon - Features of Katalon - Use Cases of Katalon - Hands-on: Creating Test Cases using Katalon - Introduction to Continuous Integration/Continuous Deployment (CI/CD)			**CO4**
Unit- V	**Test and Process Automation**	**Periods: 09**	
Understanding the Concepts of Test and Process Automation - Tools Used in Test and Process Automation - Hands-on: Creating Automated Tests and Automating a Business Process - Introduction to Robotic Process Automation (RPA).			**CO5**

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

Text Books

1. Glenford J. Myers, Corey Sandler, and Tom Badgett,"The Art of Software Testing", 3rd Edition", 2011
2. Al Sweigart,"Automate the Boring Stuff with Python", No Starch Press, 2nd Edition, 2015.
3. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant", 1st Edition, 2018.

Reference Books

1. Robert C. Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", 2008
2. Mark Fewster and Dorothy Graham, "Software Test Automation", Addison-Wesley Professional, 3rd Edition, 2009
3. Jez Humble and David Farley, "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", 2010
4. Dorothy Graham and Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", 2012
5. Jaime Buelta, "Python Automation Cookbook", 2018

Web References

1. https://www.selenium.dev/documentation/en/
2. https://docs.katalon.com/katalon-studio/docs/overview.html
3. https://www.techopedia.com/definition/32099/automation-techniques
4. https://www.geeksforgeeks.org/software-engineering-automation-tools/
5. https://www.atlassian.com/continuous-delivery/principles/continuous-integration-vs-delivery-vs-deployment

2.A.4.57

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	2	1	2	-	-	-	-	2	1	1	2	2	1
2	3	3	3	2	3	-	-	-	2	2	2	2	3	3	2
3	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3
4	3	3	3	3	3	-	-	-	2	2	2	2	3	3	3
5	3	3	3	3	3	1	-	-	2	2	2	2	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2. A. 4. 58

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PE				*End Semester Exam Type:TE		
Course Code	U23ITE510	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Parallel and Distributed Computing	3	0	0	3	25	75	100
IT								

Prerequisite	Operating Systems, Database Management Systems	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the fundamental principles of Parallel Computing	K2
	CO2 Develop algorithms using Parallel Computing models.	K2
	CO3 Apply the design techniques for various distributed applications.	K3
	CO4 Analyze and evaluate Distributed Algorithms	K4
	CO5 Implement and integrate Distributed Computing concepts into real-world applications.	K3

Unit- I	Introduction to Parallel Computing	Periods: 09
Introduction to Parallel Computing - Need for Parallel Computing - Parallel Architectures: SISD, SIMD, MISD, MIMD - Parallel Programming Models - Types of Parallelism: Data Parallelism, Task Parallelism - Introduction to Shared Memory and Distributed Memory Architectures.		CO1
Unit- II	**Parallel Algorithms and Applications**	**Periods: 09**
Parallel Algorithm Design Principles - Parallel Sorting Algorithms: Bitonic Sort, Odd-Even Transposition Sort - Matrix Multiplication in Parallel - Performance Metrics: Speedup - Efficiency - Scalability - Parallel Programming with OpenMP and MPI - Case Studies and Applications of Parallel Computing.		CO2
Unit- III	**Introduction to Distributed Computing**	**Periods: 09**
Distributed Systems Overview - Characteristics and Design Issues - Communication in Distributed Systems - Processes and Threads - Models of Distributed Computing: Client-Server - Peer-to-Peer - Cloud Computing.		CO3
Unit- IV	**Distributed Algorithms and Synchronization**	**Periods: 09**
Clock Synchronization in Distributed Systems - Logical Clocks: Lamport's Logical Clocks, Vector Clocks - Distributed Mutual Exclusion Algorithms - Leader Election Algorithms - Distributed Deadlock Detection - Case Studies of Distributed Algorithms.		CO4
Unit- V	**Advanced Distributed Computing and Applications**	**Periods: 09**
Advanced Distributed Computing Models - Distributed Databases and Replication - Security in Distributed Computing - Emerging Trends in Distributed Computing - Case Studies and Applications.		CO5

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

Text Books

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", 2nd Edition, Addison-Wesley, 2003
2. Ajay D. Kshemkalyani , Mukesh Singhal, " Distributed Computing: Principles, Algorithms, and Systems", 2nd Edition, Cambridge University Press, 2011
3. Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Prentice Hall, 2nd Edition, 2016

Reference Books

1. Kai Hwang, Zhiwei Xu, "Scalable Parallel Computing: Technology, Architecture, Programming", McGraw-Hill, 1998
2. Barry Wilkinson and Michael Allen, "Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers", 2nd Edition Pearson, 2004
3. Hagit Attiya and Jennifer Welch, "Distributed Computing: Fundamentals, Simulations, and Advanced Topics", 2nd Edition, Wiley, 2004
4. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems: Concepts and Design", Pearson, 5th Edition, 2011
5. Christian Cachin, Rachid Guerraoui, and Louis Rodrigues, " Introduction to Reliable and Secure Distributed Programming", 2nd Edition, Springer, 2011

Web References

1. https://mpitutorial.com/
2. https://www.coursera.org/learn/cloud-computing
3. https://cs105.net/
4. https://it.iiita.ac.in/ParallelandDistributedComputing.html/
5. https://www.udemy.com/topic/distributed-computing/

2.D.4.59

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	-	-	-	-	1	-	1	2	2	-
2	3	2	2	2	2	-	-	-	-	2	-	1	2	2	1
3	3	3	3	2	2	-	-	-	1	2	-	2	3	2	1
4	3	3	3	3	3	-	-	-	1	2	-	2	3	3	2
5	3	3	3	3	3	1	-	-	1	2	-	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.4.60

Department	Computer Science and Engineering	Programme: **B.Tech.**						
Semester	V	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	U23CSPC05	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Intelligence Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE, IT and CCE)

Prerequisite	Basics of Algorithms and Probability	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Apply Search Algorithms to implement and compare heuristic-based search algorithms like Greedy Best First Search, A*, and AO* to solve pathfinding and graph-based problems.	**K3**
	CO2 Solve CSPs with Backtracking to model and solve complex Constraint Satisfaction Problems (CSPs) such as N-Queens or Sudoku using backtracking techniques.	**K3**
	CO3 Design Inference Engines: Students will develop forward and backward chaining inference engines, leveraging First-Order Logic for AI decision-making tasks.	**K3**
	CO4 Perform Probabilistic Reasoning: to construct and use Bayesian Networks, Hidden Markov Models, and Kalman Filters for probabilistic reasoning and sequence prediction tasks.	**K3**
	CO5 Explore the benefits of AI in different applications.	**K3**

List of Exercises

1. Implement Greedy Best First Search and A* Search for pathfinding problems (e.g., solving a grid-based puzzle).
2. Model a classic Constraint Satisfaction Problem (e.g., N-Queens problem or Sudoku) and solve using backtracking.
3. Implement AO* search for a graph-based problem.
4. Develop an inference engine using forward chaining and backward chaining to deduce conclusions from a given set of facts and rules.
5. Implement basic inference techniques in First-Order Logic using forward and backward chaining for an AI-based decision-making task.
6. Construct a Bayesian Network for a real-world problem (e.g., medical diagnosis) and perform inference using conditional probabilities.
7. Implement a Hidden Markov Model for sequence prediction (e.g., weather prediction or speech recognition).
8. Simulate a Kalman Filter for a tracking or navigation problem (e.g., predicting object positions over time).
9. Implement basic belief functions and apply Dempster-Shafer theory for uncertainty modeling in a decision-making problem.
10. Develop a model to predict stock price movements using historical data.

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

Reference Books

1. Cherry Bhargava,"Artificial Intelligence Fundamentals and Applications", 1st Edition,CRC Press,2021.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson, 2020.
3. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill, 2017.
4. Chris Thornton, Benedict Du Boulay, "Artificial Intelligence through Search",4th Edition, Springer Netherlands,2012.
5. S.Rajasekaran,G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms synthesis and applications",15th Edition, PHI Learning Private Limited,2011

Web References

1. https://www.tutorialspoint.com/artificial_intelligence/index.html
2. https://www.javatpoint.com/artificial-intelligence-ai
3. https://www.geeksforgeeks.org/artificial-intelligence/

* TE – Theory Exam, LE – Lab Exam

2.A.4.61

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

2.A.4.62

Department	Information Technology	Programme: B.Tech.						
Semester	V	Course Category Code: PC				*End Semester Exam Type: LE		
Course Code	U23ITP503	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Information and Network Security Laboratory	0	0	2	1	50	50	100

Prerequisite	Data Communication and Computer Networks	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Demonstrate classical Encryption Techniques to solve the information security problems.	K3
	CO2 Build cryptosystems by applying symmetric and public key encryption algorithms.	K3
	CO3 Implement applications using key exchange and message authentication algorithms.	K3
	CO4 Develop a digital signature scheme using Digital signature standard.	K3
	CO5 Demonstrate the network security system using open source tools, Snort, Net Stumbler, KF Sensor	K3

List of Exercises

1. Implement the following substitution techniques:
   a. Caesar Cipher
   b. Playfair Cipher
   c. Hill Cipher
   d. Vigenere Cipher
2. Implement the following transposition techniques
   a. Rail fence
   b. Row & Column Transformation
3. Implement DES & AES algorithm for practical applications.
4. Implement RSA Algorithm for public key cryptography.
5. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
6. Calculate the message digest of a text using the SHA-3 algorithm.
7. Implementation of RSA based signature system using Digital signature standard.
8. Learn to install Virtual Box or any other equivalent software on the host OS.
9. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
10. Setup a honey pot and monitor the honeypot on network. (KF Sensor)
11. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (Net Stumbler)
12. Demonstrate Intrusion Detection System (IDS) using Snort Tool

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

Reference Books

1. William Stallings, "Cryptography and Network Security Principles and Practice", Pearson Publishers, Eighth Edition, 2023.
2. Michael Gregg,Build Your Own Security Lab: A field guide for network Testing, Wiley,India edition, ISBN: 9788126516919.
3. Arthur Cobnklin, 'Principles of Computer Security CompTIA Security+ and Beyond', Greg White 5th Edition,2018,McGraw-Hill Education.

Web References

1. https://www.coursera.org/learn/-network-security
2. https://www.mitel.com/articles/web-communication-cryptography-and-network-security
3. http://williamstallings.com/Cryptography/Crypto7e-Student/
4. https://www.imperva.com/learn/data-security/information-security-infosec/
5. https://www.udemy.com/course/infosec-fundamentals/
6. https://archive.nptel.ac.in/courses/106/106/106106129/
7. https://www.snort.org/

* TE – Theory Exam, LE – Lab Exam

2.11.4.63

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	2	-	-	-	-	1	-	-	1	-	1
2	3	2	2	2	2	-	-	-	-	1	-	-	2	-	1
3	3	2	2	2	2	1	-	-	-	1	-	-	2	-	1
4	3	3	2	2	2	-	-	-	-	1	-	-	2	-	1
5	3	3	2	2	2	1	-	-	-	1	-	-	2	-	1

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

Evaluation Method

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

2.A4.64

Department	**Information Technology**			Programme: **B.Tech.**			
Semester	**V**			Course Category Code: **ES**		*End Semester Exam Type: **LE**	
Course Code	**U23ITP504**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Analytics Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Prerequisite	Probability and Statistics, Programming in Python	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Demonstrate the ability to install necessary software and set up environments to perform data analytics tasks	**K3**
	CO2 Implement data collection and importing data techniques.	**K3**
	CO3 Analyze and preprocess and encoding categorical variables to prepare datasets for analysis.	**K4**
	CO4 Implement visualization techniques to visualize data	**K3**
	CO5 Apply various machine learning models for classification and clustering.	**K3**

List of Exercises

1. Introduction to Data Analytics Tools
   - Install Python/R and set up Jupyter Notebook/RStudio.
   - Perform basic operations: importing libraries, reading datasets and Implement DES algorithm for practical applications.
2. Perform web scraping to collect data using Python libraries like BeautifulSoup/Scrapy. Fetch data from APIs and import it into Python/R. Import datasets from various formats (CSV, Excel, SQL databases).
3. Handle missing data using techniques like mean/mode imputation and removal. Perform data normalization and standardization. Encode categorical variables using techniques like one-hot encoding.
4. Compute descriptive statistics (mean, median, mode, variance, standard deviation) and create basic visualizations: histograms, bar charts, and box plots using Matplotlib/Seaborn.
5. Create advanced visualizations: scatter plots, pair plots, heatmaps. Conduct correlation analysis and visualize correlations using heatmaps.
6. Implement logistic regression and evaluate the model using confusion matrix, accuracy, precision, recall, and F1 score.
7. Build and visualize decision trees, prune decision trees and evaluate their performance
8. Implement K-Means clustering and determine the optimal number of clusters using the elbow method.
9. Visualize time series data and identify patterns and implement simple time series forecasting models such as moving averages and ARIMA
10. Implement the Apriori algorithm to find frequent itemsets. Conduct market basket analysis and generate association rules
11. Hadoop and Spark: setup and basic operations and Implement basic data processing tasks using PySpark.

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

Reference Books

1. Python for Data Analysis" by Wes McKinney
2. "R for Data Science" by Hadley Wickham and Garrett Grolemund

Web References

1. https://researchportal.vub.be/en/organisations/data-analytics-laboratory
2. https://link.springer.com/article/10.1023/A:1019299211575

* TE – Theory Exam, LE – Lab Exam

2.A.4.65

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	3	2	1	1	2	-	-	-	-	1	-	-	1	1	1
2	3	2	2	1	2	-	-	-	-	1	-	-	1	1	1
3	3	3	2	2	2	-	-	-	-	1	-	-	1	-	1
4	3	2	2	1	2	1	-	-	-	1	-	-	1	1	1
5	3	3	2	2	2	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
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

2.A-4.66

Department	Information Technology	Programme: **B. Tech.**						
Semester	V	Course Category Code: **PA**				*End Semester Exam Type: -		
Course Code	U23ITW501	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Micro Project	0	0	2	1	100	-	100
IT								
Prerequisite	Programming Languages, IT Essentials							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Identify the problem statement for the micro project work through the literature survey	K2
CO2	Choose the proper components as per the requirements of the design/ system.	K2
CO3	Apply the acquainted skills to develop final model/system	K3

There shall be a Micro Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the micro project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and, in the hardware, / software he/she using in the Project. The Micro-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Micro Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Micro Project work with weightage as indicated evaluation Methods.

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

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	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

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

Evaluation Method

Assessment	Review 1			Review 2				Total Marks
	Novelty	Presentation	Viva	Presentation	Demonstration	Viva	Report	
Marks	10	20	10	20	20	10	10	100

2.A.4.67

2.A.4.68

Department	**Information Technology**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam Type: -			
Course Code	**U23ITC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course - V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	-							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as "pass" on satisfactory completion. A letter grade "P" is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

2. A. 4. 69

2-A-4-70

Department	**Information Technology**	Programme: **B.Tech.**					
Semester	**V**	Course Category Code: **MC**			*End Semester Exam Type: -		
Course Code	**U23ITM505**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Essence of Indian Traditional Knowledge**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

Common to all Branches

Prerequisite	-	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Familiarize with the philosophy of Indian culture	**K2**
	CO2 Distinguish the Indian languages and literature	**K2**
	CO3 Describe the philosophy of ancient, medieval and modern India	**K2**
	CO4 Illustrate the information about the fine arts in India	**K2**
	CO5 Describe the contribution of scientists of different eras	**K2**

UNIT- I	**Introduction To Culture**	**Periods:06**	
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India			**CO1**
UNIT- II	**Indian Languages, Culture and Literature**	**Periods:06**	
Indian Languages and Literature - I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature			**CO2**
UNIT- III	**Religion and Philosophy**	**Periods:06**	
Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)			**CO3**
UNIT- IV	**Fine Arts in India (Art, Technology and Engineering)**	**Periods:06**	
Indian Painting, Indian handicrafts, Music, divisions of Indian classical music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India			**CO4**
UNIT-V	**Education System in India**	**Periods:06**	
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India			**CO5**

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

Reference Books

1. Kapil Kapoor, "Text and Interpretation: The India Tradition", ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450 494-X, 200
4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN 13: 978 - 8120810990, 2014

Web References

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/101/104/101104065/
3. https://nptel.ac.in/courses/109/108/109108158/
4. https://nptel.ac.in/courses/109/106/109106059/
5. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ae01/

* TE – Theory Exam, LE – Lab Exam

2.A.4.71

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	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

2.A.4.72

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PC				*End Semester Exam Type:TE		
Course Code	U23ITTC03	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Machine Learning	3	0	0	3	25	75	100

Common to CSE, IT and CCE

Prerequisite	Engineering Mathematics, Artificial Intelligence, Data Analytics	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the basic concepts of machine learning	K2
	CO2 Apply supervised algorithms for different classification problems	K3
	CO3 Explain the need for ensemble methods	K2
	CO4 Apply unsupervised and reinforcement learning techniques to various problems	K3
	CO5 Apply dimensionality reduction and optimization techniques	K3

Unit- I	Introduction	Periods: 09
Introduction: Machine learning; Examples of Machine Learning Applications: Learning associations - Classification - Regression - Unsupervised learning - Reinforcement learning; Preliminaries: Weight space - Curse of dimensionality - Testing machine learning algorithms - Turning data into probabilities - Basic statistics - Bias-variance tradeoff.		CO1

Unit- II	Supervised Learning	Periods: 09
Neural Networks and Linear Discriminants: Brain and the Neuron - Neural networks - Perceptron - Linear separability - Linear regression; Multi-layer Perceptron: Forward and Backward propagation; Support Vector Machines.		CO2

Unit- III	Probabilistic Learning, Learning with Trees	Periods: 09
Probabilistic Learning: Gaussian mixture models - Nearest neighbor methods; Learning with Trees: Constructing decision trees - Classification and Regression trees - Classification example; Ensemble Learning: Boosting - Bagging - Random forests.		CO3

Unit- IV	Unsupervised Learning, Reinforcement Learning	Periods: 09
Unsupervised: K-means algorithm; Reinforcement learning: State and action space - Reward function - Discounting - Action selection - Policy - Markov decision process - Values - SARSA and Q-learning.		CO4

Unit- V	Dimensionality Reduction, Optimization Techniques	Periods: 09
Dimensionality Reduction Techniques: Linear Discriminant analysis, Principal Component Analysis; Optimization and Search: Least-squares optimization - Conjugate gradients - Search approaches - Exploitation and exploration.		CO5

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

Text Books

1. Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, The MIT Press, 2014
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective", 2nd Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2015
3. Oliver Theobald, "Machine Learning for Absolute Beginners", 3rd Edition, 2021

Reference Books

1. Jason Bell, "Machine learning - Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012
3. Richert, Willi, "Building machine learning systems with Python", Packt Publishing, 2013
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Education (India), 2013
5. Y S Abu-Mostafa, M Magdon-Ismail, H T Lin, "Learning from Data", AML Book Publishers, 2012

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

2.A.4.73

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	2	-	-	-	-	-	-	2	3	2	-
2	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
3	3	3	2	1	2	-	-	-	-	-	-	2	3	2	-
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	2
5	3	3	3	3	3	-	-	-	-	-	-	3	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.4. #9

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23ITT608	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Mobile Application Development	3	0	0	3	25	75	100
IT								
Prerequisite	Programming in JAVA, Database Management Systems							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Exhibit the knowledge on Android devices and platforms.	K2
CO2	Build android applications using the core android design components	K3
CO3	Design and develop sophisticated mobile interfaces using rapid prototyping techniques.	K3
CO4	Use simulator tools to test and publish the application.	K3
CO5	Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace	K3

Unit- I	Introduction To Android	Periods: 09
Introduction to Android: The Android Platform- Android SDK - Eclipse Installation - Android Installation. Building you First Android application - Understanding Anatomy of Android Application - Android Manifest file		CO1
Unit- II	**Android Application Design Essentials**	**Periods: 09**
Anatomy of Android applications - Android terminologies. Application Context - Activities - Services - Intents - Receiving and Broadcasting Intents. Android Manifest File and its common settings - Using Intent Filter – Permissions		CO2
Unit- III	**Android User Interface Design & Multimedia**	**Periods: 09**
User Interface Screen elements - Designing User Interfaces with Layouts - Drawing and Working with Animation. Playing Audio and Video - Recording Audio and Video - Using the Camera to Take and Process Pictures		CO3
Unit- IV	**Testing Android applications**	**Periods: 09**
Testing Android applications - Publishing Android application - Using Android preferences. Managing Application resources in a hierarchy - Working with different types of resources - Memory Management		CO4
Unit- V	**Android APIs**	**Periods: 09**
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		CO5

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

Text Books

1. Ricardo Costeira , Fuad Kamal , Kevin D. Moore ,"Android Fundamentals by Tutorials : Build Android Apps With Kotlin & Jetpack Compose", Kodeco Inc., 2024
2. Reto Meier, "Professional Android 4 Application Development", Wrox., 2012
3. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd Edition, 2011

Reference Books

1. Bill Phillips, Chris Stewart and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", 4th Edition, Big Nerd Ranch Guides, 2019
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O" Reilly SPD Publishers, 2015
3. Erik Hellman, "Android Programming - Pushing the Limits", 1st Edition, Wiley India Pvt. Ltd., 2014
4. Ed Burnette, Hello Android: Introducing Google's Mobile Development Platform, The Pragmatic Publishers, North Carolina USA, 3rd Edition, 2010
5. Mark L Murphy, "Beginning Android", Wiley India Pvt. Ltd., 2009

Web References

1. https://developer.android.com/training/basics/firstapp
2. Google Developer Training, "Android Developer Fundamentals Course - Concept Reference", Google Developer Training Team, 2017

2.A.4. 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	3	3	2	1	3	1	-	-	-	-	-	2	3	2	1
2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	2
3	3	3	3	2	3	-	-	-	-	2	-	2	3	3	2
4	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
5	3	3	3	3	3	1	-	-	2	-	-	3	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.76

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PC *End Semester Exam Type: TE						
Course Code	U23ITT609	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Blockchain Technology	3	0	0	3	25	75	100
IT								
Prerequisite	Database Management Systems, Information and Network Security							

Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Articulate the basic concepts of Block Chain Technologies.	K2
	CO2 Explain the functional /operational aspects of Cryptocurrency Ecosystem	K2
	CO3 Develop an application using Ethereum	K3
	CO4 Compute models for Block Chain Technology	K3
	CO5 Implement applications in diverse domains using Block chain technology.	K3

Unit- I	Introduction to Block Chain	Periods: 09	
Block Chain - History of Block Chain – Types of Block Chain – Consensus – CAP Theorem and Block Chain – Decentralization using Block Chain – Block Chain and full ecosystem decentralization – Platforms for decentralization.			CO1
Unit- II	**Introduction to Cryptocurrency**	**Periods: 09**	
Bitcoin – Digital keys and addresses – Transactions – Mining – Bitcoin Network and Payments – Wallets – Bitcoin Payments Alternative coins – Theoretical Foundations - Bitcoin limitations – Name coin – Lite coin – Prime coin – Zcash – Smart contracts – Ricardian contracts.			CO2
Unit- III	**Ethereum**	**Periods: 09**	
Introduction – Ethereum network – Components of the Ethereum ecosystem – Programming Languages – Ethereum Development Environment – Development Tools and Frameworks. Illustrative: Setup the Ethereum development environment.			CO3
Unit- IV	**Web3 and Hyperledger**	**Periods: 09**	
Introduction to Web3 – Contract Deployment – Development Frameworks – Hyperledger as a protocol – Reference Architecture – Hyperledger Fabric - Sawtooth Lake – Corda.			CO4
Unit- V	**Block Chain Applications**	**Periods: 09**	
IoT with Block Chain – Block Chain based voting system - Border Control – Medical Record Management System - Alternative Blockchains – Kadena – Ripple – Rootstock – Quorum - Scalability – Privacy – Other Challenges			CO5

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

Text Books

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", 2nd Edition, Packt Publishing, 2018
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016
3. Roberto Infante, "Building Ethereum Dapps: Decentralized Applications on the Ethereum Blockchain", O'Reilly, 2019

Reference Books

1. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 2nd Edition, O'Reilly, 2015
2. Andreas M. Antonopoulos, "Mastering Ethereum: Building Smart Contracts and DApps", 1st Edition, O'Reilly, 2018
3. Narayan Prusty, "Building Blockchain Projects", Packt, 2017

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

2.A.4.77

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	2	-	-	-	-	-	-	2	3	2	1
2	3	2	2	2	2	-	-	-	-	-	-	2	3	2	2
3	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
5	3	3	3	3	3	-	2	2	2	2	3	3	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.78

Department	Information Technology	Programme : B.Tech					
Semester	VI	Course Category Code :PE			End Semester ExamType:TE		
Course Code	U23ITE611	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Quantum Computing	3	0	0	3	25	75	100
IT								
Prerequisite	Quantum Mechanics, Probability, Computing							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the basics of quantum mechanics	K2
CO2	Identify Different Qubits and Gates used for quantum operations	K2
CO3	Apply Different Quantum Algorithms with gates and circuits	K3
CO4	Summarize Various Quantum error correction algorithms.	K3
CO5	Demonstrate the real-time applications of quantum computing.	K3

UNIT-I	Quantum Computing Concepts	Periods:09

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions — CO1

UNIT-II	Quantum Gates and Circuits	Periods:09

Universal logic gates - Basic single qubit gates - Pauli Gates - Hadamard Gate - Phase Gate - Multiple qubit gates: Controlled Gates - SWAP Gate - Toffoli Gate - Circuit development - Quantum error correction — CO2

UNIT-III	Quantum Algorithms	Periods:09

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm – Quantum Counting — CO3

UNIT-IV	Quantum Information Theory	Periods:09

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels – Quantum Information over Noisy Quantum Channels. — CO4

UNIT-V	Quantum Cryptography	Periods:09

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm – Quantum Cryptography - Quantum Key Distribution - BB84 - Ekart 91 — CO5

Lecture Periods:45	Tutorial Periods:-	Practical Periods:-	TotalPeriods:45

Text Books

1. Parag K Lala, "Quantum Computing, A Beginners Introduction", 1st Edition, Mc Graw Hill Education, 2020
2. Chris Bernhardt, "Quantum Computing for Everyone", MIT Press, 2020
3. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", 10th Edition, Cambridge University Press, 2010.

Reference Books

1. Norlen, H.,"Quantum Computing in Practice with Qiskit and IBM Quantum Experience",Packt Publishing, 2020
2. Johnston, E. R., Harrigan, N., & Gimeno-Segovia, M, "Programming Quantum Computers: Essential Algorithms and Code Samples". O'Reilly Media, 2019
3. Rieffel, E. G., & Polak, W. H., "Quantum Computing: A Gentle Introduction", MIT Press, 2011

Web References

1. https://learn.microsoft.com/en-us/azure/quantum/
2. https://quantum.ibm.com/
3. https://www.nist.gov/programs-projects/quantum-information-program

* TE – Theory Exam, LE – Lab Exam

2.A.4.79

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	2	-	-	-	-	-	-	2	3	2	1
2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
3	3	3	3	2	3	-	-	-	-	-	-	3	3	3	2
4	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3
5	3	3	3	3	3	-	2	2	2	2	3	3	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.80

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PE			*End Semester Exam Type: TE			
Course Code	U23ITE612	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Full Stack Development	3	0	0	3	25	75	100

Prerequisite	Database Management System, Web Application Development	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe the various stacks available for web application development	K2
	CO2 Use Node.js for application development	K3
	CO3 Develop applications with MongoDB	K3
	CO4 Use the features of Angular and Express	K3
	CO5 Develop React applications	K3

Unit-I	Basics of Full Stack	Periods:09
Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular– Node – Mongo DB – React		CO1

Unit-II	Node Js	Periods:09
Basics of Node JS – Installation – Working with Node packages – Using Node package manager –Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js		CO2

Unit-III	Mongo DB	Periods:09
Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts –Access control – Administering databases – Managing collections – Connecting to MongoDB fromNode.js – simple applications		CO3

Unit-IV	Express and Angular	Periods:09
Implementing Express in Node.js - Configuring routes - Using Request and Response objects -Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives		CO4

Unit-V	React	Periods:09
MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering		CO5

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

TextBooks

1. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development", Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, "Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node", Second Edition, Apress, 2019.
3. Jennifer Niederst Robbins, "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics", Dokumen Publication,2018

Reference Books

1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress; 1st edition, 2018
2. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications using React and Redux", Addison-Wesley Professional, 2nd edition, 2018

Web References

1. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
2. https://www.coursera.org/specializations/full-stack-react
3. https://www.udemy.com/course/the-full-stack-web-development/

9.A.4.81

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	3	2	1	1	2	-	-	-	2	2	1	2	2	3	1
2	3	3	3	2	3	-	-	-	2	2	2	3	3	3	2
3	3	3	3	3	3	-	-	-	3	2	2	3	3	3	2
4	3	3	3	3	3	-	-	-	3	2	2	3	3	3	3
5	3	3	3	3	3	-	2	2	3	3	2	3	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.82

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PE				*End Semester Exam Type: TE		
Course Code	U23ITE613	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Edge and Fog Computing	3	0	0	3	25	75	100

Prerequisite	Database Management Systems, Computer Networks	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the fundamentals of Fog and Edge Computing	K2
	CO2 Explain the various Challenges in Federating Edge	K2
	CO3 Apply the concept of optimization and middleware	K3
	CO4 Infer the Data Management methodologies in Fog Computing	K3
	CO5 Apply the Computing techniques in building applications	K3

UNIT-I	Introduction	Periods: 09
Fog and Edge Computing Completing the Cloud - Advantages of FEC: SCALE - FEC Advantages: SCANC - Hierarchy of Fog and Edge Computing		CO1

UNIT-II	Challenges in Federating Edge Resources	Periods: 09
Introduction - Networking Challenges - Management Challenges - Edge-as-a-Service (EaaS) Platform - Edge Node Resource Management (ENORM) Framework - Miscellaneous Challenges		CO2

UNIT-III	Optimization and Middleware	Periods: 09
Optimization Problems in Fog and Edge Computing, Middleware for Fog and Edge Computing : Design Issues		CO3

UNIT-IV	Data Management in Fog Computing	Periods: 09
Introduction - Fog Data Management - Fog Data Life Cycle - Data Characteristics - Data Pre-Processing and Analytics - Data Privacy - Data Storage and Data Placement		CO4

UNIT-V	Applications and Issues	Periods: 09
Exploiting Fog Computing in Health Monitoring - Testing Perspectives of Fog-Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog		CO5

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

Text Books

1. Rajkumar Buyya, Satish Narayana Srirama,"Fog and Edge Computing: Principles and Paradigms", Wiley, 2019.
2. Wei Chang ,Jie Wu, "Fog/Edge Computing For Security, Privacy, and Applications" , Springer, 2021.
3. Taehong Kim, Seong-Eun Yoo, Youngsoo Kim, " Edge/Fog Computing Technologies for IoT Infrastructure " , MDPI , 2021.

Reference Books

1. Taehong Kim, Seong-Eun Yoo, Youngsoo Kim, " Edge/Fog Computing Technologies for IoT Infrastructure " , MDPI , 2021.
2. Muhammad Maaz Rehan ," Blockchain-Enabled Fog and Edge Computing Concepts Architectures and Applications ", Taylor & Francis/Routledge , 2022.
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.

Web References

1. https://www.mdpi.com/1424-8220/21/24/8226

* TE – Theory Exam, LE – Lab Exam

2.A.4.83

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	2	-	-	-	2	2	1	2	3	3	2
2	3	3	2	2	2	-	-	-	2	2	2	2	3	2	2
3	3	3	3	3	3	-	-	-	3	2	2	3	3	3	3
4	3	3	3	3	3	-	-	-	3	2	2	3	3	3	3
5	3	3	3	3	3	-	-	-	3	3	2	3	3	3	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

g. A. 4. 84

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PE				*End Semester Exam Type:TE		
Course Code	U23ITEC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Software Defined Networks	3	0	0	3	25	75	100

Common to IT and CCE

Prerequisite	Data Communication and Computer Networks	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the basics of networking and working of SDN	K2
CO2	Articulate SDN controllers	K3
CO3	Infer various Emerging Protocol, Controller, and Application Models	K2
CO4	Relate technologies adopted in Data Center	K4
CO5	Expound the exploration of SDN in other environments	K2

UNIT-I	Introduction	Periods:9	
History of Software Defined Networking (SDN) - Modern Data Center - Traditional Switch Architecture - Evolution of Switches and Control Planes, Data Center Needs, The Evolution of Networking Technology, Evolution of SDN - SDN Working - Centralized and Distributed Control and Data Planes			CO1
UNIT-II	**Open Flow & SDN Controllers**	**Periods:9**	
OpenFlow Overview - Potential Drawbacks of Open SDN - OpenDaylight - Floodlight controllers - SDN via APIs - SDN via Hypervisor - Based Overlays - SDN via Opening Up the Device - Alternatives Overlap and Ranking			CO2
UNIT-III	**Emerging Protocol, Controller, and Application Models**	**Periods:9**	
Expanded Definitions of SDN - SDN Protocol Models - SDN Controller Models - Application Models - New Approaches to SDN Security - The P4 Programming Language - SDN programming interfaces			CO3
UNIT-IV	**Data Center**	**Periods:9**	
Data Center Definition - Data Center Demands - Tunneling Technologies for the Data Center - Path Technologies in the Data Center - Ethernet Fabrics in the Data Center - SDN Use Cases in the Data Center - Comparison of Open SDN - Overlays and APIs - Real-World Data Center Implementations			CO4
UNIT-V	**SDN in Other Environments**	**Periods:9**	
Wide Area Networks - Service Provider and Carrier Networks - Campus Networks - Hospitality Networks - Mobile Networks - Optical Networks - SDN vs P2P/Overlay Networks - Network Function Virtualization - SDN Platforms -Juniper - IETF			CO5

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

Text Books

1. P. Goransson, C. Black, T. Culver," Software Defined Networks - A Comprehensive Approach", 2nd Edition, Elsevier, October 20, 2016
2. Siamak Azodolmolky, "Software Defined Networking with OpenFlow", Packt, October 2013
3. Patricia A. Morreale, James M. Anderson," Software Defined Networking", CRC Press, 2014

Reference Books

1. Anand Nayyar (Editor), Bhawna Singla (Editor), Preeti Nagrath (Editor), "Software Defined Networks: Architecture and Applications", Wiley, June 2022
2. Doug Marschke, Jeff Doyle, Pete Moyer, "Software Defined Networking (SDN): Anatomy of OpenFlow", Volume I, Lulu Publishing Services, April 3, 2015
3. Paul Goransson, Chuck Black, Timothy Culver, "Software Defined Networks: A Comprehensive Approach",2nd Edition,2016

Web References

1. https://sdn.systemsapproach.org/
2. https://www.ciscopress.com/articles/article.asp?p=3145761&seqNum=4

* TE – Theory Exam, LE – Lab Exam

2.A.4-85

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	2	1	1	-	-	2	1	1	2	2	2
2	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
3	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
4	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
5	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.86

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PE				*End Semester Exam Type:TE		
Course Code	U23ITEC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Natural Language Processing	3	0	0	3	25	75	100

Common to IT and CCE

Prerequisite	Engineering Mathematics, Artificial Intelligence, Machine Learning	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the Fundamental Models in NLP	K2
	CO2 Describe various Language Models in NLP	K2
	CO3 Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language	K3
	CO4 Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with respect to morphology	K3
	CO5 Apply learning algorithms for various NLP applications	K3

Unit-I	Introduction to NLP	Periods:09
Introduction to NLP - Various stages of NLP - The Ambiguity of Language: NLP Is Difficult. Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives - verbs - Phrase Structure. Statistics Essential Information Theory: Entropy – perplexity - The relation to language - Cross entropy		CO1

Unit-II	Language Modelling	Periods:09
Words: Collocations - Frequency-Mean and Variance - Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios. Statistical Inference: n - gram Models over Sparse Data: Bins: Forming Equivalence Classes - N gram model - Statistical Estimators - Combining Estimators		CO2

Unit-III	Markov Model and POS Tagging	Periods:09
Markov Model: Hidden Markov model - Fundamentals - Probability of properties - Parameter estimation - Variants - Multiple input observation. The Information Sources in Tagging: Markov model taggers - Viterbi algorithm - Applying HMMs to POS tagging - Applications of Tagging		CO3

Unit-IV	Probabilistic Context Free Grammars and Probabilistic parsing	Periods:09
The Probability of a String - Problems with the Inside-Outside Algorithm - Parsing for disambiguation - Tree banks - Parsing models vs. language models - Phrase structure grammars and dependency - Lexicalized models using derivational histories, Dependency - models.		CO4

Unit-V	NLP Applications	Periods:09
Text Alignment - Word Alignment - Clustering - Vector Space Model - Term Distribution Model - Latent Semantic Indexing - Discourse Segmentation - Decision Trees - Maximum Entropy Modeling - k- Neighbor Classification		CO5

Lecture Periods:45	Tutorial Periods:-	Practical Periods: -	TotalPeriods:45

Text Books

1. Christopher D. Manning and Hinrich Schutze, "Foundations of Natural Language Processing", 6th Edition, The MIT Press Cambridge, Massachusetts London, England, 2003
2. Daniel Jurafsky and James H. Martin, "Speech and Language Processing", 3rd Edition, Prentice Hall, 2024
3. T V Geetha," Understanding Natural Language Processing", Pearson,2024

Reference Books

1. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010
2. James Allen "Natural Language Understanding", Pearson Publication, 8th Edition, 2012
3. Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd Edition, MIT Press Cambridge, MA, 2003
4. Hobson lane, Cole Howard, Hannes Hapke, "Natural Language Processing in Action", MANNING Publications, 2019
5. Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012

Web References

1. https://machinelearningmastery.com/natural-language-processing/
2. https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1
3. https://www.nlp.com/what-is-nlp/

2.A.4.87

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	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
2	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
3	2	2	2	-	1	-	-	-	-	1	-	-	3	1	-
4	1	2	2	2	1	-	-	-	-	1	-	-	3	1	-
5	3	1	2	2	1	-	-	-	-	1	-	-	3	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.4.88

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type:**TE**			
Course Code	**U23ITB603**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IoT Programming**	**2**	**-**	**2**	**3**	**50**	**50**	**100**
		IT						

			BT Mapping (Highest Level)
Prerequisite	Basics of Programming in Python		
Course Outcomes	**On completion of the course, the students will be able to**		
	CO1	Recognize the IoT's underlying technology and architecture.	**K2**
	CO2	Explain the basic concepts of IoT devices using popular IoT platforms.	**K2**
	CO3	Apply IoT protocols, Networking and Troubleshooting techniques.	**K3**
	CO4	Develop simple and practical IoT solutions using Python for real-world applications.	**K3**
	CO5	Understand and apply sensor data reading and actuator control in IoT systems using Python.	**K3**

UNIT-I **IoT Fundamentals** **Periods:10**

Introduction to IoT, IoT architecture, IoT Levels and deployment template, Physical Design of IoT - Things in IoT - Logical Design of IoT, IoT security and privacy, IoT standards and ecosystems. **CO1**

UNIT-II **IoT Platforms and Programming** **Periods:10**

Introduction to popular IoT platforms, programming IoT devices working with sensors and actuators, IoT device management, IoT device lifecycle, IoT edge computing, IoT cloud computing, applications of IoT in various fields like healthcare, agriculture, transportation, smart cities, industrial IoT. **CO2**

UNIT-III **IoT Protocols, Networking and Troubleshooting** **Periods:10**

Introduction to IoT protocols, MQTT, CoAP, HTTP, WebSocket's, IoT data protocols, IoT networking, IoT network security, analyzing IoT systems, troubleshooting common IoT issues, IoT testing and debugging. **CO3**

UNIT-IV **IoT Applications** **Periods:15**

List of Exercises **CO4**

1. Write a Python program that uses classes and objects to simulate a simple IoT device.
2. Develop a Python program that uses classes and objects to create a virtual environment for an IoT device.
3. Implement a Python program that uses classes and objects to simulate a network of IoT device.
4. Develop an IoT system to create a traffic light system using LEDs in the Raspberry Pi kit.
5. Implement an IoT system to create a LED light show using Python and Raspberry Pi.
6. Create a smart door lock system using IoT which can be controlled remotely using Python.

UNIT-V **IoT Troubleshooting** **Periods:15**

List of Exercises **CO5**

1. Develop a simple IoT system to monitor soil moisture for smart agriculture using Python.
2. Develop a simple IoT system to monitor humidity using a humidity sensor and Python.
3. Write a Python program to read data from a temperature sensor connected to an IoT device.
4. Implement a Python program to measure speed using an ultrasonic sensor in an IoT device.
5. Develop a Python program for basic image detection using a camera module in an IoT device.
6. Implement a Python program to debug and troubleshoot an IoT application.

LecturePeriods:30	**Tutorial Periods:**	**Practical Periods:30**	**Total Periods:60**

Text Books

1."Internet of Things: A Hands-On Approach", Arshdeep Bahga and Vijay Madisetti, Universities Press, 2014.
2."Programming the Internet of Things: An introduction to building integrated, device-to-cloud IoT solutions", Dawid Borycki, Microsof Press, 2020.
3."Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Daniel Minoli, Wiley, 2013.

Reference Books

1. "Internet of Things: Principles and Paradigms", Rajkumar Buyya and Amir Vahid Dastjerdi, Morgan Kaufmann, 2016.
2. "Designing the Internet of Things", Adrian McEwen and Hakim Cassimally, Wiley, 2013.
3. "Architecting the Internet of Things", Dieter Uckelmann, Mark Harrison, and Florian Michahelles, Springer, 2011.
4. "Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud", Cuno Pfister, O'Reilly Media, 2011.
5. "Enterprise IoT: Strategies and Best Practices for Connected Products and Services", Dirk Slama, Frank Puhlmann, Jim Morrish, and Rishi M Bhatnagar, O'Reilly Media, 2015

Web References

1. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/
2. https://developer.mozilla.org/en-US/docs/Web/API/WebSockets_API
3. https://www.eclipse.org/paho/index.php?page=clients/python/index.php
4. https://www.postscapes.com/internet-of-things-protocols/
5. https://www.iotforall.com/iot-applications-in-agriculture/

* TE – Theory Exam, LE – Lab Exam

2.A.4.89

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	2	1	1
2	2	1	1	-	-	-	-	-	-	-	-	1	2	1	1
3	2	1	1	-	-	-	-	-	-	-	-	1	2	1	1
4	1	3	3	2	2	-	-	-	-	-	-	1	2	1	3
5	1	3	3	2	2	-	-	-	-	-	-	1	2	1	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks									#End Semester Examination (ESE) Marks (Theory)	Tot Mar
	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**	10
*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.4.90

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: PC			*End Semester Exam Type: LE			
Course Code	U23ITPC03	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Machine Learning Laboratory	0	0	2	1	50	50	100

Common to CSE, IT and CCE

Prerequisite	Engineering Mathematics, Artificial Intelligence, Data Analytics	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Apply python packages and libraries for various problems	**K3**
	CO2 Apply supervised learning techniques for various problems	**K3**
	CO3 Develop an open-ended solution with data privacy and ethical concerns, for a given real-world problem.	**K3**
	CO4 Apply unsupervised and reinforcement learning techniques for various problems	**K3**
	CO5 Apply ensemble techniques to solve the problems and demonstrate the working of dimensionality reduction methods	**K3**

List of Exercises

1. Working with Python packages - Numpy, Scipy, Scikit-learn, Matplotlib
2. Loan amount prediction using linear regression and visualize the interpretation
3. Handwritten character recognition using neural networks
4. Classification of Email spam and MNIST data using Support Vector Machines.
5. Predicting Diabetes using decision tree
6. Applications of Random Forest and AdaBoost ensemble techniques
7. K-means clustering for Euclidean distance metric
8. k-Nearest Neighbor algorithm
9. Applications of dimensionality reduction techniques on any dataset
10. Analyze any two supervised / unsupervised machine learning algorithms for any of the following real-time applications: (a) Text processing (b) Image processing (c) IoT systems

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

Reference Books

1. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012.
3. Richert, Willi, "Building machine learning systems with Python", Packt Publishing, 2013.
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Education (India), 2013.
5. Y S Abu-Mostafa, M Magdon-Ismail, H T Lin, "Learning from Data", AML Book Publishers, 2012

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

* TE – Theory Exam, LE – Lab Exam

2.A.4.91

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	2	-	2	-	-	-	1	-	-	2	3	1	2
2	3	2	2	-	2	-	-	-	1	-	-	2	3	1	2
3	3	3	3	-	2	-	-	-	1	-	-	2	3	1	2
4	3	2	3	-	2	-	-	-	1	-	-	2	3	1	2
5	3	2	3	3	2	-	-	-	2	3	-	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

2. A. 4. 92

Department	Information Technology	Programme: B. Tech.						
Semester	VI	Course Category Code: PC			*End Semester Exam Type: LE			
Course Code	U23ITP605	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Mobile Application Development Laboratory	0	0	2	1	50	50	100
IT								
Prerequisite	Programming in Java							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Develop mobile applications using GUI and Layouts.	K2
CO2	Develop mobile applications using Event Listener.	K3
CO3	Develop mobile applications using Databases.	K3
CO4	Develop mobile applications using RSS Feed, SMS, Multithreading and GPS.	K3
CO5	Analyze and discover own mobile app for simple needs.	K4

List of Exercises

1. Develop an application that uses GUI components, Font and Colors
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen
4. Develop an application that makes use of databases.
5. Write a mobile application that makes use of RSS feed
6. Develop an application that makes use of Notification Manager
7. Implement an application that uses Multi-threading
8. Develop a native application that uses GPS location information
9. Implement an application that creates an alert upon receiving a message
10. Develop a mobile application to send an email.
11. Create an application using Sensor Manager
12. Create an android application that converts the user input text to voice

Develop a Mobile application for simple needs (Mini Project)

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

Reference Books

1. Dr.K. Venkata Nagendra, "Mobile Application Development - Practical Approach", 2020
2. Michael Gregg ,"Build Your Own Security Lab",Wiley India, 2012

Web References

1. http://www.edutechlearners.com/mobile-computing-lab-manual/

* TE – Theory Exam, LE – Lab Exam

9.A.4.93

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	3	3
2	3	2	1	1	3	-	-	-	2	-	3	2	3	3	3
3	3	2	1	1	3	-	-	-	2	-	3	2	3	3	3
4	3	2	1	1	3	-	-	-	2	-	3	2	3	3	3
5	3	2	2	2	3	-	-	-	2	-	3	2	3	3	3

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

Evaluation Method

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

2.A.4.94

Department	Information Technology	Programme: B.Tech.					
Semester	VI	Course Category Code: PC			*End Semester Exam Type: LE		
Course Code	U23ITP606	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Blockchain Technology Laboratory	0	0	2	1	50	50	100

IT

Prerequisite	Database Management Systems, Information and Network Security	
Course Outcomes	**On completion of the course, the students will be able to**	**BT Mapping (Highest Level)**
	CO1 Perform the operations on the Ethereum blockchain	K3
	CO2 Illustrate about Web3.js to interact with Smart Contracts	K3
	CO3 Creating and Deploying Hyperledger Fabric network	K3
	CO4 Create Smart Contract and Transactions using Solidity	K3
	CO5 Create Smart Contract and Transactions using Remix IDE	K3

List of Exercises

1a) Generate Public private key pairs for Bitcoin and Ethereum addresses

b) Connect to the Public/Testnet Ethereum Blockchain network using popular wallets (Metamask, Brave browser) and understand various terminologies like gas, gas fee, gas price, priority fee

2. Send test ether from one account to another
3. Send test ether to smart contract
4. Create a Private Ethereum Blockchain network
5. Using Web3.js to Transfer Ether from one account to another account
6. Using Web3.js to Interact with Smart Contracts
7. Create a Hyperledger Fabric Permissioned blockchain network
8. Write, deploy and execute chain code in Hyperledger Fabric network
9. Creating Smart Contract using Solidity and Remix IDE
10. Creating Transactions using Solidity and Remix IDE
11. Embedding wallet and transaction using Solidity

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

Reference Books

1. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", 1st Edition, Cambridge University Press, 2012.
3. Richert, Willi, "Building machine learning systems with Python", Packt Publishing, 2013.
4. Tom M Mitchell, "Machine Learning", McGraw-Hill Education (India), 2013.
5. Y S Abu-Mostafa, M Magdon-Ismail, H T Lin, "Learning from Data", AML Book Publishers, 2012

Web References

1. https://nptel.ac.in/courses/106/105/106105152/
2. https://www.coursera.org/learn/machine-learning
3. https://machinelearningmastery.com/
4. https://towardsdatascience.com/machine-learning/home/
5. https://www.analyticsvidhya.com/blog/2017/09/common-machine-learning-algorithms/

2.A.4.95

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	2	-	2	-	-	-	1	-	-	2	3	1	2
2	3	2	2	-	2	-	-	-	1	-	-	2	3	1	2
3	3	3	3	-	2	-	-	-	1	-	-	2	3	1	2
4	3	2	3	-	2	-	-	-	1	-	-	2	3	1	2
5	3	2	3	3	2	-	-	-	2	3	-	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

2. A. 4. 96

Department	Information Technology	Programme: B. Tech.						
Semester	VI	Course Category Code: PA				*End Semester Exam Type: -		
Course Code	U23ITW602	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Mini Project	0	0	2	1	100	-	100
IT								

Prerequisite	Programming Languages, IT Essentials	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify the problem statement for the mini project work through the literature survey	K2
	CO2 Choose the proper components as per the requirements of the design/ system.	K2
	CO3 Apply the acquainted skills to develop final model/system	K3

There shall be a Mini Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the mini project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and, in the hardware, / software he/she using in the Project. The Mini-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Mini Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Mini Project work with weightage as indicated evaluation Methods.

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

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	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	2	2	2

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

Evaluation Method

Assessment	Review 1			Review 2				Total Marks
	Novelty	Presentation	Viva	Presentation	Demonstration	Viva	Report	
Marks	10	20	10	20	20	10	10	100

2.A.4.97

2.A.4.98

Department	**Information Technology**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **AEC**			End Semester Exam Type: -			
Course Code	**U23ITC6XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Certification Course - VI**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
		IT						
Prerequisite	-							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as "pass" on satisfactory completion. A letter grade "P" is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

2.A.4.99

2.A.4.100

Department	Information Technology	Programme: B. Tech.						
Semester	VI	Course Category: MC			End Semester Exam Type :TE			
Course Code	U23ITM606	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Gender Equality	2	0	0	-	100	-	100

Prerequisite	-	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe the general identity, social construction of gender roles.	K2
	CO2 Illustrate the causes and issues of gender discrimination in Indian society.	K2
	CO3 Describe the workplace discrimination, media influences on gender and culture.	K2
	CO4 Familiarize with international and Indian frameworks on gender equality.	K2
	CO5 Illustrate the current challenges in gender equality, including the glass ceiling and the role of technology.	K2

UNIT – I	Introduction to Gender Equality	Periods:06
Gender equality – exploring gender identity and expression, Understanding the social construction of general roles and norms, historical perspectives on gender roles, Analyzing key milestones in the fight for gender equality.		CO1

UNIT – II	Gender Inequality and Its Manifestations	Periods:06
Gender discrimination in Indian society – causes of gender inequality – Illiteracy, patriarchal set up, lack of awareness, social beliefs, practice and custom – Issues of gender discrimination – Child marriage, child domestic work, poor education and health, violence and exploitation in workplace.		CO2

UNIT – III	Gender and Culture	Periods:06
Workplace discrimination, Media influences on gender and culture, Gender and power dynamics in society. Strategies for promoting gender equality and cultural understanding.		CO3

UNIT – IV	Promoting Gender Equality	Periods:06
Gender Equality and Human Rights – International frameworks and Conventions on Gender Equality – Equality under the Indian Constitution – Policies and initiatives for gender mainstreaming – Strategies for promoting Gender Equality in various contexts.		CO4

UNIT – V	Contemporary Challenges and Future Directions	Periods:06
Current challenges and emerging issues in gender equality – Glass ceiling – role of technology in continuing or challenging gender inequality – Exploring possibilities for transformative change and envisioning a gender-equal future.		CO5

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

Text Books

1. "Gender and Society" by Raewyn Connell – This book provides a comprehensive overview of gender roles, power dynamics, and the social construction of gender.
2. "The Second Sex" by Simone de Beauvoir – A historical and philosophical examination of women's oppression and gender inequality.
3. "Women and Gender in the Indian Society" by Neera Desai and Usha Thakkar – Focuses on the context of gender roles, inequality, and feminist movements in India.

Reference Books

1. Woman in early Indian societies, New Delhi: Manohar Publications. Sita A. Raman (2009).
2. A social and Cultural history, Volume1. Connecticut: Oxford: Praeger. Sita Raman (2009).
3. A social and Cultural history, Volume2. Connecticut: Oxford: Praeger.
4. Iftikhar R. (2016). Indian Feminism: Class, Gender and Identity in Medieval Ages. Chennai: Notion Press. Iftikhar, R. (2012).

Web References

1. https://www.unwomen.org
2. https://ncw.nic.in
3. https://en.unesco.org/themes/gender-equality
4. https://www.weforum.org/reports
5. https://wcd.nic.in

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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	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

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

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

OPEN ELECTIVES

2. A. 4. 104

Department	Management Studies	Programme : B.Tech						
Semester	V/VI	Course Category Code: OE				*End Semester Exam Type: TE		
Course Code	U23HSOC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Intellectual Property Rights	3	0	0	3	25	75	100

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	*On completion of the course, the students will be able to*	**BT Mapping (Highest Level)**
	CO1 Describe the Concept and Importance of Intellectual Property Rights (IPR).	**K2**
	CO2 Describe the procedures for patent registration, including recognizing legal remedies for infringement.	**K3**
	CO3 Apply copyright laws to hypothetical scenarios involving academic integrity and plagiarism.	**K3**
	CO4 Infer the different types of trademarks and understand the registration process and infringement issues.	**K4**
	CO5 Explain the legalities surrounding industrial designs, geographical indications, and their protection mechanisms.	**K2**

UNIT-I-	**Overview of Intellectual Property**	**Periods: 9**
Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Trade Secret – International protection of IPR- Major International conventions and agreements: WTO/TRIPS Agreement, Paris Convention, The Berne Convention, Universal Copyright Convention, WIPO Convention, Madrid Agreement, Nice Agreement and TRIPS Agreement		**CO1**

UNIT-II	**Law of Patents**	**Periods: 9**
Meaning and Nature of Patent - Subject matter of Patent - Registration Procedure, Patentable and Non-patentable Inventions - Process and product Patent, Legal Requirements for Patents – Patent document: Specification and Claims - Granting of Patents - Transfer of Patent rights - Infringement of Patents and Remedies - Evergreening of Patents		**CO2**

UNIT-III	**Law of Copyrights**	**Periods: 9**
Meaning and Nature of Copyright - Subject matter of copyright - Law of Copyrights - Authorship and Ownership of copyright, Registration Procedure, Assignment and Licensing of copyright - Infringement of Copyrights and Remedies - Emerging new trends in Copyrights - Related Rights: Celebrity Rights, Academic Integrity or Plagiarism: An Intellectual Theft - Copyrights with special reference to software.		**CO3**

UNIT-IV	**Law of Trademarks**	**Periods: 9**
Meaning and Nature of Trademarks - Different kinds of Trademarks - Registrable and Non-Registrable Trademarks - Registration of Trademarks - Grounds for refusal of Registration: Absolute Ground and Relative Ground - Assignment and Licensing of trademarks - Infringement, Remedies and Penalties - Offenses relating to Trademarks - Passing off action – Deceptive similarity - Defenses - Emerging New trends in trademarks		**CO4**

UNIT-V	**Other Forms of IPR**	**Periods: 9**
Meaning and nature of Industrial Design - Subject Matter - Procedure for registration - Infringement of Copyrights in designs - Remedies for Infringement - Trade secret Law-Determination of Trade Secret Status - Liability for misappropriations of Trade Secrets- Protection for submission-Trade Secret litigation - Meaning and Nature of Geographical Indication (GI) - Procedure for registration - Infringement of Geographical indication - Remedies for Infringement.		**CO5**

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

Text Books

1. Nithyananda, K. V. Intellectual Property Rights: Protection and Management, 2nd edition, Cengage Learning India Private Limited, 2019.
2. Neeraj, P., and Khusdeep, D. Intellectual Property Rights, 2nd edition, PHI Learning Private Limited, 2018.

Reference Books

1. Ahuja, V. K. Law Relating to Intellectual Property Rights, 2nd edition, Lexis Nexis, 2017.
2. Bouchoux, Deborah E. Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 4th edition., Cengage Learning, 2013.
3. Ganguli P. Intellectual Property Rights: Unleashing the Knowledge Economy. Tata McGraw-Hill Publishing Company; 2022.
4. Jyoti Rattan. Intellectual Property Rights, 2nd edition, Bharat Law House, 2024.
5. Surendra Malik and Sudeep Malik, Supreme Court on Intellectual Property, Eastern Book Company, 2022.

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Web References
1. https://www.wipo.int/about-ip/en/ 2. https://www.uspto.gov/patents/basics/general-information-patents 3. https://www.wto.org/english/tratop_e/trips_e/trips_e.htm 4. https://www.epo.org/about-us/annual-reports-statistics/annual-report.html 5. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India 6. https://www.inta.org/trademarks/trademark-basics/.

***TE-Theory Exam, LE-Lab Exam**

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	3	2	2	-	2	1	2	-	2	-
CO2	1	2	-	2	-	3	2	2	-	2	1	1	2	-	-
CO3	-	2	-	-	-	2	2	3	-	2	-	1	-	2	-
CO4	1	1	-	-	-	3	2	2	-	2	1	1	-	-	2
CO5	1	2	-	-	-	3	3	2	-	2	1	1	2	-	2

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

Evaluation Methods

Assessment	Internal Assessment Marks (IAM)					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	Management Studies	Programme: B. Tech						
Semester	V/VI	Course Category Code: OE			*End Semester Exam Type: TE			
		Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Code	U23HSOC02	3	0	0	3	25	75	100
Course Name	New Product Development							
Prerequisite	Common to ALL Branches							

			BT Mapping (Highest Level)
Course Outcomes	*On completion of the course, the students will be able to*		
	CO1	Explain the stages and importance of new product development (NPD) in modern business contexts.	K2
	CO2	Apply market research to identify customer needs and translate them into product specifications.	K3
	CO3	Illustrate the product concepts using screening and scoring techniques to select the most viable option.	K3
	CO4	Examine product prototype that incorporates principles of product architecture and design for manufacturing.	K3
	CO5	Analyze a business plan and market strategy for the successful launch of a new product.	K4

UNIT-I	Introduction to New Product Development	Periods: 9	
Introduction to New Product Development (NPD) - Product Development vs New Product Development - Stages of NPD - Role of Innovation and Creativity in NPD - Reverse Engineering and its Application in NPD - Business Models for New Products - Risk Management in New Product Development - Sustainability and Ethical Considerations in NPD			CO1
UNIT-II	Market Research and Customer Needs	Periods: 9	
Identifying Market Opportunities for New Products - Conducting Market Research for NPD - Translating Customer Needs into Product Specifications - Establishing and Refining Product Specifications - Competitive Analysis and Benchmarking in NPD - Tools for Understanding Consumer Behaviour: Surveys, Focus Groups, and Ethnography			CO2
UNIT-III	Concept Generation and Evaluation	Periods: 9	
Concept Generation Process: Continuous and External Idea Sources - Clarifying the Problem and Brainstorming Solutions - Design Thinking for New Products - Techniques for Concept Generation - Systematic Exploration of Concepts - Screening and Scoring Product Concepts - Concept Evaluation and Selection Methods - Prototyping Techniques			CO3
UNIT-IV	Product Design and Development	Periods: 9	
Product Architecture and its role in NPD - Modular vs. Integral Product Architecture - Design for Sustainability - Environmental Considerations - Organizing Product Development Teams - Stages of team Development - Collaboration and Cross - Functional Teams in Product Development - Tools for Effective Product Design - Agile Product Development Methodologies			CO4
UNIT-V	Launch, Strategy and Commercialization	Periods: 9	
Developing a New Product Strategy - Building Market Demand and Entry Strategies for New Products - Developing a New Product Business Plan - Preparing for Market Launch - Post - Launch Evaluation - Product Life Cycle - Continuous Improvement and Future Product Enhancements			CO5
Lecture Periods: 45	Tutorial Periods:	Practical Periods:	Total Periods: 45

Text Books

1. Ulrich KT, Eppinger SD. Product design and development. 7th edition. McGraw-Hill Education; 2020.
2. Crawford CM, Di Benedetto A. New products management. 11th edition. McGraw-Hill Education; 2014.
3. Cooper RG. Winning at new products: Creating value through innovation. 5th edition. Basic Books; 2017.

Reference Books

1. Trott, P. Innovation management and new product development 6th edition. Pearson Education. 2017
2. Thomke, S. Experimentation works: The surprising power of business experiments. Harvard Business Review Press. 2020
3. Blank, S. G., & Dorf, B. The startup owner's manual: The step-by-step guide for building a great company. Wiley. 2020
4. Brown, T. Change by design: How design thinking transforms organizations and inspires innovation. Harper Business. 2009
5. Kelley, T., & Littman, J. The ten faces of innovation: IDEO's strategies for beating the devil's advocate and driving creativity throughout your organization. Currency/Doubleday. 2006

Web References
1. https://conjointly.com/kb/
2. https://www.entrepreneur.com/article/281999
3. https://www.mindtools.com/pages/article/newSTR_66.htm
4. https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy
5. https://www.productplan.com/glossary/product-architecture/
6. https://hbr.org/2019/09/why-design-thinking-works
7. https://www.smartsheet.com/new-product-development.
8. https://www.ptc.com/en/blogs/cad/best-practices-for-developing-new-products

***TE-Theory Exam, LE-Lab Exam**

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO1	3	-	3	-	3	1	1	-	-	1	-	2	-	-	2
CO2	1	-	2	1	3	-	-	1	-	1	-	3	-	2	-
CO3	1	1	3	-	2	-	1	-	2	-	1	2	2	-	-
CO4	3	-	1	1	3	1	-	1	2	-	1	1	2	-	2
CO5	1	-	3	-	3	-	-	-	2	-	1	2	-	2	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

Department	Management Studies	Programme : B.Tech						
Semester	V/VI	Course Category Code: OE			*End Semester Exam Type: TE			
Course Code	U23HSOC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Finance for Engineers	3	0	0	3	25	75	100

Common to ALL Branches

Prerequisite	Nil	
	On completion of the course, the students will be able to	**BT Mapping (Highest Level)**
Course Outcomes	**CO1** Explain the objectives, scope, and role of financial management in engineering, and differentiate between profit maximization and wealth maximization.	**K2**
	CO2 Apply the concepts of the time value of money to engineering projects and use investment appraisal techniques such as NPV, IRR, and Payback Period for decision-making.	**K3**
	CO3 Demonstrate the steps in the capital budgeting process and apply techniques like cost-benefit and sensitivity analysis for evaluating engineering projects.	**K3**
	CO4 Analyze financial statements, including balance sheets and income statements, from an engineering perspective, and evaluate financial ratios to assess the financial performance of engineering projects.	**K4**
	CO5 Analyze different types of costs, such as fixed, variable, and marginal costs, and evaluate cost-benefit analysis and break-even analysis for engineering decision-making.	**K4**

Unit-I-	**Introduction to Financial Management**	**Periods: 9**
Overview of Financial Management: Objectives, Scope, and Role in Engineering - Financial Planning and Strategy: Short-Term and Long-Term Planning - Basic Concepts: Profit Maximization vs Wealth Maximization - Role of Engineering Managers in Financial Decision - Making, Relationship between Finance and Other Engineering Disciplines.		**CO1**

Unit-II	**Time Value of Money and Investment Decisions**	**Periods: 9**
Time Value of Money: Concept, Importance and Applications in Engineering Project, Present Value and Future Value Calculations - Investment Appraisal Techniques: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR) (Theory only) and Profitability Index (PI) - Risk Analysis in Investment Decision Making.		**CO2**

Unit-III	**Capital Budgeting for Engineering Projects**	**Periods: 9**
Capital Budgeting Process: Steps and Key considerations, Techniques for Evaluating Engineering Project, Cash-Flow Estimation for Project, Cost - Benefit Analysis in Engineering Project, Sensitivity Analysis, and Decision Trees for Project Evaluation.		**CO3**

Unit-IV	**Financial Statements and Ratio Analysis**	**Periods: 9**
Introduction to Financial Statements: Balance Sheet, Income Statement, and an Engineering Perspective on Financial Statement Interpretation - Financial Ratios: Liquidity, Profitability - Engineering Case Studies on Financial Performance Evaluation - Limitations of Ratio Analysis in Engineering Projects.		**CO4**

Unit-V	**Cost Estimation and Engineering Economic Analysis**	**Periods: 9**
Introduction to Cost Estimation in Engineering - Types of Costs: Fixed, Variable, Marginal, and Sunk Costs, Cost-Benefit Analysis in Engineering Projects, Break-Even Analysis and Its Application in Engineering Decision Making - Engineering Economic Analysis: Replacement Analysis.		**CO5**

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

Text Books

1. Sullivan WG, Wicks EM, Koelling CP. Engineering Economy. 17th edition. Pearson; 2020.
2. Brealey RA, Myers SC, Allen F. Principles of Corporate Finance. 19th edition. McGraw-Hill Education; 2022.
3. Brigham EF, Houston JF. Fundamentals of Financial Management. 15th edition. Cengage Learning; 2019.

Reference Books

1. Ranganath BJ, Sinha KK. Financial Management for Engineers. 4th edition. Vikas Publishing House; 2018.
2. Crundwell F. Finance for Engineers: Evaluation and Funding of Capital Projects. Springer; 2017.

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Web References

1. https://www.netsuite.com/portal/resource/articles/financial-management/financial-management.shtml
2. https://www.investopedia.com/ask/answers/033015/why-time-value-money-tvm-important-concept-investors.asp
3. https://omnicard.in/blogs/capital-budgeting-24042024
4. https://www.linkedin.com/pulse/role-capital-budgeting-process-engineering-studies-ashraf
5. https://corporatefinanceinstitute.com/resources/accounting/financial-ratios/
6. https://www.dau.edu/acquipedia-article/engineering-cost-estimation-method

***TE-Theory Exam, LE-Lab Exam**

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO1	1	2	-	-	-	1	1	1	-	2	1	1	-	-	2
CO2	1	2	1	-	1	2	1	2	-	3	1	-	2	-	-
CO3	-	3	3	-	1	3	1	2	-	3	1	1	-	-	2
CO4	1	2	-	2	1	1	2	1	1	2	1	-	-	2	2
CO5	-	3	-	-	2	3	2	2	1	2	2	3	2	-	2

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

Evaluation Methods

Assessment	Internal Assessment Marks (IAM)					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.4.110

Department	Management Studies	Programme: B. Tech						
Semester	V/VI	Course Category Code: OE			*End Semester Exam Type: TE			
Course Code	U23HSOC04	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Economics for Engineers	3	0	0	3	25	75	100

Common to ALL Branches

Prerequisite	Basics of Economics	
Course Outcomes	*On completion of the course, the students will be able to*	BT Mapping (Highest Level)
	CO1 Interpret principles of managerial economics to real-world scenarios, utilizing demand analysis and forecasting techniques.	K2
	CO2 Discuss production functions and cost structures to evaluate their impact on managerial decision-making and market strategies.	K2
	CO3 Examine various market structures and pricing strategies, synthesizing their effects on market behavior and competitive dynamics.	K3
	CO4 Apply macroeconomic policies and their implications on business cycles, investment decisions, and economic stability.	K3
	CO5 Analyze recent economic trends, such as technological advancements and income inequality.	K4

UNIT-I	Introduction to Managerial Economics	Periods: 9
Managerial Economics: Meaning, Scope, and Importance - Functions of a Managerial Economist - Demand Analysis: Law of Demand, Elasticity of Demand, Law of Supply, Elasticity of supply and Market Equilibrium - Comparative statistics: Shift of a curve and movement along with the curve - Demand Forecasting: Criteria for Effective Forecasting - Qualitative Methods - Quantitative Methods.		CO1

UNIT-II	Production Function and Cost Concepts	Periods: 9
Production Function: Meaning, Types, Applications in Managerial Decision Making - Law of variable proportion and law of returns to scale - ISO Quants - Producer Surplus: Price ceiling and price floor - Cost concept: Types of Costs - Total, average and marginal cost - Revenue Concepts: Total Revenue (TR) - Marginal Revenue (MR) and Average Revenue (AR).		CO2

UNIT-III	Market Structure	Periods: 9
Market structure: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly - Pricing policies: Cost-Based Pricing, Demand - Based Pricing, Competition - Based Pricing, Psychological Pricing, Geographical Pricing, Dynamic Pricing, Bundle Pricing, Price Discrimination, Premium Pricing and practices.		CO3

UNIT-IV	Macroeconomics	Periods: 9
Globalization and Economic Policies - National Income Concepts: Methods of measuring national income - circular flow of income - Monetary policy and Fiscal Policy - Business Cycles concepts - Inflation, deflation and its types - Foreign Direct Investment (FDI) - Foreign Institutional Investment (FII).		CO4

UNIT-V	Recent Trends in Economics	Periods: 9
Digital Economy : E-commerce, Fintech, and Online Services - Role of Technology : Big Data, Artificial Intelligence and Automation in Economic Decision-Making - Gig Economy : Growth of Freelance and Contract Work - Impact on Global Economies - Income In - equality : Causes, Effects, and Socio - political Impact		CO5

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

Text Books

1. Samuelson, William F., and Marks, Stephen G. Managerial Economics: Theory, Applications, and Cases, 10th edition, Wiley, 2020.
2. Ahuja, H. L. Principles of Managerial Economics, 7th edition, Tata McGraw-Hill, 2017
3. Mithani, D. M. Managerial Economics, 3rd edition., Himalaya Publishing House,2021.

Reference Books

1. Varian, Hal R. Intermediate Microeconomics: A Modern Approach, 9th edition., W.W. Norton & Company, 2014.
2. Brickley, James A., Smith Jr., Clifford W., and Zimmerman, Jerold L. Managerial Economics and Organizational Architecture, 7th edition., McGraw-Hill Education, 2016.
3. Samuelson, Paul, and Nordhaus, William. Economics, 20th edition., McGraw-Hill Education, 2019.
4. Schiff, Peter, and Schotter, Andrew J. Introduction to Microeconomics, 3rd edition., Cengage Learning, 2012.
5. Moore, James C. Economic Theory and Operations Analysis, 2nd edition., Academic Press, 1970.

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Web References

1. https://www.jaroeducation.com/blog/nature-and-types-of-managerial-economics/
2. https://psu.pb.unizin.org/introductiontomicroeconomics/chapter/chapter-6-costs-and-production/
3. https://corporatefinanceinstitute.com/resources/economics/market-structure.
4. https://www.britannica.com/money/macroeconomics
5. https://www2.deloitte.com/us/en/insights/economy/global-economic-outlook/weekly-update.html

*TE-Theory Exam, LE-Lab Exam

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO1	1	1	1	--	1	1	--	--	--	2	2	--	-	2	2
CO2	1	1	1	2	2	2	2	--	--	3	3	3	2	-	2
CO3	1	1	1	2	-	2	2	--	--	3	-	3	-	-	2
CO4	1	1	-	2	2	2	2	2	--	3	3	3	-	2	-
CO5	1	1	1	2	2	-	2	2	--	3	3	3	-	2	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.4.112.

Department	Management Studies	Programme: B. Tech						
Semester	V/VI	Course Category Code: OE			*End Semester Exam Type: TE			
Course Code	U23HSOC05	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Marketing Management	3	0	0	3	25	75	100

Common to ALL Branches

Prerequisite		
Course Outcomes	*On completion of the course, the students will be able to*	BT Mapping (Highest Level)
	CO1 Explain the importance of marketing and differentiate between marketing and selling.	K2
	CO2 Apply the consumer decision-making process and differentiate between industrial and consumer buying behavior.	K3
	CO3 Examine product life cycle management strategies and demonstrate the steps involved in new product development.	K3
	CO4 Illustrate the role of distribution channels and design an effective channel distribution strategy for both consumer and industrial goods.	K3
	CO5 Analyze emerging trends in marketing, including Customer Relationship Management and experiential marketing strategies.	K4

UNIT-I	Introduction to Marketing	Periods: 9
Marketing - Importance of Marketing - Difference between Marketing and Selling - Marketing Environment: The Macro and Micro Environment factors, Importance of environment analysis – Strategic Marketing planning: Introduction, Need, Framework of Strategic planning process and Steps in strategic planning - Ethical and Social Responsibility of Marketing - 4 Ps of Marketing		CO1
UNIT-II	**Consumer Behaviour and Marketing Strategy**	**Periods: 9**
Role of buyer - Types of Buying behavior - Factors influencing buying decisions - Consumer decision making process: Meaning and Steps in Consumer decision making Process – Organizational buying behaviour: Classification of organizational markets, Characteristics, Difference between Industrial and Consumer buying - Market Segmentation - Needs, Classification and Significance – Targeting, Positioning and Competitive Strategies.		CO2
UNIT-III	**Product and Pricing Mix**	**Periods: 9**
Product classifications - Product Life cycle - Strategies for managing Product Life cycle – Categories of New product, Importance and Steps in New Product Development – Packaging: Need for packaging, Essential qualities of packaging, kinds of packaging and advantages of packaging – Labelling: Functions, Types of labelling, advantages and disadvantages of labelling – Pricing objectives – Pricing strategies		CO3
UNIT-IV	**Place and Promotion Mix**	**Periods: 9**
Distribution Channel and Physical distribution: Meaning and Importance of distribution channel - Channel design decisions – Channels of distribution for consumer and industrial goods – Physical Distribution: Meaning, Objectives and components of physical distribution - Promotion: Objectives, Types of sales promotion: Consumer, Salesperson and Dealer sales promotion – Introduction to Integrated Marketing Communication		CO4
UNIT-V	**Trends in Marketing**	**Periods: 9**
Emerging trends in Marketing - Customer Relationship Management: Definition, features, Types and importance - Experiential Marketing: Meaning, strategies and benefits - Mobile Marketing: Definition and types of mobile marketing - Digital Marketing: Meaning, types of digital marketing – Inbound marketing: Meaning, fundamentals and difference between inbound and outbound marketing - Marketing Analytics: Meaning, importance, metrices of marketing analytics – An overview of Sustainable Marketing		CO5

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

Text Books

1. Keller, Philip and Kevin Lane Kotler "Marketing Management" 16th Edition, Pearson Education Limited, 2022.
2. V.S.Ramaswamy, S.Namakumari, 6th Edition, Sage Publications India Pvt Ltd, 2018

2.A.4.113.

Reference Books
1. Prachi Gupta, Ashita Aggarwal, et al. "Marketing Management: Indian Cases" Pearson Education Limited, 2024 2. Arunkumar, Meenakshi.N, "Marketing Management" 3rd Edition, Vikas Publishing House, 2016 3. Rajan Saxena, "Marketing Management" 5th Edition, MacGraw Hill Publications, 2017
Web References
1. https://www.ama.org/ 2. https://www.marketingprofs.com/ 3. https://indianjournalofmarketing.com/ 4. http://www.publishingindia.com/ijamm/ 5. https://onlinecourses.swayam2.ac.in/imb20_mg36/preview

***TE-Theory Exam, LE-Lab Exam**

COs/POs/PSOs Mapping

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Program Specific Outcomes (PSOs)		
													PSO1	PSO2	PSO3
CO 1	1	2	-	-	-	2	1	1	-	2	1	1	-	2	2
CO 2	1	2	1	-	1	2	1	2	-	2	1	1	2	2	-
CO 3	1	2	3	-	1	2	1	2	-	2	1	1	2	-	2
CO 4	1	1	3	-	2	1	2	1	1	2	2	1	-	2	2
CO 5	1	3	2	2	2	3	2	2	1	2	2	3	-	2	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.4.114

Department	Information Technology	Programme: B.Tech.						
Semester	VI	Course Category Code: OE				*End Semester Exam Type:TE		
Course Code	U23ITOC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Database System: Design and Development	3	0	0	3	25	75	100

Common to EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS

Prerequisite	-

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Summarize the fundamental concepts of databases and Entity-Relationship (E-R) model	K2
CO2	Apply E-R Model to create relational databases for the given problems.	K2
CO3	Manipulate and build database queries using Structured Query Language	K3
CO4	Apply data normalization principles to develop a normalized database or a given application	K3
CO5	Discover about transaction management principles on relational databases	K2

Unit- I	Introduction To Database System and ER Model	Periods: 09

Database Systems Applications-Purpose of Database Systems, Views of Data –Data Abstraction – Instances and Schemas - Data Models - Database System Architecture - Entity-Relationship Model – ER Diagram - Extended ER Model - ER into Relational Model | CO1

Unit- II	Relational Model	Periods: 09

Introduction to the Relational Model – Structure – Database Schema, Keys – Schema Diagrams, Tables. Relational Algebra - Extended-Relational Algebra Operations. | CO2

Unit- III	Database Languages	Periods: 09

SQL: Introduction - DDL - DML – Integrity Constraints - Set Operations - Joins - Nested Queries - View - Trigger - Stored Procedures. | CO3

Unit- IV	Relational-Database Design	Periods: 09

Functional Dependencies – Non-loss Decomposition – First, Second and Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form. | CO4

Unit- V	Transactions	Periods: 09

Transactions: Transaction concepts and states - Concurrent Execution – Serializability – Concurrency Control: Lock based Protocol - Timestamp based Protocol - Recovery System: Log - Based Recovery -Shadow Paging. | CO5

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

Text Books

1. Abraham Silberschatz, Henry F.Korth, S.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. Shio Kumar Singh, Database Systems: Concepts, Design and Applications, Pearson Education, New Delhi, Second Edition,2011.

Reference Books

1. Abraham Silberschatz, Henry F.Korth, S.Sudarshan, Database System Concepts, 6th Edition – McGraw-Hill Higher Education, International Edition, 2015
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015
3. Date C J, Kannan A and Swamynathan S, "An Introduction to Database System", 8th Edition, Pearson Education, New Delhi, 2006
4. Alan Beaulieu, "Mastering SQL Fundamentals", Second Edition, O'Reilly,2009

Web References

1. http://www.database.com/
2. http://freevideolectures.com/course/2668/database-management-system/

2.A.4.115.

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	-	-	-	-	-	-	-	-	2	1	2	2
2	2	1	3	1	3	-	-	-	-	-	-	2	1	2	2
3	2	1	3	2	3	1	-	-	-	-	-	2	2	2	2
4	2	2	3	2	3	2	-	-	-	-	-	2	2	2	2
5	2	2	2	-	-	-	-	-	-	-	-	2	1	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.4.116.

Department	Information Technology	Programme: B.Tech.						
Semester	V/VI	Course Category Code: OE				*End Semester Exam Type:TE		
Course Code	U23ITOC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Computer Hardware and Troubleshooting	3	0	0	3	25	75	100

Common to EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS

Prerequisite	-	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify and describe the key components of a motherboard	K2
	CO2 Explain the concept of primary memory	K2
	CO3 Explain the characteristics of secondary storage devices and can perform partitioning, formatting of HDD	K2
	CO4 Gain knowledge about data recovery, handling viruses, and working with DOS.	K2
	CO5 Utilize various software diagnostic tools and multimeters in troubleshooting the devices	K2

UNIT- I	Motherboard Components	Periods:9	
Introduction to Hardware Software and Firmware - Mother Board- IO and memory expansion slots- SMPS- Drives- front panel and rear panel connectors- Processors - Chipsets . Bus Standards: Overview and features of PCI, AGP, PCMCIA			CO1
UNIT-II	**Primary Memory Storage Devices**	**Periods:9**	
Introduction to Primary Memory- Main Memory, Cache memory – DDR, DDR2, DDR3, DDR4, DDR5, Low power DDR -Reading memory error messages			CO2
UNIT-III	**Secondary and Removable Storage Devices**	**Periods:9**	
Secondary Storage: Hard Disk Drive- IDE, Ultra ATA, Serial ATA; HDD Partition - Formatting, SSD, Removable Storage: CD-R, CD-RW,DVD - ROM and DVD - RW, USB.			CO3
UNIT-IV	**Installation and Preventive Maintenance**	**Periods:9**	
Introduction – System configuration – Pre installation planning – Installation practice – routine checks – PC Assembling and integration – BIOS setup – Engineering versions and compatibility – preventive maintenance – DOS – Virus – Data Recovery			CO4
UNIT-V	**Troubleshooting Hardware Problems**	**Periods:9**	
Troubleshooting Tools: Software Diagnostic Disk -Multimeter- Cable tester-Troubleshooting Power-Supply Problems-Troubleshooting RAM problems - Troubleshooting HDD problems			CO5

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

Text Books

1. Craig Zacker & John Rourtre,"PC Hardware- The complete reference", TMH.
2. Mark Minosi," The Complete PC Upgrade & Maintenance Guide 4/e, BPB publications.
3. S.K. Chauhan, "PC Upgrading, maintenance and troubleshooting guide",
4. Charles J.Brooks," PC Maintenance and Troubleshooting Field Guide",Pearson IT Certification Publishers

Reference Books

1. Dr. Ajay Rana and Dr. Ajit Mittal, Mastering PC Hardware & Networking, latest edition, Khanna Publishers
2. Balasubramanian D, Computer Installation and Servicing 2nd Edition , McGraw hill Publications, 2010
3. Hans Peter Messmer, Indispensable PC Hardware Book, Pearson Education, 4th Edition, 2003.
4. Scott Muller, Upgrading and Repairing PCs, 15th Edition, 2002.

Web References

1. https://edu.gcfglobal.org/en/computerbasics/basic-troubleshooting-techniques/1/

* TE – Theory Exam, LE – Lab Exam

2.A.4.113

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	2	1	1	-	-	2	1	1	2	2	2
2	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
3	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
4	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2
5	2	1	2	1	2	1	1	-	-	2	1	1	2	2	2

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2.A.4.118

Department	Information Technology	Programme: B.Tech.						
Semester	VII	CourseCategoryCode: OE			*End SemesterExamType:TE			
CourseCode	U23ITOC03	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Essentials of Data Science	3	0	0	3	25	75	100

Common to EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS

Prerequisite	Nil	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Ability to have a broad insight, understanding and intuition of the data science life cycle	K2
	CO2 Create artful graphs to visualize complex data sets and functions.	K3
	CO3 Discuss in depth a variety of data mining techniques, and their applicability to various problem domains	K2
	CO4 Select and apply data mining technique to a practical case study	K2
	CO5 Understand the concept, challenge and technology of big data	K2

Unit-I	Introduction to Data Science	Periods:09
Introduction: Need for data science – Benefits and uses – Facets of data-Data science process: Retrieving data – Cleansing, integrating, and transforming data – Data analysis – Build the models -Epicycles of Analysis- Exploratory Data Analysis- Using Models to Explore Data-Inference: A Primer- Formal Modeling-Inference vs. Prediction : Implications for Modeling Strategy - Interpreting results.		CO1
Unit-II	**Data Analytics Using R**	**Periods:09**
Introduction to R: Data structures, vectors, matrices, data frames–Exploratory Data Analysis: Descriptive statistics, Data visualization with ggplot2, Correlation and covariance analysis Statistical – Hypothesis testing- Analysis of variance (ANOVA)- Regression analysis- Processing and analyzing text data -Association rule mining - Clustering techniques		CO2
Unit-III	**Supervised Learning**	**Periods:09**
Regression - Linear Regression - Logistic Regression - Reasons to Choose and Cautions - Additional Regression Models - Classification - Decision Trees – Na'ive Bayes – Diagnostics of Classifiers – Additional Classification Methods – Time Series Analysis – Overview of Time Series Analysis – ARIMA Model		CO3
Unit-IV	**Unsupervised Learning**	**Periods:09**
Clustering - Overview of Clustering – K-means - Additional Algorithms –Association Rules- Overview - A priori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Validation and Testing – Diagnostics - Text Analysis – Text Analysis Steps – Collecting Raw Text – Representing Text – Term Frequency-Inverse Document Frequency (TFIDF) - Categorizing Documents by Topics –Determining Sentiments – Gaining Insights		CO4
Unit-V	**Big Data Analytics**	**Periods:09**
Data science in a Big Data world - Benefits and uses of data science and Big Data - Facets of data - The Big Data ecosystem and data science – Introduction of Hadoop - Handling large data on a single computer - The problems in handling large data - General techniques for handling large volumes of data - General programming tips for dealing with large datasets- Case study : Predicting malicious URLs, Recommender system - Steps in Big Data - Distributing data storage and processing with frameworks - Case study: Assessing loan risk.		CO5

LecturePeriods:45	TutorialPeriods:	PracticalPeriods:-	TotalPeriods:45

TextBooks

1. Peng, R. D., & Matsui. E, The Art of Data Science- A Guide for Anyone Who Works with Data, Skybrude Consulting, 2015.
2. Norman Matloff, "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011.
3. David Dietrich, Barry Heller & Beibei Yang, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, John Wiley & Sons, 2015.

ReferenceBooks

1. Davy Cielen, Arno Meysman, Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Manning Publications, 2016.
2. Joel Grus, Data science from scratch: first principles with python, O'Reilly Media, Inc., 2015.
3. Steven S. Skiena, The Data Science Design Manual, First Edition, Springer, 2017.
4. Martin Czygan, Phuong Vo.T.H, Getting Started with Python Data Analysis, Packt Publishing, 2015.

2.A.4.119

Web References

1. www.ibm.com/Data Analytics/
2. https://www.coursera.org/learn/r-programming
3. https://www.ijser.org/researchpaper/Importance-of-Clustering-in-Data-Mining.pdf
4. https://datafloq.com/read/7-innovative-uses-of-clustering-algorithms/6224
5. https://publications.waset.org/10011058/improving-fake-news-detection-using-k-means-and-support- vector-machine-approaches
6. https://statisticsbyjim.com/regression/when-use-regression-analysis/

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
2	3	3	3	-	-	-	-	-	-	-	-	-	3	2	3
3	3	3	3	-	-	-	-	-	-	-	-	-	3	2	1
4	3	2	2	-	-	-	-	-	-	-	-	-	3	2	1
5	3	2	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

2.9.4.120

Department	Information Technology	Programme: B.Tech.					
Semester	VII	Course Category Code: OE			*End SemesterExamType:TE		
CourseCode	U23ITOC04	Periods/Week			Credit	MaximumMarks	
		L	T	P	C	CAM	ESE	TM
Course Name	Big Data Technologies	3	0	0	3	25	75	100

Common to EEE, ECE, ICE, CCE, BME, CIVIL, MECH, MECHATRONICS

Prerequisite	Fundamental knowledge in Computing Technologies

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Build distributed data processing applications using Apache Hadoop and Spark	K3
	CO2 Develop a streaming application using Apache Spark in teams	K3
	CO3 Experiment with Apache Kafka for processing stream data	K3
	CO4 Big Data Frameworks in teams applying best practice	K3
	CO5 Integrating Machine Learning Integration and Data Security	K2

Unit-I	Introduction to Big Data Technologoy	Periods:09

Introduction – Understanding Big Data – Big Data: Benefiting – Managing – Organizing and Analyzing Big Data: Learning and Analytics; Technology Challenges for Big Data- Distributed File System – HDFS Design Goals – MapReduce Overview – Writing and Testing MapReduce Programs – Installing Spark and Setting up Spark Cluster – Spark Shell-Creating Spark Session Object – Resilient Distributed Datasets (RDD) – Manipulating RDD – NoSQL – SparkSQL – GraphX. **CO1**

Unit-II	Stream Processing	Periods:09

Stream Processing Concepts – Distributed Stream Processing – Stream Processing Model – Streaming Architecture – Lamda and Kappa Architecture – Structured streaming – Spark Streaming – Spark Streaming Programming Model – Other Distributed Real Time Stream Processing Systems **CO2**

Unit-III	Streaming Processing using Kafka	Periods:09

Apache Kafka – Installing Kafka – Producers and Consumers – Kafka Internals – Building Data Pipelines – Cross Cluster Data Mirroring – Administering and Monitoring Kafka – Getting started with Kafka Streams – Kafka Streams Development – Applications with Kafka Streams **CO3**

Unit-IV	Big Data Frameworks	Periods:09

Apache Flume – Overview and Architecture – Quick Start Guide to Flume – Basics of Sqoop
Integrating Sqoop with Hadoop – Getting to Grips with Zookeeper – Getting Started with Zookeeper API – Machine Learning using Apache Mahout – Clustering & Classification Algorithms in Mahout-Extending Spark with H2O – H2O.. **CO4**

Unit-V	Machine Learning Integration and Security	Periods:09

Machine learning algorithms in autonomous system – MLlib in Apache Spark for distributed machine learning – Challenges and opportunities in deploying ML models in autonomy –Security considerations for autonomous data –Ethical implications in handling large datasets in autonomous engineering **CO5**

LecturePeriods:45	TutorialPeriods:	PracticalPeriods:-	TotalPeriods:45

TextBooks

1. Mike Frampton, "Mastering Apache Spark", Packt Publishers, 2015.
2. Krishna Sankar, "Fast Data Processing using Spark 2", 3rd Edition, Packt Publishers, 2016.
3. Neha Narkhede, Gwen Shapira, and Todd Palino, "Kafka – Definitive Guide", 2017.

ReferenceBooks

1. Gerald Maas, Francois Gorillot, "Stream Processing with Apache Spark", O'Reilly Media, 2019.
2. Gaurav Vaish, "Getting Started with NoSQL", Packt Publishing Ltd, 2013.
3. William P Bejeck Jr, "Kafka Streams in Action", Manning Publications, 2018.
4. Jayani Withanawasam, "Apache Mahout Essentials", Packt Publishers, 2015.
5. Steve Hoffman, "Apache Flume: Distributed Log Collection for Hadoop", 2nd Edition, Packt Publishers, 2015.
6. Flavio Junqueira, Benjamin Reed, "ZooKeeper: Distributed Process Co-ordination Pa- perback", O'Reilly Media, 2014.

Web References

1. http://www.bigdatauniversity.com/

2.A.4.121

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	3	3
2	3	3	2	-	-	-	-	-	-	-	-	-	3	2	1
3	3	3	2	2	2	-	-	-	-	-	-	-	3	2	2
4	3	2	1	2	2	-	-	-	-	-	-	-	3	1	1
5	3	2	1	2	2	-	-	-	-	-	-	-	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	10		5	5	5	75	100

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

2.A.4.122

ANNEXURE II

Course Details - Ratification

2.A.4.123

2.A.4.124.

Department	**Information Technology**	Programme: **B.Tech.**					
Semester	**II**	Course Category: **PC**			End Semester Exam Type: **LE**		
Course Code	**U23ITPC01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Digital Design and System Architecture Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to CSE and IT)

Prerequisite	NIL	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Experiment simplifications of Boolean Gates	**K3**
	CO2 Develop any combinational logic functions and design combinational circuit	**K3**
	CO3 Demonstrate the behavior of sequential circuits	**K3**
	CO4 Simulate basic knowledge of computer organizations	**K3**
	CO5 Design memory unit and simulate memory operations	**K3**

List of Exercises **Periods: 30**

1. Design and Verification of logic gates.
2. Design and Verification of Half adder and Full adder
3. Design and Verification of Half subtractor and Full subtractor
4. Convert BCD to Excess 3 and Excess 3 to BCD
5. Design of 2-to-4 decoder
6. Design of 8-to-3 encoder
7. Design of flip flops: SR, JK and T flipflop
8. Design of a N- bit Register of Serial- in Serial –out and Serial in parallel out.
9. Design of a N- bit Register of Parallel in Serial out and Parallel in Parallel Out.
10. 8-bit simple ALU and CPU design

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

Reference Books

1. M. Morris Mano and Michael Ciletti, Digital Design, Sixth Edition, Pearson India Education Services, Pvt. Ltd., 2018
2. Stephen Brown and ZvonkoVranesic, "Fundamentals of Digital Logic with VHDL Design", Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, 2012.
3. John F.Wakerly,"Digital Design Principles and Practices",Pearson Education,Fourth Edition,2008.
4. M K Gooroochurn," Introduction to Digital Logic & Boolean Algebra",Paperback, 2018.
5. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", fifth edition, Tata McGraw Hill Education, 2011.

Web References

1. http://www.ee.surrey.ac.uk/Projects/CAL/digital-logic/gatesfunc/
2. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
3. https://www.tutorialspoint.com/digital_circuits/digital_circuits_flip_flops
4. https://www.geeksforgeeks.org/hardware-description-language/

* TE – Theory Exam, LE – Lab Exam

2.A.4.185

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	-	-	3	-	-
2	2	1	2	-	1	-	-	-	-	1	-	-	3	-	-
3	3	1	2	-	1	-	-	-	-	1	-	-	3	-	-
4	3	1	2	-	1	-	-	-	-	1	-	-	3	-	-
5	3	1	2	-	1	-	-	-	-	1	-	-	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.4.126.

Department	Information Technology	Programme: B.Tech.						
Semester	III	Course Category Code: PC				*End Semester Exam Type:TE		
Course Code	U23ITT302	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Automata Languages and Computation	3	0	0	3	25	75	100

Prerequisite	Discrete Mathematics, Design and Analysis of Algorithms	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand and construct various types of finite automata.	K3
	CO2 Write regular expressions for given pattern and convert it to automata	K3
	CO3 Convert push down Automata to context free grammar and context free grammar topush down automata	K4
	CO4 Design Turing Machine to accept regular languages and perform computations	K4
	CO5 Explore the un-decidability and NP-class problems.	K4

Unit-I	Automata and Regular Expressions	Periods:9
Need for automata theory - Introduction to formal proof – Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Equivalence between NFA and DFA – conversion of NFA into DFA. Finite Automata with Epsilon transitions – Equivalence of NFAs with and without ε-moves – conversion of NFA ε-moves into NFA. Finite Automata with output – Mealy and Moore machines		CO1
Unit-II	**Regular Expressions and Languages**	**Periods:9**
Regular expression – Regular Languages - Equivalence of Finite Automata and regular expressions – Conversion of regular expression into NFA ε-moves - Conversion of regular expression into DFA (Direct and indirect method). Minimization of DFAs. Proving languages to be not regular (Pumping Lemma) – Closure properties of regular languages.		CO2
Unit-III	**Context Free Grammar and Push Down Automata**	**Periods:9**
Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages – Derivations and Parse trees – Ambiguity in grammars and languages – Push Down Automata (PDA): Definition – Moves - Instantaneous descriptions -Languages of pushdown automata – Equivalence of pushdown automata and CFG – conversion of CFG to PDA – PDA to CFG.		CO3
Unit-IV	**Normal Forms and Turing Machines**	**Periods:9**
Normal forms for CFG – Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF). Turing Machine : Basic model – definition and representation – Instantaneous Description – Turing Machine for accepting Regular languages – TM as Computer of Integer functions(Addition & subtraction)		CO4
Unit-V	**Undecidability**	**Periods:9**
Undecidable Problems –PCP-MPCP– Classes of problems: P, NP,NP complete and NP hard – NP Complete problems - 3-CNF SAT problem – Clique Problem - Node cover Problem.		CO5

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

Text Books

1. John C Martin , "Introduction to Languages and the Theory of Computation", 4th Edition, Tata McGraw Hill, 2011.
2. Hopcroft J.E., Motwani R. & Ullman J.D., "Introduction to Automata Theory, Languages and Computations", 3rd Edition,Pearson Education, 2008.

Reference Books

1. Peter Linz, "An Introduction to Formal Language and Automata", 6th Edition, Jones & Bartlett, 2016.
2. Harry R Lewis and Christos H Papadimitriou , "Elements of the Theory of Computation", 2nd Edition, Prentice Hall ofIndia, 2015.
3. K.L.P.Mishra and N.Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2006.

2.A.4.127

Web References

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview
2. https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/
3. https://www.javatpoint.com/automata-tutorial
4. https://www.gatevidyalay.com/tag/theory-of-computation-tutorial/

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	2	3	-	-	-	-	1	1	2	3	1	3	2
2	2	2	3	2	1	-	-	-	3	3	2	3	3	1	2
3	2	2	3	2	1	-	-	-	1	3	1	2	1	2	2
4	2	2	2	1	-	-	-	-	1	3	3	2	1	3	2
5	2	2	2	1	1	-	-	-	1	1	3	2	3	1	3

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

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ANNEXURE III

HONORS/MINOR DETAILS

2.A.4.129.

Advanced Web Development

COURSE DETAILS											
Sl. No.	Sem	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
					L	T	P		CAM	ESM	Total
Theory											
1	IV	U23ITX401	Frontend Development	PC	3	1	0	4	25	75	100
2	V	U23ITX502	Advanced Databases	PC	3	1	0	4	25	75	100
3	VI	U23ITX603	Microservices and Spring-Boot	PC	3	1	0	4	25	75	100
4	VII	U23ITX704	Container Orchestration and Security	PC	3	1	0	4	25	75	100
5	VIII	U23ITX805	Cloud Management	PC	3	1	0	4	25	75	100
	Total							20*	125	375	500
Equivalent NPTEL courses##											
1	IV to VII	U23ITXN01	Web Development Equivalent NPTEL Courses					3	12 WEEKS Course		

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Department	Information Technology	Programme: B.Tech. (Honors/Minor)						
Semester	IV	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23ITX401	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Frontend Development	3	1	0	4	25	75	100

Prerequisite	Basic knowledge of Programming, Web Application Development	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the fundamentals of HTML and CSS and their role in web development.	K2
	CO2 Understand the principles of responsive design and learn to use Bootstrap for creating responsive web pages.	K2
	CO3 Implement database operations using DML and DDL commands in a relational database.	K3
	CO4 Understand the basics of Node.js and learn to build server-side applications that connect to a database.	K2
	CO5 Build an Event Management System	K3

Unit- I	HTML and CSS	Periods: 12
Introduction to Web Development - HTML Basics - CSS Basics - Advanced HTML and CSS - Hands-on Projects: Building a static web page, Creating a responsive portfolio site.		CO1

Unit- II	Bootstrap and Database Commands	Periods: 12
Introduction to Bootstrap - Advanced Bootstrap - Database Fundamentals - Database Commands (DDL, DML) - Hands-on Projects: Building a web page with Bootstrap, Basic CRUD operations in a database.		CO2

Unit- III	Connecting Database using Node js	Periods: 12
Introduction to Node.js - Node.js Basics - Building a Server with Node.js - Database Integration - Hands-on Projects: Building a RESTful API with Node.js, Connecting the API to a database.		CO3

Unit- IV	Connecting Database using Angular js	Periods: 12
Introduction to Angular.js - Angular.js Basics - Advanced Angular.js - Database Integration - Hands-on Projects: Building a dynamic web application with Angular.js, Integrating the web app with a database.		CO4

Unit- V	Case Study: Event Management System	Periods: 12
Project Planning - Frontend Development - Backend Development - Database Integration - Project Implementation - Deployment - Project Documentation.		CO5

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

Text Books

1. Jon Duckett, "HTML and CSS: Design and Build Websites", 1st Edition, Wiley, 2011.
2. Brad Dayley, Brendan Dayley, and Caleb Dayley, "Node.js, MongoDB, and Angular Web Development", 2nd Edition, Addison-Wesley Professional, 2018.
3. Shama Hoque, "Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js", 2nd Edition, Packt Publishing, 2020.

Reference Books

1. Marijn Haverbeke, "Eloquent JavaScript: A Modern Introduction to Programming", 3rd Edition, No Starch Press, 2018.
2. Kyle Simpson, "You Don't Know JS Yet: Get Started", 2nd Edition, 2020.
3. Ethan Brown, "Web Development with Node and Express: Leveraging the JavaScript Stack", 2nd Edition, O'Reilly Media, 2019.
4. Adam Freeman, "Pro Angular 9: Build Powerful and Dynamic Web Apps", 4th Edition, Apress, 2020.
5. "Learning SQL: Generate, Manipulate, and Retrieve Data", 3rd Edition, O'Reilly Media, 2020.

Web References

1. https://developer.mozilla.org/en-US/docs/Web/HTML
2. https://developer.mozilla.org/en-US/docs/Web/CSS
3. https://getbootstrap.com/docs/
4. https://nodejs.org/en/docs/
5. https://angular.io/docs

2.A.4.131

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
2	3	2	1	1	2	-	-	-	-	-	-	-	-	1	1
3	3	2	1	1	2	-	-	-	-	-	-	-	-	1	1
4	3	2	1	1	2	-	-	-	-	-	-	-	-	1	1
5	3	2	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

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Department	Information Technology	Programme: B.Tech. (Honors/Minor)						
Semester	V	Course Category Code: PC			*End SemesterExamType:TE			
CourseCode	U23ITX502	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Advanced Databases	3	1	0	4	25	75	100

Prerequisite	Database Management Systems	
CourseOutcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Illustrate parallel and distributed databases to optimize database performance in practice.	K2
	CO2 Use various Data mining and warehousing tools	K3
	CO3 Examine data on Active, spatial and temporal databases	K3
	CO4 Develop cloud-based applications	K3
	CO5 Analyze access layer in applications using recent database technologies.	K4

Unit-I	Parallel and Distributed DBMS	Periods:12
Parallel DBMS: Architecture Query evaluation - Query optimization Parallelizing individual operations. Distributed DBMS: Architecture - Storing - Data Cataloguing - Query processing - Updations - Transactions Concurrency and Recovery.		CO1

Unit-II	Data Mining, Data Warehousing	Periods:12
Data Mining: Introduction - Counting co-occurrences - Mining for rules - Tree structured rules - Clustering -Similarity search over sequences. Data Warehousing: Definition and terminology - Characteristics - Data modeling - Data warehouse Vs Views -Typical functionality of a warehouse.		CO2

Unit-III	Active, Temporal, Spatial Databases	Periods:12
Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) - Taxonomy - Applications - Design Principles for Active Rules. Temporal Databases: Overview of Temporal Databases - TSQL2 Spatial Databases - Spatial Data Types - Spatial Relationships - Spatial Data Structures - Spatial Access Methods - Spatial DB Implementation.		CO3

Unit-IV	Cloud Based Databases	Periods:12
Data Storage Systems on the Cloud - Cloud Storage Architectures - Cloud Data Models - Query Languages - Introduction to Big Data - Storage - Analysis		CO4

Unit- V	Recent Database Technologies	Periods:12
Mobile Databases - Multimedia Databases - Geographical Information Systems - Genome Data Management.		CO5

LecturePeriods: 45	TutorialPeriods: 15	PracticalPeriods: -	TotalPeriods: 60

TextBooks

1. Thomas M. Connolly, Carolyn Begg, "Database Systems: Practical approach to Design, Implementation, and Management", Pearson Education Limited, 6th Edition,2019
2. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", 7th Edition, McGraw Hill, 2019.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems", Morgan Kaufmann publishers,2006.

ReferenceBooks

1. Martin Kleppmann,"Designing Data-Intensive Applications",2017
2. Raghu Ramakrishnan and Johannes Gehrke,"Database Management Systems", 3rd Edition, McGraw Hill Publications
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

Web References

1. http://www.exploredatabase.com/p/blog-page.html
2. http://csce.uark.edu/~cwt/COURSES/2014-01--CSCE-4543--SW-ARCH/03--CHAPTERS/Chapter09--Spatial and Temporal DBMS Extensions--Namburi.pdf
3. https://www.tutorialspoint.com/Mobile-Databases

2.A.4.133

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	2	2	3	-	-	-	-	-	-	1	3	2	-
2	3	2	2	2	3	-	-	-	-	-	-	1	3	2	-
3	3	2	2	2	3	-	-	-	-	-	-	1	3	2	-
4	3	2	2	2	3	-	-	-	-	-	-	1	3	2	-
5	3	2	2	2	3	-	-	-	-	-	-	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

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2.A.4.134

Department	Information Technology	Programme: B.Tech. (Honors/Minor)						
Semester	VI	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23ITX603	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ES E	TM
Course Name	Microservices and Spring-Boot	3	1	0	4	25	75	100

Prerequisite	Programming in JAVA, Web Technology, Database Management Systems	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand microservices architecture and develop a basic Spring Boot microservice.	K2
	CO2 Manage configuration, apply dependency injection, and use Spring Boot Actuator.	K2
	CO3 Implement service discovery, inter-service communication, and fault tolerance.	K3
	CO4 Perform data persistence, manage migrations, and implement event-driven architecture.	K3
	CO5 Secure microservices, containerize with Docker, deploy with Kubernetes, and implement monitoring and logging.	K3

Unit- I	**Introduction to Microservices and Spring Boot**	**Periods: 12**
Fundamentals of Microservices Architecture: Definition and core principles of microservices - Advantages and challenges of microservices - Comparison with monolithic architecture **Overview of Spring Boot:** Introduction to the Spring Framework - Key features and benefits of Spring Boot - Setting up a Spring Boot development environment **Creating a Basic Microservice:** Building a simple Spring Boot application - Understanding essential Spring Boot annotations - Running and testing a basic microservice		**CO1**
Unit- II	**Core Spring Boot Features**	**Periods: 12**
Configuration Management: Externalized configuration using application. Properties and application.yml - Using Spring profiles for environment-specific configurations **Dependency Injection and Bean Management:** Understanding dependency injection (DI) - Configuring beans and component scanning - Using @Autowired and other Spring annotations **Spring Boot Actuator:** Introduction to Spring Boot Actuator for monitoring - Key Actuator endpoints and their usage – Customizing Actuator endpoints		**CO2**
Unit- III	**Building and Integrating Microservices**	**Periods: 12**
Service Discovery with Eureka: Setting up a Eureka server for service discovery - Client-side load balancing using Ribbon **Inter-Service Communication:** RESTful web services with Spring Boot - Using Rest Template and Web Client for inter-service communication - Introduction to gRPC for communication **Handling Fault Tolerance:** Implementing circuit breaker pattern with Resilience4j - Configuring retries and fallbacks		**CO3**
Unit- IV	**Data Management in Microservices**	**Periods: 12**
Data Persistence with Spring Data JPA: Introduction to Spring Data JPA - Configuring and using JPA repositories - Basic CRUD operations **Database Migrations:** Using Flyway for database migrations - Managing database schema changes **Event-Driven Architecture:** Introduction to event-driven microservices - Using RabbitMQ/Kafka for messaging- Spring Cloud Stream for event-driven communication		**CO4**
Unit- V	**Security, Deployment, and Monitoring**	**Periods: 12**
Security in Microservices: Introduction to Spring Security - Implementing basic authentication and authorization - Securing microservices with OAuth2 and JWT **Containerization with Docker:** Basics of Docker and containerization - Creating Docker images for Spring Boot applications - Running Spring Boot applications in Docker containers **Microservices Orchestration with Kubernetes:** Introduction to Kubernetes - Deploying Spring Boot microservices to Kubernetes - Managing microservices with Kubernetes **Monitoring and Logging:** Implementing centralized logging with ELK stack- Monitoring microservices with Prometheus and Grafana		**CO5**

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

2.A.4.135

Text Books

1. Microservices with Spring Boot and Spring Cloud: Build Resilient and Scalable Microservices Using Spring Cloud, Istio, and Kubernetes, 2nd Edition
2. Title: "Microservices Architecture: Aligning Principles, Practices, and Culture", Author: Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen
3. Title: "Hands-On Microservices with Spring Boot and Spring Cloud: Build and deploy Java microservices using Spring Cloud, Istio, and Kubernetes", Author: Magnus Larsson

Reference Books

1. "Spring Microservices in Action" by John Carnell
2. "Building Microservices" by Sam Newman
3. "Microservices Patterns: With examples in Java" by Chris Richardson
4. "Spring Boot in Action" by Craig Walls
5. "Cloud Native Java: Designing Resilient Systems with Spring Boot, Spring Cloud, and Cloud Foundry" by Josh Long and Kenny Bastani

Web References

1. https://docs.spring.io/spring-boot/index.html
2. https://www.baeldung.com/
3. https://www.javaguides.net/p/spring-boot-microservices-tutorial.html
4. https://www.javatpoint.com/microservices
5. https://www.geeksforgeeks.org/java-spring-boot-microservices-example-step-by-step-guide/

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	1	-	1	-	-	-	-	-	-	3	2	1
2	2	3	3	3	-	3	-	-	-	-	-	-	3	2	1
3	3	3	3	3	1	3	-	-	-	-	-	-	3	2	1
4	3	3	3	3	1	3	-	-	-	-	-	-	3	2	1
5	3	3	3	3	1	3	-	-	-	-	-	-	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.4.136-

Department	Information Technology	Programme : B.Tech. (Honors/Minor)						
Semester	VII	Course Category Code :PC			End Semester Exam Type: TE			
Course Code	U23ITX704	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Container Orchestration and Security	3	1	0	4	25	75	100
IT								
Prerequisite	Networking, Cloud Computing							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Understand the basics of Container Orchestration and Security	K2
CO2	Identify Kubernetes architecture and integrating Kubernetes with CI/CD	K2
CO3	Overview of Orchestration with Docker Swarm and Other Tools	K3
CO4	Identify Security principles, encompassing authentication, authorization (RBAC).	K3
CO5	Understand the secure CI/CD integration with containers, utilizing tools	K2

UNIT-I	Introduction to Container Orchestration and Security	Periods:12	
Introduction to Docker - Server virtualization - Advantages of Docker - Docker Setup - Limitations in Docker - Convergence of containerization and virtualization - Containerization innovations			CO1
UNIT-II	**Kubernetes Concepts**	**Periods:12**	
Kubernetes Architecture - Overview of Kubernetes architecture - Integrating Kubernetes with CI/CD pipelines - Pod Lifecycle and Management - Pod states and transitions - Multi-container Pod patterns			CO2
UNIT-III	**Container Orchestration with Docker Swarm and Other Tools**	**Periods:12**	
Docker Swarm Fundamentals - Overview of Docker Swarm - Setting up a Docker Swarm cluster - Comparison with Other Orchestration Tools - Docker Swarm vs. Kubernetes - Overview of Apache Mesos			CO3
UNIT-IV	**Kubernetes Security**	**Periods:12**	
Kubernetes Security - Authentication and authorization in Kubernetes (RBAC) - Pod security policies and network policies- Securing: Kubernetes data store security - Container Security - Securing container images and runtimes Managing secrets and sensitive data in Kubernetes			CO4
UNIT-V	**Securing and Monitoring Containerized Environments**	**Periods:12**	
CI/CD Integration - Continuous integration and continuous deployment with containers - CI/CD tools: Jenkins, GitLab CI, Tekton - Automating deployments with Kubernetes and Docker - Use cases and scenarios for different Orchestration tools			CO5

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

Text Books

1. Brendan Burns, Joe Beda, Kuan-Wei Chiu, et al. , "Up and Running", 2nd edition, O'Reilly Media, 2019
2. Nigel Poulton & Pushkar Joglekar , "The Kubernetes Book", Self-published, 2018
3. Liz Rice, Michael Hausenblas , "Kubernetes Security", O'Reilly Media , 2018

Reference Books

1. Matt Butcher, Matt Farina, Josh Dolitsky, "Learning Helm: Managing Apps on Kubernetes", O'Reilly Media , 2021
2. Ivan Piskunov, "Kubernetes security. Guide for beginners from zero to hero", Self-published, 2021.
3. Josh Rosso, Rich Lander, Alex Brand, John Harris, "Production Kubernetes" ,O'Reilly Media, Inc. 2021
4. Randall Smith, "Docker Orchestration", Packt Publishing, 2017
5. Gigi Sayfan, "Mastering Kubernetes", Packt Publishing ,2020

Web References

1. https://www.cb-india.com/books/operating-systems/unix-and-linux/book-of-kubernetes/
2. https://www.oreilly.com/library/view/python-for-devops/9781492057680/ch12.html
3. https://www.powells.com/book/-9781718502642/1-0
4. https://dl.acm.org/doi/10.5555/3265145
5. https://malaysia.kinokuniya.com/The_Book_of_Kubernetes_:_A_Complete_Guide_to_Container_Orchestration/bw/9781718502642

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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 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

Department	Information Technology	Programme: B.Tech. (Honors/Minor)						
Semester	VIII	Course Category Code: PC				*End Semester Exam Type: TE		
Course Code	U23ITX805	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Cloud Management	3	1	0	4	25	75	100

Prerequisite	Computer Networks, Operating Systems	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Exhibit cloud-design skills to build and automate business solutions using cloud technologies	K4
CO2	Possess Strong theoretical foundation leading to excellence and excitement towards adoption of cloud-based services	K4
CO3	Solve the real-world problems using Cloud services and technologies	K3
CO4	Explain the Cloud Service in economical point of view	K3
CO5	Govern various Cloud Services	K3

Unit- I	Cloud Service Management Fundamentals	Periods: 12
Cloud Ecosystem - The Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models		CO1

Unit- II	Cloud Services Strategy	Periods: 12
Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture		CO2

Unit- III	Cloud Service Management	Periods: 12
Cloud Service Reference Model, Cloud Service LifeCycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management		CO3

Unit- IV	Cloud Service Economics	Periods: 12
Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models		CO4

Unit- V	Cloud Service Governance & Value	Periods: 12
IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership		CO5

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

Text Books

1. Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020
2. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013
3. Imad M. Abbadi, "Cloud Management and Security", Wiley, 1st Edition, 2014.

Reference Books

1. S.K.Rao, "Cloud Computing: Security and Risk Management", Discovery Publishing House, 2023.
2. James F. Ransome , John W. Rittinghouse, "Cloud Computing: Implementation, Management, and Security", CRC Press Inc, 1st Edition, 2009
3. Toby Velte. Anthony Velte, "Cloud Computing A Practical Approach", Tata McGraw-Hill, 2nd Edition.
4. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall, 2013
5. Dr. Kumar Saurabh, "Cloud Computing: Architecting Next-Gen Transformation Paradigms", 4th Edition, Wiley.

Web References

1. https://www.geeksforgeeks.org/cloud-management-in-cloud-computing/
2. https://www.techtarget.com/searchcloudcomputing/definition/cloud-management
3. https://aws.amazon.com/what-is/cloud-management/
4. https://www.ibm.com/topics/cloud-management
5. https://www.opentext.com/en-gb/what-is/cloud-management

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	2	2	3	-	-	-	-	-	-	1	3	2	3
2	3	2	2	2	3	-	-	-	-	-	-	1	3	2	3
3	3	2	2	2	3	-	-	-	-	-	-	1	3	2	3
4	3	2	2	2	3	-	-	-	-	-	-	1	3	2	3
5	3	2	2	2	3	-	-	-	-	-	-	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
	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

8.A.4.140