SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)
Puducherry

Minutes of Meeting

of

6th Meeting of Board of Studies

for the courses
B.Tech – Computer Science and Engineering
M.Tech-Computer Science Engineering
M.Tech-Computer Science Engineering(Big Data Analytics)

Venue
Seminar Hall, Department of CSE
4th Floor, New Building
and Online Zoom Meeting
Sri Manakula Vinayagar Engineering College
Madagadipet, Puducherry – 605 107

Date & Time
22.07.2023 & 11.00 AM Onwards

2.A.3.1

Department of Computer Science and Engineering

Minutes of 6th Board of Studies Meeting (UG)

The Sixth Board of Studies meeting of Computer Science and Engineering Department was held on **22nd July 2023 at 11:00 A.M** in Seminar Hall (CSE Department), University block, Sri Manakula Vinayagar Engineering College, with Head of the Department in the Chair through online mode.

The following members were present for the BoS meeting

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS
1.	**Dr.K. Premkumar** Professor and Head Sri ManakulaVinayagar Engineering College hodcse@smvec.ac.in 9842127679	Chairman
2.	**Mr. M. Shanmugam** Associate Professor, Sri Manakula Vinayagar Engineering College shanmugam.mm@smvec.ac.in 9444370963	Member Secretary
3.	**Dr. S. R. Balasundaram** Professor and Head Department of Computer Applications, National Institute of Technology, Trichy. blsundar@nitt.edu 9994291420	Subject Expert (Pondicherry University Nominee)
4.	**Dr.Chokkalingam Subramanian** Professor & Head, Department of Information Technology, Saveetha University, Chennai. chomas75@gmail.com 9840161575	Subject Expert (Academic Council Nominee)
5.	**Dr.S.Udhayakumar** Professor, Department of Computer Science and Engineering, Rajalakshmi Engineering College, Chennai. mailtoudhay@gmail.com 9841593116	Subject Expert (Academic Council Nominee)
6.	**S.Diwahar** Senior Engineer, Dell Technologies, Bangalore diwahar.sivaraman@gmail.com 9442300744	Representative from Industry
7.	**R.SakthiMurugan** Director,	Postgraduate Alumnus (nominated by the Principal)

9.A.23

	Interjet India Pvt. Ltd., Puducherry, sakthimuruga@gmail.com 9994298296	
8.	**Dr. M. Ganesan** Associate Professor, Department of Computer Science and Engineering, SMVEC	Internal Member
9.	**Dr. R. Ramachandiran** Associate Professor, Department of Computer Science and Engineering, SMVEC	Internal Member
10.	**Dr.J.Raja** Associate Professor, Department of Computer Science and Engineering, SMVEC	Internal Member
11.	**Dr. T. Megala** Assistant Professor Department of Computer Science and Engineering, SMVEC	Internal Member
12.	**Dr.M.A.IshrathJahan** Associate Professor, Department of English, SMVEC	Internal Member
13.	**Dr.T.Jayavarthanan** Professor and Head, Department of Physics, SMVEC	Internal Member
14.	**Dr.S.Savithiri** Professor and Head, Department of Chemistry, SMVEC	Internal Member
15.	**Prof.K.Raja** Assistant Professor, Department of Mathematics, SMVEC	Internal Member

Agenda of the Meeting	
Item No.: / BoS / 6 / 2023 / CSE / UG/ 6.1	Welcome Address and to confirm the minutes of the Fifth meeting of Board of Studies held on 17.09.2022.
Item No.: / BoS / 6 / 2023 / CSE / UG /6.2	To discuss and approve the B.Tech. Degree Regulations (R-2023), Curriculum for eight semesters and syllabi of first and second Semesters for the B.Tech Computer Science and Engineering students to be admitted from the academic year 2023-24..
Item No.: / BoS / 6 / 2023 / CSE / UG /6.3	To discuss and approve the Honours Degree Programme introducted for B.Tech Computer Science and Engineering under R-2023 regulation from the Academic Year 2023 -2024
Item No.: / BoS / 6 / 2023 / CSE / UG /6.4	To apprise about the List of Courses for Professional Electives / Open Electives / Ability Enhancement Courses / Skill Enhancement Courses / Mandatory Courses under R-2023 for the students admitted from the academic Year 2023-24
Item No.: / BoS / 6 / 2023 / CSE / UG /6.5	To apprise about the Industry Institute Interactions of the department of Computer Science and Engineering • Guest lectures

2.A.3.4

	• Internship details • MOUs • Industrial Visits • Value Added Courses
Item No.: / BoS / 6 / 2023 / CSE / UG /6.6	To apprise the End Semester Results of the students admitted in the Academic Year 2020-2021 (V sem), 2021-2022 (III sem), 2022-2023 (I sem) and to discuss about Extra-Curricular and Co-Curricular activities.
Item No.: / BoS / 6 / 2023 / CSE / UG /6.7	To apprise the schedule of the End Semester Examination to be conducted in the month of July/August 2023 and to discuss and recommend the panel of examiners to the Academic Council
Item No.: / BoS / 6 / 2023 / CSE / UG 6.8	Any other item with the permission of chair

Minutes of the Meeting

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

Item No.: / BoS / 6 / 2023 / CSE / UG 6.1

Welcome Address and to confirm the minutes of the Fifth meeting of Board of Studies held on 17.09.2022.

Chairman, BoS, apprised the minutes of 6th BoS, its implementation and then it is confirmed with the approval in 5th BoS meeting for the incorporation of minor revisions needed as mentioned below.

S. No	Regulation	Semester	Course Name with Code	Unit	Suggestions given and Changes incorporated
1.	R-20	VIII	Block chain and Cryptography (U20CST819)	I	Experts Recommended to remove the topic "Hash function and digital signature" from unit I since the syllabus as separate unit on cryptographic Techniques.
				IV	The expert panel has suggested to rename unit IV title as "Cryptography Techniques" instead of "Introduction to Cryptography"
2.	R-20	VIII	Practical-Entrepreneurship Management-(U20HSP804)	-	Experts have suggested to include latest version of the text book.

2.A.3.5

3.	R-20	VIII	Professional Elective V - Pervasive Computing (U20CSE824)	II	Recommended to include the topic "Wireless Markup Language(WML)" since introducing WML with XML would be appropriate.
4.	R-20	VIII	Professional Elective VI – Quantum Computing (U20CSE826)	-	The Expert Panel as recommended to reduce the Syllabus since it is a very new domain under research.
5.	R-20	VIII	Professional Elective VI – Trusted computing (U20CSE827)	III,V	The Expert panel has suggested to remove the title "Trusted Platform Module tools" from unit V and to include the same in unit III as unit III introduces different tools.
6.	R-20	VIII	Professional Elective VI – Client Server Computing (U20CSE828)	II	Experts have recommended to include topics on "Middleware" in Unit II
				III	Recommended to include new types of servers in Unit III.

The above correction was incorporated and approved by BoS members in 5th BoS meeting, and the details were appraised in the meeting.

Item No.: / BoS / 6 / 2023 / CSE / UG 6.2

To discuss and approve the B.Tech. Degree Regulations (R-2023), Curriculum for eight semesters and syllabi of first and second Semesters for the B.Tech Computer Science and Engineering students to be admitted from the academic year 2023-24.

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

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-23	I	Practical- Programming in C Laboratory (U23CSPC01)	-	Experts recommends to use "To write a C program" instead of "To create a C program"

2.A.3.6

The above correction was incorporated and the details of curriculum and Syllabi is enclosed in Annexure –I and II.

Item No.: / BoS / 6 / 2023 / CSE / UG 6.3

To discuss and approve the Honours Degree Programme Introducted for B.Tech Computer Science and Engineering under R-2023 regulation from the Academic Year 2023 -2024

The Details of Honours degree is apprised and approved by the experts.

Item No.: / BoS / 6 / 2023 / CSE / UG 6.4

To apprise about the List of Courses for Professional Electives / Open Electives / Ability Enhancement Courses / Skill Enhancement Courses / Mandatory Courses under 2023-24

The details of Ability Enhancement Courses / Skill Enhancement Courses / Mandatory Courses under R-2023 for the students admitted from the academic Year 2023-24 is enclosed in Annexure-I

Consideration of offering of Professional and Open electives for the IV semester students and VI semester students under R-2020 for the students admitted in the Academic Year 2021-22 and 2020-21.

The students are registered the following *professional electives* in IV and VI semester

Offering Department	Semester	Course Code / Course Name	Number of Students registered
CSE	IV	U20CSE402: E-Business	**120**
		U20CSE402: Object Oriented Analysis and Design	**68**
CSE	VI	U20CSE612: Service Oriented Architecture	188

a) The students are registered the following *Open electives* in IV and VI semester which is offered by other department

Offering Department	Semester	Course Code / Course Name	Number of Students registered
AIDS	IV	U20ADO401: Knowledge representation and reasoning	**188**
MBA	VI	U20HSO601: Product Development and Design	188

Item No.: / BoS / 6 / 2023 / CSE / UG 6.5

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

2.A.3.7

and Engineering

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

Guest lectures

The guest lectures held in the department of Computer Science and Engineering were apprised.

Internship details

The students have undergone internship program to Unisys and various other multinational companies

MOU Signed

The MOU signed with the industries was apprised.

Industrial Visits

The Industrial visit of I,II and III year were apprised.

Value Added Courses

The value added courses provided to the students was apprised and approved

The details of various Industry Institute Interactions is enclosed in Annexure-IV

Item No.: / BoS / 6 / 2023 / CSE / UG 6.6

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

The details of End semester Results and the student's participation in Extra-Curricular and Co-Curricular activities was apprised in the meeting.

Item No.: / BoS / 6 / 2023 / CSE / UG 6.7

To apprise the schedule of the End Semester Examination to be conducted in the month of July/August 2023 and to discuss and recommend the panel of examiners to the Academic Council

The list of question paper setters and Evaluators was presented and recommended by the BoS members to the academic council and the details are enclosed in Annexure-3

Item No. : BoS/ UG/ CSE 6.8

Any other item with the permission of chair.

2.A.B.8

Department of Computer Science and Engineering

Minutes of 6th Board of Studies Meeting
(M.Tech -Computer Science and Engineering)

Agenda of the Meeting	
Item No. : BoS / 6 / 2023 / CSE / PG /6.1	Welcome Address and to confirm the minutes of the Fifth meeting of Board of Studies held on 17.09.2022
Item No. : BoS / 6 / 2023 / CSE / PG/ 6.2	To discuss and approve the M.Tech. Degree Regulations (R-2023), Curriculum for four semesters and syllabi of first and second Semesters for the M.Tech Computer Science and Engineering students to be admitted from the academic year 2023-24
Item No. : BoS / 6 / 2023 / CSE / PG /6.3	To apprise the End Semester Results of the students admitted in the Academic Year 2021-2022 (III sem), 2022-2023 (I sem). and to discuss about Extra-Curricular and Co-Curricular activities.
Item No. : BoS / 6 / 2023 / CSE / PG /6.4	To apprise about the List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24.
Item No. : BoS / 6 / 2023 / CSE / PG /6.5	To apprise the schedule of the End Semester Examination to be conducted in the month of July/August 2023 and to discuss and recommend the panel of examiners to the Academic Council
Item No. : BoS / 6 / 2023 / CSE / PG /6.6	Any other item with the permission of chair

Minutes of the Meeting

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

Item No. : **BoS / 6 / 2023 / CSE / PG /6.1**

Welcome Address and to confirm the minutes of the Fifth meeting of Board of Studies held on 17.09.2022

Chairman, BoS, apprised the minutes of 6th BoS, its implementation and then it is confirmed with the approval in 5th BoS meeting.

Item No. : **BoS / 6 / 2023 / CSE / PG /6.2**

To discuss and approve the M.Tech. Degree Regulations (R-2023), Curriculum for four semesters and syllabi of first and second Semesters for the M.Tech Computer Science and Engineering students to be admitted from the academic year 2023-24

2.4.3.9

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

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-23	I	Advanced Data structures and Algorithms (P23CSTD01)	V	Experts recommended to rename unit v name "Linear Programming" to "Dynamic Programming"
2	R-23	I	Block chain and crypto currency (P23CSE104)	I	Experts recommends to rename "Basic of Blockchain" to "Introduction to blockchain"
3	R-23	II	Advanced Operating Systems (P23CST205)	V	Experts recommended to include Tiny OS
4	R-23	II	Smart sensing for IOT (P23CSE210)	V	Experts recommended to rename "Preparing for IOT project as "IOT Projects"

The above correction was incorporated and approved by BoS members in 6th BoS meeting, and the details are enclosed in Annexure - V.

Item No. : BoS / 6 / 2023 / CSE / PG/ 6.3

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

The panel discussed about Results of I and III semester and the students participation in Extra-Curricular and Co-Curricular activities

Item No. : BoS / 6 / 2023 / CSE / PG /6.4

To apprise about the List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24.

Discussed about the offering of List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24 and the same was approved by BoS members and details are enclosed in Annexure-V

Item No. : BoS / 6 / 2023 / CSE / PG/ 6.5

To apprise the schedule of the End Semester Examination to be conducted in the month of July/August 2023 and to discuss and recommend the panel of examiners to the Academic Council

The list of question paper setters and Evaluators was presented and recommended by the

2.A.3.10

BoS members to the academic council (enclosed in Annexure-III)

Item No. : BoS / 6 / 2023 / CSE / PG/ 6.6

Any other item with the permission of chair

The panel discussed about bringing up new industry oriented topic in curriculum

2. A.B.11

Department of Computer Science and Engineering

Minutes of 6th Board of Studies Meeting
M.Tech- Computer Science Engineering(Big Data Analytics)

Agenda of the Meeting	
Item No. : BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA) /6.1	To discuss and approve the M.Tech. Degree Regulations (R-2023), Curriculum for four semesters and syllabi of first and second Semesters for the M.Tech Computer Science Engineering (Big Data Analytics) students to be admitted from the academic year 2023-24.
Item No. : BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA) /6.2	To apprise about the List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24
Item No. : BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA) /6.3	Any other item with the permission of chair

Minutes of the Meeting

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

Item No. : BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA) /6.1

To discuss and approve the M.Tech. Degree Regulations (R-2023), Curriculum for four semesters and syllabi of first and second Semesters for the M.Tech Computer Science Engineering (Big Data Analytics) students to be admitted from the academic year 2023-24.

The M.Tech. Degree curriculum and syllabus approval of I and II semesters under Autonomous Regulations 2023 for the M.Tech Programme and the students admitted in the AY 2023-24 were discussed and recommended with the following modifications.

S. No	Regulation	Semester	Subject Name with code	Unit	Particulars
1	R-23	I	Big Data Framework (P23BDT103)	II	Panel members suggested to rename title of the unit as "Hadoop ecosystem"

2.A.3.12

				III	Experts suggested to Include topics related to "spark"
2	R-23	I	Semantic web and knowledge Management (P23BDE214)	III	Panel members suggested to rename title of the unit III as "Introduction to Knowledge management"

The above correction was incorporated and approved by BoS members in 6th BoS meeting, and the details are enclosed in Annexure – VI.

Item No. : BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA)/ 6.2

To apprise about the List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24.

Discussed about the offering of List of Courses for Professional Electives / Ability Enhancement Courses under R-2023 for the students admitted from the academic Year 2023-24 and the same was approved by BoS members and details enclosed in Annexure-VI

Item No.: BoS / 6 / 2023 / CSE / PG – M.Tech. CSE (BDA) /6.3

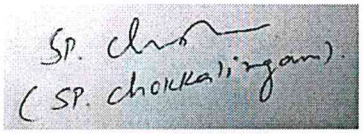
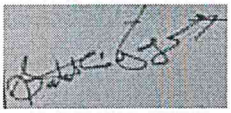
Any other item with the permission of chair

No other item discussed by the panel.

The meeting for the above Agenda regarding B.Tech – Computer Science and Engineering, M.Tech-Computer Science and Engineering and M.Tech-Computer Science Engineering(Big Data Analytics) was concluded by 3:00 pm by **Dr. K.Premkumar**, Chairman-BoS and Head of Department, Department of Computer Science and Engineering, Sri Manakula Vinayagar Engineering College.

Sl.No	Name of the Member with Designation and official Address	Responsibility in the BoS	Signature
1.	Dr. K.Premkumar Professor and Head, Department of Computer Science and Engineering, Sri Manakula Vinayagar Engineering College	Chairman	
2.	Mr. M. Shanmugam Associate Professor, Department of Computer Science and Engineering Sri Manakula Vinayagar Engineering College	Member Secretary	

2.A.3.13

External Members			
3.	Dr. S. R. Balasundaram, Professor and Head Department of Computer Applications, National Institute of Technology, Trichy.	Subject Expert (Pondicherry University Nominee)	S. R. Balasundaram
4.	Dr. Chokkalingam Subramanian, Professor & Head, Department of Information Technology, Saveetha University, Chennai.	Subject Expert (Academic Council Nominee)	
5.	Dr.S.Udhayakumar, Professor, School of Engineering , Amrita Vishwa Vidyapeetham, Chennai .	Subject Expert (Academic Council Nominee)	
6.	S.Diwahar, M.Tech., Senior Engineer, Dell Technologies, Bangalore	Representative from Industry	
7.	R.Sakthi Murugan, Director, Interjet India Pvt. Ltd., Puducherry.	Postgraduate Alumnus (nominated by the Principal)	
Internal Members			
8.	Dr. M.Ganesan Professor, Department of CSE, SMVEC.	Internal Member	M. Ganesan
9.	Dr.R.Ramachandiran Associate Professor, Department of CSE, SMVEC.	Internal Member	R. Ramachandiran
10.	Dr.J.Raja Associate Professor, Department of CSE, SMVEC	Internal Member	
11.	Dr.T.Megala Assistant Professor, Department of CSE, SMVEC	Internal Member	
Co-opted Members			
12.	Dr.M.A.Ishrath Jahan Associate Professor, Department of English, SMVEC	Internal Member	
13.	Dr.T.Jayavarthanan Professor, Department of Physics, SMVEC	Internal Member	
14.	Dr.S.Savithiri, Professor, Department of Chemistry, SMVEC	Internal Member	

2.A.3.14

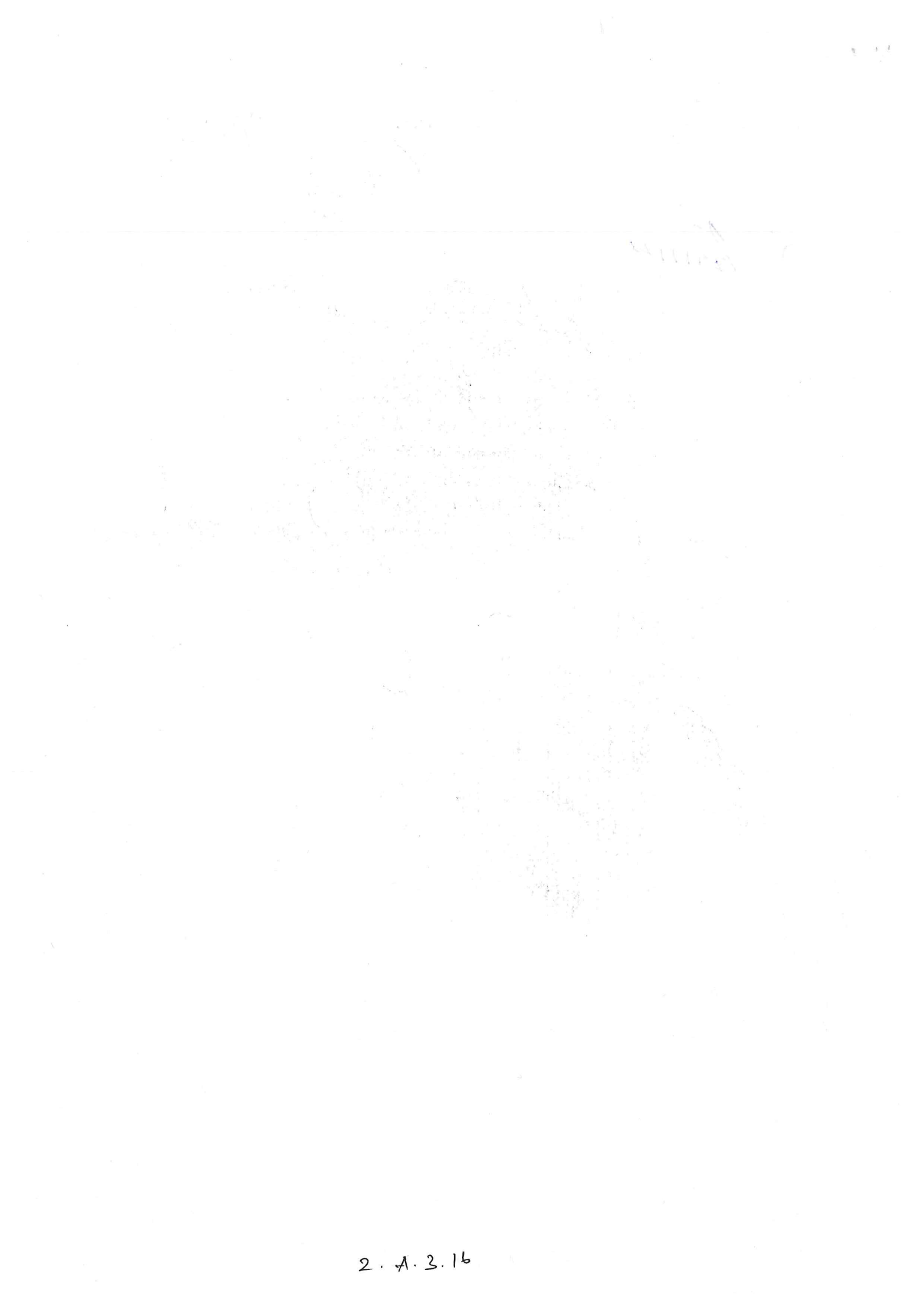
15.	Prof.K.Raja, Assistant Professor, Department of Mathematics, SMVEC	Internal Member	

Head of the department
(Dr.K.Premkumar)

Dean-Academics
(Dr.S.Anbumalar)

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

2.A.3.15



ANNEXURE I
CURRICULUM
B.TECH.
COMPUTER SCIENCE AND ENGINEERING

2.A.3.17

2. A·3·18

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

B.TECH.

COMPUTER SCIENCE AND ENGINEERING

ACADEMIC REGULATIONS 2023
(R - 2023)

Dr.K.PREMKUMAR
Professor & Head
Dept. of Computer Science and Engg.
Sri Manakula Vinayagar Engg. College
[An Autonomous Institution]

CURRICULUM

25 years of ACADEMIC EXCELLENCE

2.A.3.19

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 create a productive learning and research environment for graduates to become highly dynamic, competent, ethically responsible, professionally knowledgeable in the field of computer science and engineering to meet the industrial needs on par with global standards.

MISSION

M1: Quality Education: Empowering the students with the necessary technical skills through quality education to grow professionally.

M2: Innovative Research: Advocating the innovative research ideas by incorporating with industries for developing products and services.

M3: Placement and Entrepreneurship: Advancing the education by strengthening the Industry-academic relationship through hands-on training to seek placement in the top most industries or to develop a start-ups.

M4: Ethics and Social Responsibilities: Stimulating professional behaviour and good ethical values to improve the leadership skills and social responsibilities.

2.A.3.20

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.

2.A.3.21

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Competitive Platform: To create a competitive platform for solving critical problems in a wide variety of fields.

PEO2: Exploration: Enthusiastic participation in learning, understanding, designing and applying new innovative research ideas as the field evolves.

PEO3: Career: Applying cutting-edge technology that improves knowledge and to commit students for life-long learning to reach the leading positions in the career.

PEO4: Professional Values: Simulate the graduates to hold the responsibilities in the context of technology, ethics, society and humanity.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Computational Skills: Graduates with the ability to apply basic knowledge of Computer Science in solving the critical problems.

PSO2: Studious Research: Ability to convert innovative ideas into research or society oriented projects through current trending technologies.

PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical business skills with the contemporary trends in the industry.

2. A. 3. 22

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl. No.	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including 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 Electives Courses (PE)	18
6	Open Electives Courses (OE)	9
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	
9	Mandatory Courses (MC*)	-
Total		**170**

SCHEME OF CREDIT DISTRIBUTION - SUMMARY

Sl. No	AICTE Suggested 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)	8	3	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	Employability Enhancement Courses (AEC)*	-	-	-	-	-	-	-	-	-
10	Mandatory Courses (MC)*	-	-	-	-	-	-	-	-	-
Total		**25**	**19**	**23**	**23**	**21**	**22**	**20**	**17**	**170**

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

HONOURS DEGREE PROGRAMME:

The student is permitted to opt for earning an *honours degree* in the same discipline ofengineeringin addition to the degree in his/her own discipline. 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.The prescribed courses offered for Honours degree are given in **Annexure IV**.

2.A.3.23

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	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	U23CSTC02	Problem Solving Approach	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	U23AEC1XX	Certification Course – I **	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23CSM101	Induction Programme	MC	2 Weeks			-	-	-	-
							21	425	575	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	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	U23AEC2XX	Certification Course – II **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CSM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							23	575	625	1200

*** Certification Courses are to be selected from the list given in Annexure III***

2.A.3.24

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23ITTC02	Microprocessors and Embedded Systems	PC	3	0	0	3	25	75	100
3	U23CST301	Software Engineering and Testing	PC	3	0	0	3	25	75	100
4	U23CSDC01	Automata and Compiler Design	PC	3	0	0	3	25	75	100
5	U23CST302	Computer Networks	PC	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSBC01	Design and Analysis of Algorithms	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC01	General Proficiency -I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ITPC02	Microprocessors and Embedded Systems Laboratory	PC	0	0	2	1	50	50	100
10	U23CSP301	Software Engineering and Testing Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23AEC3XX	Certification Course – III**	AEC	0	0	4	-	100	-	100
12	U23CSS301	Skill Enhancement Course – I*	SEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23CSM303	Climate Change	MC	2	0	0	-	100	-	100
							23	675	625	1300

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC05	Discrete Mathematics	BS	3	1	0	4	25	75	100
2	U23ITTC03	Programming in Java	ES	3	0	0	3	25	75	100
3	U23CSTC05	Operating Systems	PC	3	0	0	3	25	75	100
4	U23CSTC06	Database Management Systems	PC	3	0	0	3	25	75	100
5	U23CSE4XX	Professional Electivel #	PE	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSB401	Cloud Computing and Big Data	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency -II	HS	0	0	2	1	50	50	100
8	U23ITPC03	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
9	U23CSPC03	Operating Systems Laboratory	PC	0	0	2	1	50	50	100
10	U23CSPC04	Database Management Systems Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23AEC4XX	Certification Course – IV **	AEC	0	0	4	-	100	-	100
12	U23CSS402	Skill Enhancement Course -II *	SEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23CSM404	Right to Information and Good Governance	MC	2	0	0	0	100	-	100
							23	675	625	1300

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

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

2.A.3.25

SEMESTER – V										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23CST503	Android Programming	PC	3	0	0	3	25	75	100
3	U23CSTC07	Artificial Intelligence	PC	3	0	0	3	25	75	100
4	U23CST504	Web Designing	PC	3	0	0	3	25	75	100
5	U23CSE5XX	Professional Elective II #	PE	3	0	0	3	25	75	100
6	U23XXO5XX	Open Elective $	OE	3	0	0	3	25	75	100
Practical										
7	U23CSP502	Android Programming Laboratory	PC	0	0	2	1	50	50	100
8	U23CSPC05	Artificial Intelligence Laboratory	PC	0	0	2	1	50	50	100
9	U23CSP503	Web Designing Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23CSW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23AEC5XX	Certification Course–V **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CSM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	600	600	1200

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23ITTC04	Machine Learning	PC	3	0	0	3	25	75	100
2	U23CST605	Designing and Building of Bots	PC	3	0	0	3	25	75	100
3	U23CST606	Animation and Visual Effects	PC	3	0	0	3	25	75	100
4	U23CSE6XX	Professional Elective III #	PE	3	0	0	3	25	75	100
5	U23XXO6XX	Open Elective II $	HS	3	0	0	3	25	75	100
Theory Cum Practical										
6	U23CSB602	Blockchain Concepts and Applications	PC	2	0	2	3	50	50	100
Practical										
7	U23ITPC04	Machine Learning Laboratory	PC	0	0	2	1	50	50	100
8	U23CSP604	Designing and Building of Bots Laboratory	PC	0	0	2	1	50	50	100
9	U23CSP605	Animation and Visual Effects Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23CSW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23AEC6XX	Certification Course – VI **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23CSM606	Gender Equality	MC	2	0	0	-	100	-	100
							22	625	575	1200

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

2.A.3.26

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23CST707	IoT and Edge Computing	PC	3	0	0	3	25	75	100
2	U23CST708	Data Science and Digital Marketing Analytics	PC	3	0	0	3	25	75	100
3	U23CST709	Network Security and Cryptography	PC	3	0	0	3	25	75	100
4	U23CSE7XX	Professional Elective IV #	PE	3	0	0	3	25	75	100
5	U23XXO7XX	Open Elective III $	OE	3	0	0	3	25	75	100
Practical										
6	U23CSP706	IoT and Edge Computing Laboratory	PC	0	0	2	1	50	50	100
7	U23CSP707	Data Science and Digital Marketing Analytics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
8	U23CSW703	Project phase – I	PA	0	0	4	2	50	50	100
9	U23CSW704	Internship / Inplant Training	PA	0	0	2	1	100	-	100
							20	375	525	900

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	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	U23CSE8XX	Professional Elective V #	PE	3	0	0	3	25	75	100
3	U23CSE8XX	Professional Elective VI #	PE	3	0	0	3	25	75	100
Project Work										
4	U23CSW805	Project phase – II	PA	0	0	16	8	50	100	150
							17	125	325	450

2.A.3.27

ANNEXURE - I
PROFESSIONAL ELECTIVE COURSES

Professional Elective –I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE401	Programming in C++
2.	U23CSE402	Cryptography for Cyber Security
3.	U23CSE403	Distributed Systems
4.	U23CSE404	IoT Design Protocols
5.	U23CSE405	Cognitive Neuroscience
Professional Elective –II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE506	Programming in C#
2.	U23CSE507	Network Security through Data Analysis
3.	U23CSE508	Azure Cloud
4.	U23CSE509	IOT challenges and Future
5.	U23CSE510	Human Cognitive Process
Professional Elective –III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE611	Haskell Programming
2.	U23CSE612	Information Security
3.	U23CSE613	Cloud Data Management
4.	U23CSE614	Open Source Programming for IOT
5.	U23CSE615	Computational Neuroscience
Professional Elective –IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSEC01	Go Programming
2.	U23CSE716	Cyber Forensics
3.	U23CSE717	Service Oriented Computing
4.	U23CSE718	Internet Cryptography
5.	U23CSE719	Brain Inspired Computing
Professional Elective –V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE820	Redux Programming
2.	U23CSE821	Mobile and Wireless Security
3.	U23CSE822	Cloud Security
4.	U23CSE823	Introduction to Industry 4.0
5.	U23CSE824	Cognitive Modelling
Professional Elective –VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1.	U23CSE825	Kotlin Programming
2.	U23CSE826	Internet Protocols and Networking
3.	U23CSE827	Distributed operating System
4.	U23CSE828	IOT Security
5.	U23CSE829	Computational and Cognitive models of perception: Vision, Sound

2.A.3.28

ANNEXURE - II
OPEN ELECTIVE COURSES (R-2023)

S.No	Course Code	Course Title	Offering Department	Permitted Departments
Open Elective – I (Offered in Semester V/VI)				
1	U23CSO501	Structured Query Language	CSE	ECE, EEE, ICE, MECH, CIVIL, BMI and MECHTRONICS
2	U23CSO502	Computer Peripherals and Networking	CSE	Offered to all Branches
Open Elective – II (Offered in Semester VII)				
1	U23CSO701	Web Programming	CSE	ECE, EEE, ICE, MECH, CIVIL, BMI AND MECHTRONICS
2	U23CSO702	Cloud Technology	CSE	ECE, EEE, ICE, MECH, CIVIL, BMI and MECHTRONICS

2.A.3.29

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
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

2.A.3.30

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

ABILITY ENHANCEMENT COURSES - (B) SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1.	U23CSS301	Skill Enhancement Course 1 *
		1) Computer Assembly and Troubleshooting
		2) Aptitude - I
		3) Electronic Devices and Circuits
2.	U23CSS402	Skill Enhancement Course 2 *
		1) Exploring Photoshop
		2) Aptitude - II
		3) Office Automation

**** Any one course to be selected from the list***

2.A.3.32

ANNEXURE – IV

HONORS DEGREE

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

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

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

2 · A · 3 · 33

2. A · 3 · 34

ANNEXURE II
SYLLABUS

B.Tech.
Computer Science and Engineering

2. A. 3. 35

2.A.3.36

SEMESTER I

2.A.3.37

Department	**Mathematics**			Programme:**B.Tech.**			
Semester	**I**			Course Category: **BS**		End Semester Exam Type: **TE**	
Course Code	**U23MATC01**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Engineering Mathematics – I**	**3**	**1**	**-**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS)

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept of Eigen values and Eigen vectors, Diagonalization of a Matrix	**K3**
	CO2 Solve higher order differential equations	**K3**
	CO3 Understand the different types of partial differential equations	**K3**
	CO4 Know about the Applications of double and triple integrals	**K3**
	CO5 Gain the knowledge about Vector Calculus and its Applications	**K3**

UNIT – I	**Matrices**	**Periods:12**	
Rank of a Matrix – Systems of Linear Equations – Characteristic equation – Cayley Hamilton Theorem – Eigen values and Eigen vectors of a real Matrix–Diagonalization of Matrices.			**CO1**

UNIT – II	**Differential Equations (Higher Order)**	**Periods:12**	
Linear Differential equations of higher order with constant coefficients – Euler's linear equation of higher order with variable coefficients –Method of Variation of parameters.			**CO2**

UNIT – III	**Functions Of Several Variables**	**Periods:12**	
Partial derivatives – Total derivatives – Maxima and Minima of two variables – Lagrange's Method of multipliers.			**CO3**

UNIT – IV	**Multiple Integrals**	**Periods:12**	
Multiple Integrals – Change of order of integration (Cartesian form). Applications: Area as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).			**CO4**

UNIT – V	**Vector Calculus**	**Periods:12**	
Gradient – Divergence and Curl – Directional derivatives – Irrotational and Solenoidal vector fields – Properties (Statement only) – Gauss Divergence Theorem and Stoke's Theorem (without proofs).			**CO5**

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

Text Books

1. M.K. Venkataraman, "Engineering Mathematics",The National Publishing Company, 2nd Edition Chennai, 2016.
2. N. P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.
3. S. Narayanan and T.K. Manickavasagam Pillay," Differential Equations and Its Applications", Viswanathan.S, Printers & Publishers Pvt Ltd, 2009.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics – I)" Balaji Publications, 9th Edition June 2023
2. A. Singaravelu, "Engineering Mathematics – I", Meenakshi publications, 1998.
3. Erwin Kreyszig, "Advanced Engineering Mathematics ", Wiley, 10th Edition, 2019.
4. B.V.Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics", A Programmed Approach, 3rd Edition, 2019.

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1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra –slides- systems of equation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

* TE – Theory Exam, LE – Lab Exam

2.A.3.39

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	1	1	-	-	-	-	1	3	-	-
2	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
3	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
4	3	2	1	1	-	1	1	-	-	-	-	1	3	-	-
5	2	2	1	-	-	-	1	-	-	-	-	1	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.3.40

Department	EEE and ECE	Programme: B.Tech.						
Semester	I / II	Course Category: ES				End Semester Exam Type: TE		
Course Code	U23ESTC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Basics of Electrical and Electronics Engineering	3	-	-	3	25	75	100

(Common to CSE, IT, MECH, CIVIL, MCTR, CCE, AI&DS, FT and CSBS Branches)

Prerequisite	Mathematics and Physics	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Apply the basic concepts and various laws in DC circuits.	K3
CO2	Analyze the AC circuits and develop resonance conditions for transmitter and receiver circuits.	K3
CO3	Gain the knowledge of power system components, importance of electrical safety measures and real time applications of transformer and motor.	K2
CO4	Understand the operator of semiconductor diode and its applications.	K2
CO5	Explain the characteristics and operation of BJT and FET.	K2
CO6	Relate and Explain Different Communication Systems.	K2

Section A – Electrical Engineering

UNIT - I	DC Circuits	Periods: 8
Concept of Potential Difference, Current, Resistance, Inductance and Capacitance, Work, Power, Energy, Current and Voltage sources - ideal and practical sources - concept of dependent and independent sources, Ohm's law, Kirchhoff's law, Series parallel combination of R, L, C components, Voltage Divider and Current Divider Rules, Mesh and Nodal analysis, Star/Delta transformation, Network Theorems - Superposition, Thevenin, Norton and Maximum Power Transfer.		CO1

UNIT - II	AC Circuits	Periods: 8
AC waveform definitions - form factor, peak factor, R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, Resonance in series and parallel circuits, band-width and quality factor, Three Phase balanced AC Circuits (Y-Δ and Y-Y) - Power Measurement – Two Wattmeter method.		CO2

UNIT - III	Electrical Safety and Electrical Machines	Periods: 7
Layout of electrical power system and its functions, Wiring Accessories, Types of domestic wiring, Necessity of earthing, insulators and cables, Safety devices - fuse, relay and circuit breaker - Sensors and its types. Faraday's Law of electromagnetic induction, Fleming's Right and Left hand rule - DC Generator and DC Motor - construction, principle, load test and performance characteristics - Auto transformer, Single phase transformer- construction, principle, load test - Single phase capacitor start and run induction motor – Load test.		CO3

Section B – Electronics Engineering

UNIT - IV	Semiconductor Diodes And Applications	Periods: 7
Introduction semiconductor materials – Doping - Intrinsic and Extrinsic Semiconductor – PN junction diode, structure, characteristics - diffusion and depletion capacitance - Rectifier, Half wave and Full wave rectifier - zener diode characteristics - zener diode as regulator – Light Emitting Diode (LED) - Solar Cell.		CO4

UNIT - V	Transistors	Periods: 7
Bipolar Junction Transistor - construction – operation - Common Base, Common Emitter, Common collector Configuration – characteristics – Biasing - numerical application. Junction Field Effect Transistor (JFET), Metal oxide semiconductor Field Effect Transistor, EMOSFET-DMOSFET operation characteristics - Numerical application.		CO5

UNIT - VI	Communication Systems	Periods: 8
Need for Modulation – Block diagram of analog communication System - AM, FM, PM Definitions and Waveforms – Comparison of digital and analog communication system- Block diagram of digital communication system – Electromagnetic Spectrum. Wired and wireless Channel – Block diagram of communication systems – satellite communication – Cellular Mobile Communication – Fibre Optical Communication System.		CO6

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

Text Books

1. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2017.
2. Dr. R. Saravanakumar, Dr.V. Jegathesan, Dr. K. Vinoth Kumar, Dr. K. Kowsalya, "Basic Electrical and Electronics Engineering", Wiley Publisher, 2nd Edition, 2022.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018.

2.A.3.41

Reference Books

1. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2017.
2. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. B. L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology – Volume - II", S Chand & Co. Ltd., New Delhi, 23rd Edition, 2009.
4. David. A. Bell, "Electronic Devices and Circuits", PHI Learning Private Ltd, India, 4th Edition, 2020
5. Wayne Tomasi, "Electronic Communication Systems- Fundamentals Theory Advanced", Pearson Education, 6th Edition, 2018.

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1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electrical4u.com/
3. https://nptel.ac.in/courses/108/102/108102146/
4. https://onlinecourses.nptel.ac.in/noc21_ee55/
5. https://nptel.ac.in/courses/117/102/117102059

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
2	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
3	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
4	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
5	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-
6	3	3	3	-	2	-	-	-	-	-	-	1	3	2	-

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

Evaluation Methods

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

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

2.A.3.42

Department	Computer Science and Engineering	Programme:B.Tech.						
Semester	I / II	Course Category: ES			End Semester Exam Type: TE			
Course Code	U23CSTC01	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in C	3	-	-	3	25	75	100

(Common to All Branches Except CSBS and FT)

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

UNIT - I	Introduction	Periods:09	
Generation and Classification of Computers - Block Diagram of a Computer –Categories of Software – Network Structure - Number System – Binary – Decimal – Conversion – Algorithm – Pseudo code – Flow Chart.			CO1
UNIT - II	**C Programming Basics**	**Periods:09**	
Introduction to 'C' Programming – Basic structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations – Decision Making and Branching – Looping statements.			CO2
UNIT - III	**Arrays and Functions**	**Periods:09**	
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations- Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion			CO3
UNIT - IV	**Structure and Pointers**	**Periods:09**	
Structure Introduction – Structure definition – Structure declaration – Structure within a structure –Self Referential Structure. Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays -Pointer to Function –Pointer and Structure- Simple programs.			CO4
UNIT - V	**Unions and Files**	**Periods:09**	
Union Introduction - Programs Using Structures and Unions – Introduction to File - File Operations - File Input and Output Functions - Random Access to Files - File System Functions - Command Line Arguments- Storage Classes - Pre-Processor Directives- Dynamic Memory Functions.			CO5

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

Text Books

1. Balagurusamy. E, "Programming in ANSI C", Tata McGraw Hill, 8thEdition,2019.
2. Yashvant Kanetkar, "Let us C", BPB Publications, 16th Edition, 2017.
3. Herbert Schildt," C: The Complete Reference", McGraw Hill, FourthEdition,2014.

Reference Books

1. Vikas B. Agarwal Jyoti P. Mirani, "Computer Fundamentals, Nirali Prakashan Aug-2019.
2. Ashok N Kamthane, "Computer Programming", Pearson education, Second Impression,2012.
3. Vikas Verma, "A Workbook on C ", Cengage Learning, Second Edition,2012.
4. P. Visu, R.Srinivasan and S. Koteeswaran, "Fundamentals of Computing and Programming", Fourth Edition, Sri Krishna Publications, 2012.
5. PradipDev, ManasGhoush, "Programming in C", Second Edition, Oxford University Press, 2011.

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1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

* TE – Theory Exam, LE – Lab Exam

2.A.3.43

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2.A.3.44

Department	Computer Science and Engineering	Programme:B.Tech						
Semester	I	Course Category: PC			*End Semester Exam Type: TE			
Course Code	U23CSTC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Problem Solving Approach	3	-	-	3	25	75	100

(Common to CSE, ICE and CCE)

Prerequisite	NIL	
Course Outcomes	**After completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the basic concepts of computational thinking and problem solving.	K2
	CO2 Explain basic concepts of algorithm and data organization.	K2
	CO3 Illustrate algorithmic solution to problem solving.	K3
	CO4 Explain the concepts of array, merging, sorting & searching.	K2
	CO5 Implement recursive algorithm to solve problems.	K3

UNIT-I	**Computational Thinking and Logic-Solving Problems**	**Periods:9**	
Computational Thinking – Information and Data – Converting Information into Data – Data Capacity – Data Types and Encoding – Logic-Solving Problems – Limits of Computation – Pseudocode and Flow Chart.			**CO1**
UNIT-II	**Algorithmic Thinking and Data Organization**	**Periods:9**	
Algorithmic Thinking: Algorithms – Software and Programming Languages – Actions. Data Organization: Name list, Graph Hierarchies – Spread Sheets – Text processing – Patterns – Pseudocode and Flow Chart.			**CO2**
UNIT-III	**Fundamental Algorithms and Factoring Methods**	**Periods:9**	
Fundamental Algorithms: Exchanging – Counting – Summing – Factorial Computation – Fibonacci Sequence – Reversing the Digit-Base Conversion – Character to number conversion. Factorial Methods: Finding Square Root – Greatest Common Divisor – Prime Number – Prime Factor – Pseudocode and Flow Chart.			**CO3**
UNIT-IV	**Array, Merging, Sorting and Searching**	**Periods:9**	
Array Techniques: Introduction – Array order reversal – Array Counting or Histogramming – Maximum and Minimum of a Set – Removal of Duplicate – Partitioning – Longest monotone. Sorting and searching: Sorting by Bubble, Selection, Insertion. Searching: Linear, Binary – Pseudocode and Flow Chart.			**CO4**
UNIT-V	**Text Processing, Pattern Searching and Recursive Algorithms**	**Periods:9**	
Key word Searching – Text Line Adjustment – Linear Pattern Search – Sub Linear Pattern Search. Recursion:Towers of Hanoi–Sample Generation – Combination Generation – Permutation Generation – Pseudocode and Flow Chart.			**CO5**

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

Text Books

1. David Riley and Kenny Hunt, "Computational Thinking for Modern Problem Solver", Chapman & Hall/CRC Text Books in Computing, 2014.
2. R.G. Dromey, "How to solve it by Computer",PHI,2008.
3. Vickers Paul, "How to Think like a Programmer: Problem Solving for the Bewildered", Cengage Learning EMEA,2008.

Reference Books

1. Kathryn Rentz, Paula Lentz, "A Problem-solving Approach", McGraw-Hill Education,2018.
2. Don McAdam, Roger Winn, "A Problem-solving Approach", Prentive Hall Canada; 2nd Edition, 2017.
3. V Anton Spraul, "Think Like a Programmer: An Introduction to Creative Problem Solving", Cengage Learning EMEA, 2012.
4. Sham Tickoo "A Problem-solving Approach", Delmar/Cengage Learning, 2009.
5. Harold Abelson & Gerald Jay Sussman, "Structure and Interpretation of Computer Programs", McGraw-Hill Book Company, 1997.

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1.https://www.edx.or g/learn/problem-solving
2. https://www.lynda.com/Business-Skills-tutorials/Problem-Solving-Techniques/553700-2.html
3. https://www.classcentral.com/course/problem-solving-skills-6687

* TE – Theory Exam, LE – Lab Exam

2.A.3.45

COs/POs/PSOs Mapping

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

2.A.3.46

Department	Computer Science and Engineering	Programme:B. Tech.						
Semester	I / II	Course Category: HS				End Semester Exam Type: TE		
Course Code	U23HSTC01	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Universal Human Values – II	2	-	-	2	25	75	100
(Common to all Branch)								
Prerequisite	UHV – I							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	K2
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K2
CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession	K2
CO4	Examine the role of a human being in ensuring harmony in society and nature.	K2
CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	K2

UNIT - I	Introduction to Value Education	Periods: 06
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education - Self-exploration as the Process for Value Education - Basic Human Aspirations - Happiness and Prosperity - Current Scenario- Method to Fulfil the Basic Human Aspirations		CO1
UNIT - II	**Harmony inthe Human Being**	**Periods: 06**
Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health		CO2
UNIT - III	**Harmony in the Family and Society**	**Periods: 06**
Harmony in the Family - Basic Unit of Human Interaction- 'trust' - Foundational Value in Relationship - 'Respect' - as the Right Evaluation - Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society-Vision for the Universal Human Order.		CO3
UNIT - IV	**Harmony in the Nature / Existence**	**Periods: 06**
Understanding Harmony in the Nature-Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - Holistic Perception of Harmony in Existence		CO4
UNIT - V	**Implications of the Holistic Understanding - A Look at Professional Ethics**	**Periods: 06**
Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value - based Life and Profession		CO5
Lecture Periods:30	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 30**

Text Book

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition, New Delhi, 2019.

Reference Books

1. A Nagraj, Jeevan Vidya Prakashan, Amarkantak, "Jeevan Vidya: EkParichaya", 2013.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 3rd Edition, 2019.
3. Annie Leonard, "The Story of Stuff", Free Press, Reprint Edition, 2011.
4. Mohandas Karam chand Gandhi, "The Story of My Experiments with Truth – Mahatma Gandhi Autobiography", Finger print Publisher, 2009.
5. E. F Schumacher, "Small is Beautiful", Vintage Publisher, 1993.
6. Cecile Andrews, "Slow is Beautiful", New Society Publishers, 2006.
7. J C Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, 2017.
8. Pandit Sunderlal, "Bharat Mein Angreji Raj", Prabhat Prakashan Publisher, 2021.
9. Dharampal, "Rediscovering India", Stosius Inc/Advent Books Division Publisher, 1983.

2.A.3.47

10. Mohandas K. Gandhi, "Hind Swaraj or Indian Home Rule", Gyan Publishing House, 2023.
11. Maulana Abdul Kalam Azad, "India Wins Freedom", Orient BlackSwan Publisher, 1st Edition, 1988.
12. Life of Vivekananda, "Romain Rolland (English)", Advaita Ashrama Publisher, India, 4th Edition, 2010.
13. Mahatma Gandhi, "Romain Rolland (English)", Srishti Publishers & Distributors, 2020.

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1. https://www.uhv.org.in/uhv-ii
2. http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	-	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	-	-	-
5	-	-	-	-	-	2	3	2	2	-	-	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	10		5	5	5	75	100

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

2.A.3.48

Department	English			Programme: B.Tech.			
Semester	I			Course Category: HS		*End Semester Exam Type: TE	
Course Code	U23ENBC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Communicative English - I	2	-	2	3	50	50	100

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the communication flow in organization and its objectives	K2
	CO2 Write the technical contents with grammatically precise sentences	K2
	CO3 Articulate with correct pronunciation and overcome vernacular impact in speaking	K3
	CO4 Express opinions confidently in formal and informal communicative contexts	K2
	CO5 Attend interview with assertiveness	K3

UNIT - I	**Workstead Communication**	**Periods:10**
Communication, Definition, Process, Channels, Barriers, Strategies for Effective Communication, Verbal and Nonverbal Communication - Listening, Types, Barriers, Enhancing Listening Skills - Bibliography: Book, Journal and Internet References		**CO1**
UNIT - II	**Common Errors In Writing And Comprehension Strategies**	**Periods:10**
Subject Verb Agreement, Misplaced Modifiers, Squinting Modifiers, Dangling Modifier, Fused Sentence, Comma Splice, Sentence Fragment - Reading Comprehension: Technical passage, Strategies: Skimming, Scanning, Intensive and Extensive Reading, Prediction, and Contextual Meaning		**CO2**
UNIT - III	**Phonetics**	**Periods:10**
Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Intonation, Spelling Rules and Words often misspelled, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue		**CO3**
UNIT - IV	**Communication Practice - I**	**Periods:15**
List of Exercises **Listening**: Self Introduction videos **Speaking**: Self-Introduction, Extempore, and Role Play **Reading**: Non-Technical Comprehension Passage **Writing:** Common Errors in Writing		**CO4**
UNIT - V	**Interpersonal Communication - I**	**Periods:15**
List of Exercises **Listening:** Speech Sounds, Interview Videos **Speaking**: Debate, Structured Group Discussion, and Conversation **Reading**: Commonly Confused Words **Writing:** Transcription		**CO5**

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

Text Books

1. Richa Mishra , RatnaRao, "A textbook of English Language Communication Skills", Macmillan Publishers India Private Ltd., Revised Edition 2021.
2. Rizvi M. Ashraf, "Effective Technical Communication", New Delhi: Tata-McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
3. Balasubramanian T, "English Phonetics for Indian students workbook", 2nd Edition, Trinity Press, 2016.

Reference Books

1. N.P.Sudharshana, C. Savitha," English for Engineers", Cambridge University Press, 2018.
2. Raman, Meenakshi, and Sharma, Sangeetha, "Technical Communication - Principles and Practice", 3rd Edition, Oxford University Press, 2017.
3. Comfort, Jeremy, etal., "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint 2011.
4. Wren & Martin, "High School English Grammar and Composition", S Chandh & Co.Ltd, 2015.
5. Boove, Courtland L, "Business Communication Today", Pearson Education, New Delhi, 2002.

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1. https://lemongrad.com/subject-verb-agreement-rules/
2. https://opentextbc.ca/advancedenglish/chapter/misplaced-and-dangling-modifiers/
3. https://www.hitbullseye.com/Reading-Comprehension-Tricks.php
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://worldscholarshipvault.com/neutralize-mother-tongue-interference/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

Theory

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	10		5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical

Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		
Listening (L)*	10	Listening (L)*	10	40
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

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

2.A.3.50

Department	EEE and ECE	Programme:B.Tech.						
Semester	I / II	Course Category: ES			End Semester Exam Type: LE			
Course Code	U23ESPC01	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Basics of Electrical and Electronics Engineering Laboratory	0	0	2	1	50	50	100

(Common to CSE, IT, MECH, CIVIL, MCTR, CCE, AI&DS, FT, CSBS Branches)

Prerequisite: Mathematics and Physics

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Build the different wiring for domestic and commercial applications.	K3
CO2	Design and analyze the domestic power distribution.	K3
CO3	Estimate the performance of transformer and motors by conducting load test.	K3
CO4	Describe characteristics of semiconductor diode and utilize it for different applications	K5
CO5	Relate the characteristics of various transistor	K2
CO6	Understand Rectifiers and Regulators	K2

List of Experiments

Section– A Electrical Experiments

Demonstration on Power Sources, Ammeter, Voltmeter, Wattmeter and Energy meter are Pre-requisite for conducting this Electrical Engineering Lab.

1. Electrical safety precautions and study of tools, accessories, electrical joints and electrical symbols.
2. Domestic Wiring Practice
   - Staircase wiring
   - Doctor's room wiring
   - Godown wiring
   - Wiring of Ceiling fan, LED lamps and Iron Box.
3. Design of Domestic power distribution.
4. Measurement of 3-phase power using two wattmeter method
5. Load test on DC shunt motor.
6. Load test on single phase transformer.
7. Load test on single phase Induction Motor.

Section – B Electronics Experiments

1. Study of Electronic components and equipment: Resistor, Capacitor
2. Measurement of AC signal parameter (Peak-Peak, rms period, frequency) using CRO.
3. VI Characteristics of PN junction diode, Zener diode
4. Input and output characteristics of Common Emitter configuration of BJT
5. Characteristics of JFET
6. Measurement of Ripple factor of HWR, FWR
7. Voltage Regulator using Zener Diode

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

Reference Books

1. S. Gowri, T. Jeyapoovan Nadar, "Engineering Practices Lab Manual", Vikas Publishing House Private Limited, New Delhi, 5th Edition, 2014.
2. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 5th Edition, 2017.
3. D. P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
4. Edward Hughes, John Hiley, Keith Brown, Ian McKenzie Smith, "Electrical and Electronics Technology", Pearson Education Limited, New Delhi, 12th Edition, 2016.
5. S.K. Sahdev, "Fundamentals of Electrical Engineering and Electronics", Dhanpat Rai and Co, 2017.

Web References

1. http://eie.sliet.ac.in/laboratories/basic-electrical-engineering-lab/
2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.allaboutcircuits.com/textbook/experiments/
4. https://www.electronicshub.org/measurements-of-ac-current/
5. http://www.electronics-tutorials.ws

* TE – Theory Exam, LE – Lab Exam

2.A.3.51

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
2	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
3	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
4	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
5	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-
6	3	2	3	-	-	1	-	-	3	-	-	1	3	2	-

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

Evaluation Methods

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

2.A.3.52

Department	Computer Science and Engineering	Programme:B.Tech.						
Semester	I / II	Course Category: ES				End Semester Exam Type: LE		
Course Code	U23CSPC01	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in C Laboratory	0	0	2	1	50	50	100

(Common to All Branches Except CSBS and FT)

Prerequisite	NIL	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Implement logical formulations to solve simple problems leading to specific applications.	K3
	CO2 Execute C programs for simple applications making use of basic constructs, arrays and strings.	K3
	CO3 Experiment C programs involving functions, recursion, pointers, and structures.	K3
	CO4 Demonstrate applications using sequential and random access file processing.	K3
	CO5 Build solutions for online coding challenges.	K3

List of Exercises

1. Write a C program to find the Area of the triangle.
2. Develop a C program to read a three digit number and produce output like
   1 hundreds
   7 tens
   2 units
   For an input of 172.
3. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
4. Write a C program to Print the numbers from 1 to 10 along with their squares.
5. Demonstrate do—While loop in C to find the sum of 'n' numbers.
6. Find the factorial of a given number using Functions in C.
7. Write a C program to check whether a given string is palindrome or not?
8. Write a C program to check whether a value is prime or not?
9. Develop a C program to swap two numbers using call by value and call by reference.
10. Construct a C program to find the smallest and largest element in an array.
11. Implement matrix multiplication using C program.
12. Write a C program to perform various string handling functions like strlen, strcpy, strcat, strcmp.
13. Develop a C program to remove all characters in a string except alphabets.
14. Write a C program to find the sum of an integer array using pointers.
15. Write a C program to find the Maximum element in an integer array using pointers.
16. Construct a C program to display Employee details using Structures
17. Write a C program to display the contents of a file on the monitor screen.
18. Write a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
19. Write a C program to create two files with a set of values. Merge the two file contents to form a single file
20. Write a C program to pass the parameter using command line arguments.

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

Reference Books

1. Zed A Shaw," Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", Addison Wesley,2016.
2. Anita Goel and Ajay Mittal," Computer Fundamentals and programming in C", Pearson Education, First edition, 2011.
3. Maureen Sprankle, Jim Hubbard," Problem Solving and Programming Concepts," Pearson, 9th Edition, 2011.
4. Yashwanth Kanethkar, "Let us C", BPB Publications, 13th Edition, 2008.
5. B.W. Kernighan and D.M. Ritchie, "The C Programming Language", Pearson Education, 2nd Edition, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

* TE – Theory Exam, LE – Lab Exam

9.A.3.53

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

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

Evaluation Methods

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

2.A.3.54

Department	Mechanical Engineering	Programme: B.Tech.						
Semester	I / II	Course Category: ES			End Semester Exam Type: LE			
Course Code	U23ESPC03	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Engineering Graphics Using AutoCAD	-	-	2	1	50	50	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	Familiarize with the fundamentals and standards of engineering graphics.	K3
CO2	Perform drawing of basic geometrical constructions and multiple views of objects.	K2
CO3	Visualize the isometric and perspective sections of simple solids.	K3
CO4	Connect side view associate on front view.	K4
CO5	Correlate sectional views and lateral surface developments of various solids.	K4

List of Experiments

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.
11. Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

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

Reference Books

1. James D. Bethune, "Engineering Graphics with AutoCAD", A Spectrum book 1st Edition, Macromedia Press, Pearson, 2020.
2. NS Parthasarathy and Vela Murali, "Engineering Drawing", Oxford university press, 2015.
3. M.B Shah, "Engineering Graphics", ITL Education Solutions Limited, Pearson **Education**Publication, 2011.
4. Bhatt N.D and Panchal V.M, "Engineering Drawing: Plane and Solid Geometry", Charotar Publishing House, 2017.
5. Jeyapoovan T, "Engineering Drawing and Graphics Using AutoCAD", Vikas Publishing House Pvt Ltd., 7th Edition, New Delhi, 2016.
6. C M Agrawal, Basant Agrawal, "Engineering Graphics", McGraw Hill, 2012.
7. Dhananjay A. Jolhe, "Engineering Drawing: With An Introduction To CAD",McGraw Hill, 2016.
8. James Leach, "AutoCAD 2017 Instructor", SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

* TE – Theory Exam, LE – Lab Exam

2.A.3.55

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

9.A.3.56

Department	Computer Science and Engineering	Programme: B.Tech.						
Semester	I	Course Category: AEC			End Semester Exam Type:-			
Course Code	U23CSC1XX	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Certification Course – I	-	-	4	-	100	-	100

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence. Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

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

2.A.3.57

2.3.A.58

Department	Computer Science and Engineering	Programme: B.Tech.					
Semester	I	Course Category: MC			End Semester Exam Type: -		
CourseCode	U23CSM101	Periods/Week			Credit	MaximumMarks	
		L	T	P	C	CAM	ESE	TM
Course Name	Induction Programme	2 Weeks			Non-Credit	-	-	-
Prerequisite	NIL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Developholisticattitudeandharmonyinthe individual,family,andSociety	K2
CO2	Acquiregrammar skills and capable to write and speak English confidently	K2
CO3	Understand the basic concepts in Mathematics and Programming	K2
CO4	Knowabouttheartandculture, language andliterature ofthisvastsecularnation	K2
CO5	Identify the inherent talent and develop it professionally	K3

UNIT - I	Universal Human Values	Periods:12	
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.			CO1

UNIT - II	Proficiency in English	Periods:12	
Communication skills – Prognosticteston Grammar - Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One-word Substitution, Homophones, Homonyms, Use of Prepositions, Subject – verb - Agreement - Writing – Paragraph writing, Letter writing, Essay writing, Story Development.			CO2

UNIT - III	Bridge Course in Mathematics and C Programming	Periods:12	
Mathematics: Fundamentalsofdifferentialandintegralcalculus:Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept ofderivative - Slope of a curve -Differentiation Techniques - Derivatives of elementary functions from first principle –Derivatives of inverse functions – Logarithmic differentiation –Method of substitution –Differentiation of parametric functions – Differentiation of implicit functions –Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts)-Definite integrals. Simple definite integrals –Properties of Definite integrals –Reduction formulae - Area andvolume - Lengthof curve -surfaceareaofa solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.			CO3

UNIT - IV	Literary Activities	Periods:12	
Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, சிறப்பு சொற்பொழிவு – தமிழர் மரபு மற்றும் தமிழர் தொழில் நுட்பம்.			CO4

UNIT - V	Creative Arts	Periods:12	
Introduction to painting and renowned artworks -Documentary and Short films -Music -Vocal, Instrumental - Dance - Classical, Cinematic -Mimicry -Mime.			CO5

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

Reference Books

1. R.R Gaur, R. Asthana, G.P. Bagaria," A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. Kumar Mohan R, "English Grammar for all (Functional and Applied Grammar)", Unicare Academy, 2022.
3. Seely, John," Oxford A-Z of Grammar and Punctuation, Oxford Publication, 2013.
4. B.V. Ramana," Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi publications, Tamil Nadu, 2019.
6. E. Balagurusamy, "PROGRAMMING IN ANSI C", Mc Graw Hill, 8th Edition, 2019.
7. Dr. K.K. Pillay,"Social Life of Tamils", A joint publication of TNTB & ESC and RMRL
8. R. Balakrishnan, "Journey of Civilization", Rojamuthiah research publishers, 1st Edition 2019.
9. தமிழகவரலாறு - மக்களும்பண்பாடும், பிள்ளை, கே. கே. , சென்னை : உலகத்தமிழாராய்ச்சிநிறுவனம் , 2002.
10. கணினித்தமிழ் - முனைவர்இல.சுந்தரம், விகடன்பிரசுரம்.
11. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம், தமிழக தொல்லியல் துறை.

Web References

1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

2.3.A59

SEMESTER II

9. A. 3. 61

Department	Mathematics	Programme: B.Tech.						
Semester	II	Course Category: BS			End Semester Exam Type: TE			
CourseCode	U23MATC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Engineering Mathematics – II	3	1	-	4	25	75	100

(Common to ALL Branches Except CSBS, FT)

Prerequisite	Basic Mathematics	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Convert a periodic function into series form.	K2
	CO2 Compute Fourier transforms of various functions.	K3
	CO3 Solve Differential Equations using Laplace transforms.	K3
	CO4 Apply inverse Laplace transform of simple functions.	K3
	CO5 Solve difference equations using Z – transforms.	K3

UNIT – I	Fourier Series	Periods:12
Dirichlet's conditions – General Fourier series – Odd and Even functions – Half-Range sine series and cosine series – Change of intervals – Parseval's Identity.		CO1
UNIT – II	**Fourier Transforms**	**Periods:12**
Fourier Transforms and its inverse – Properties of Fourier Transform (without proof) – Fourier sine and cosine Transforms and their properties (excluding proof).		CO2
UNIT – III	**Laplace Transforms**	**Periods:12**
Laplace transforms of elementary functions and Periodic functions – Basic properties (excluding proof) – Laplace transforms of derivatives and integrals – Initial and final value theorems.		CO3
UNIT – IV	**Inverse Laplace Transforms**	**Periods:12**
Definition of inverse Laplace Transforms – Convolution theorem (excluding proof) – Solutions of Linear Ordinary Differential Equations of second order with constant coefficients.		CO4
UNIT – V	**Z – Transforms**	**Periods:12**
Z-transforms – Elementary Properties – Inverse Z-transforms (using partial fraction and Residues) – Solution of difference equations using Z - transform.		CO5

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

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill,New Delhi, 3rd Edition,2011.
2. C. P. Gupta, Shree Ram Singh. M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi,2nd Edition, 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand, New Delhi,22nd Edition 2019.

Reference Books

1. N.P. Bali and Dr. Manish Goyal, "A TEXTBOOK OF ENGINEERING MATHEMATICS", UNIVERSITY SCIENCE PRESS,India, 8th Edition, 2016.
2. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearson India Education services Pvt. Ltd, India 1st2017.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. G. Balaji, "Engineering Mathematics - Transforms and Partial Differential Equations", G. Balaji Publishers, 18th Edition, 2022.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi,2017.

Web References

1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/11110711
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 63

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

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

2. A. 3. 6

Department	**Physics / Chemistry**	Programme: **B.Tech.**					
Semester	**I/II**	Course Category: **BS**			End Semester Exam Type: **TE**		
Course Code	**U23BSTC01**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Physical Science for Engineers**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

(Common to all Branches)

Prerequisite	Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basic ofproperties of magnetic, dielectric and superconductors.	**K2**
	CO2 Identify the wave nature of the particles, physical significance of wave functions	**K3**
	CO3 Understand the basic principles of laser and fiber optics communication	**K2**
	CO4 Understand and familiar with the water treatment.	**K2**
	CO5 Understand the electrode potential for its feasibility inelectrochemical reactionand uses of variousbatteries.	**K2**
	CO6 Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.	**K2**

SECTION A - PHYSICS

UNIT - I	**Magnetic, Dielectric and Superconducting Materials**	**Periods: 8**
Introduction to magnetic materials, Ferromagnetism- Domain theory-Types of energy-Hysteresis-Hard and Soft magnetic materials-ferrites-Dielectric materials-Typesof polarization – Langevin-Debye equation-Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials-Superconducting materials and their properties.		**CO1**

UNIT - II	**Quantum Mechanics**	**Periods: 7**
Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode.		**CO2**

UNIT-III	**Laser and Fiber Optics**	**Periods: 7**
Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action –components of laser - Types of Lasers - NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)		**CO3**

SECTION B – CHEMISTRY

UNIT-IV	**Water and its Treatment**	**Periods: 8**
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment–Ion exchange demineralization and zeolite process.		**CO4**

UNIT-V	**Electrochemical Cells and Storage Devices**	**Periods: 8**
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel andAg/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H_2 -O_2 fuel cell-applications.		**CO5**

UNIT-VI	**Corrosion**	**Periods: 7**
Corrosion –Introduction - factors – types – chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects – electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electroless plating of nickel.		**CO6**

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

2. A. 3. 65

Text Books

1. V Rajendran, "Engineering Physics", 2nd Edition, TMH, New Delhi 2011.
2. S.S Dara – "A text book of Engineering Chemistry" - 15th Edition, 2021. S.Chand Publications.
3. C. Jain, Monica Jain, —"Engineering Chemistryll" 17thEd. Dhanpat Rai Pub. Co., NewDelhi, (2015).

Reference Books

1. R. Murugeshan, "Modern Physics", S. Chand &Co, New Delhi 2006.
2. William D Callister Jr., "Material Science and Engineering", 6th Edition, John Wiley and sons, 2009.
3. Jain & Jain "Engineering chemistry", 23rd Edition, Dhanpat Rai Publishing Company. 2022
4. Mars Fontana "Corrosion Engineering", July 2017
5. Jina Redlin, "Handbook of Electrochemistry", March 28, 2005

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1. https://www.sciencedaily.com/terms/materials_science.htm.
2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
3	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
4	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-

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

Evaluation Methods

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

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

2.A.3.66

Department	**Artificial Intelligence and Data Science**	Programme: **B.Tech**					
Semester	**II/III**	CourseCategory:**ES**			End Semester Exam Type: **TE**		
Course Code	**U23ADTC01**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming in Python**	**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 Interpret the basic concepts of Python programs.	**K2**
	CO2 Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.	**K2**
	CO3 Experiment with Numpy package.	**K3**
	CO4 Apply and analyze Data Manipulation with Pandas.	**K3**
	CO5 Illustrate programming concept for Visualization with Matplotlib.	**K3**

UNIT - I	**Introduction To Python**	**Periods:09**
Structure of Python Program – Underlying mechanism of Module Execution – Branching and Looping – Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.		**CO1**
UNIT - II	**Sequence Datatypes and Object-Oriented Programming**	**Periods:09**
Sequences – Mapping and Sets – Dictionaries. Classes: Classes and Instances – Inheritance – Exception Handling – Introduction to Regular Expressions using "re" module.		**CO2**
UNIT - III	**Using Numpy**	**Periods:09**
Basics of NumPy – Computation on NumPy – Aggregations – Computation on Arrays – Comparisons – Masks and Boolean Arrays – Fancy Indexing – Sorting Arrays – Structured Data: NumPy's Structured Array.		**CO3**
UNIT - IV	**Data Manipulation with Pandas**	**Periods:09**
Introduction to Pandas Objects – Data indexing and Selection – Operating on Data in Pandas – Handling Missing Data – Hierarchical Indexing – Combining Data Sets. Aggregation and Grouping – Pivot Tables –Vectorized String Operations – Working with Time Series – High Performance Pandas – eval() and query().		**CO4**
UNIT - V	**Visualization With Matplotlib**	**Periods:09**
Basic functions of Matplotlib – Simple Line Plot – Scatter Plot – Density and Contour Plots – Histograms – Binnings and Density – Customizing Plot Legends – Colour Bars – Three-Dimensional Plotting in Matplotlib.		**CO5**

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

Text Books

1. Jake VanderPlas, "Python Data Science Handbook - Essential Tools for Working with Data", O'Reily Media Inc, 2016.
2. Zhang.Y, "An Introduction to Python and Computer Programming", Springer Publications, 2016.
3. Wesley J Chun, "Core Python Programming", Pearson Education, 2nd Edition, 2006.

Reference Books

1. John Paul Mueller, Luca Massaron, "Python for Data Science for Dummies", 2nd Edition, John Wiley& Sons, 2019.
2. Jesus Rogel-Salazar, "Data Science and Analytics with Python", CRC Press Taylor and Francis Group, 2017.
3. Brian Draper, "Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language", CreateSpace Independent Publishing Platform, 2016.
4. Mark Lutz, Laura Lewin, Frank Willison, "Programming Python", O'Reilly Media, 3rd Edition, 2006.
5. Gowrishankar S, Veena A, "Introduction to Python Programming", CRC Press, 2018.

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1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

* TE – Theory Exam, LE – Lab Exam

2.A.3.67

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

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

Evaluation Methods

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

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

2. A. 3. 68

Department	**Computer Science and Engineering**	Programme: B.Tech						
Semester	**II/III**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Structures**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to All Branches except CSBS and FT)

Prerequisite	Any Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Compute time and space complexity for given problems	**K2**
	CO2 Demonstrate stack, queue and its operation.	**K2**
	CO3 Illustrate the various operations of linked list.	**K3**
	CO4 Use the concepts of tree for various applications.	**K3**
	CO5 Outline the various Tables, Graphs and Sets techniques.	**K3**

UNIT - I	**Basic Terminologies of Data Structures**	**Periods:09**	
Introduction: Basic Terminologies – Asymptotic Notations: Complexity analysis. Array and its operations - Searching: Linear Search and Binary Search Techniques. Sorting: Bubble Sort – Selection Sort – Insertion Sort – Heap Sort – Shell Sort. Performance and Comparison among the sorting methods.			**CO1**
UNIT - II	**Stack and Queue Operations**	**Periods:09**	
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. Types of Queue: Simple Queue – Circular Queue – Priority Queue – Deque.			**CO2**
UNIT - III	**Linked List Operations**	**Periods:09**	
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing - Searching - Insertion - Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.			**CO3**
UNIT - IV	**Trees**	**Periods:09**	
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree - Threaded Binary Tree - Binary Search Tree - Binary Tree Traversals – AVL Tree- Red Black Tree.			**CO4**
UNIT - V	**Graphs, Tables and Sets**	**Periods:09**	
Graph: Basic Terminologies and Representations - Graph traversal algorithms. Tables: Different types of tables - Hash Table and its operations - Applications. Sets: Representation of Sets- Operations and its applications.			**CO5**

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

Text Books

1. Ellis Horowitz, Sartaj Sahni," Fundamentals of Data Structures", Illustrated Edition, Computer Science Press, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI, Third Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", 4th Edition, 2009.

Reference Books

1. D. Samanta, "Classic Data Structures", Prentice-Hall of India, Second Edition, 2012.
2. Robert Kruse, C.L. Tondo and Bruce Leung, "Data Structures and Program Design in c" . Prentice-Hall of India, Second Edition, 2007.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Second. Edition,2006.
4. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Illustrated Edition, Addison-Wesley Publishing Company, 1995.
5. Mark Allen Weiss," Algorithms, Data Structures and Problem Solving with C++", Addison- Wesley Publishing Company, Illustrated Edition, 1995.

Web References

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

* TE -- Theory Exam, LE – Lab Exam

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

2. A. 3.70

Department	Information Technology	Programme: B.Tech.						
Semester	II	Course Category: PC			*End Semester Exam Type: TE			
CourseCode	U23ITTC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Digital Design and System Architecture	3	0	0	3	25	75	100

(Common to CSE and IT)

Prerequisite	Basic mathematics, Basics of Electrical and Electronics Engineering	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Demonstrate simplifications of Boolean functions.	K2
	CO2 Describe various combinational logic circuits.	K2
	CO3 Illustrate various sequential circuits.	K2
	CO4 Narrate the basic components and computer organization	K2
	CO5 Explain memory types and I/O organization	K2

UNIT - I	Review of Number Systems	Periods:09
Review of Number systems – Conversion of Number systems – Binary addition and subtractions – Binary representation: Signed magnitude representation and Compliment representations - Binary codes – Boolean Algebra – Boolean functions – canonical forms - Simplifications of Boolean function: Theorems and laws, K-Map and Quine McCluskey method.		CO1

UNIT - II	Logic Gates and its Types	Periods:09
Introduction to combinational circuits – Design procedures of Combinational circuits – Adders - Subtractors – Binary parallel Adder – BCD Adder – Carry look ahead adder – Decoder – Encoder – Priority Encoder – Multiplexer.		CO2

UNIT - III	Sequential Logic Design	Periods:09
Introduction to Sequential Circuits – Latches - Types of Latches: SR Latch and D Latch – Flip-Flop- Types of Flip-Flops: RS, JK, D,T Flip-Flops – Excitation table of Flip-Flops – Counters : Asynchronous Counters – Synchronous counters – Mod counters - Shift registers – Types of Shift registers : SISO,SIPO,PISO,PIPO and Universal Shift registers – Ripple counter and Johnson counter.		CO3

UNIT - IV	Fundamentals Of Computer Organization	Periods:09
Block diagram of Digital Computer, Organization and Design: Instruction codes, Registers, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt, ALU design, Execution of a complete instruction-Multiple bus organization, Hardwired control Microprogrammed control, Pipelining: Basic concepts, Data hazards, Instruction hazards, Parallel and Vector Processors.		CO4

UNIT - V	Memory And I/O Organization	Periods:09
Memory hierarchy - Main memory, Memory chip Organization, Auxiliary memory, Associate memory, Virtual memory, Cache memory, input-output interface, asynchronous data transfer, Modes of transfer, Priority interrupt, DMA - Buses Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB), Case study – Advanced Processors.		CO5

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

Text 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. M.Moris Mano, Computer System Architecture, Third Edition, Pearson Education,2017: The Complete Reference", McGraw Hill, FourthEdition,2014

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Reference Books

1. Tocci R J and Widmer N S, "Digital Systems - Principles and Applications", Prentice Hall of India, New Delhi,11th Edition, 2010.
2. John.F.Wakerly,"Digital Design Principles and Practices", Pearson Education,4th Edition, 2006.
3. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", 5th edition, Tata McGraw Hill Education, 2011.
4. David A. Patterson and John L. Hennessey, "Computer Organization and Design", 5th edition, Morgan Kauffman /Elsevier, 2014
5. Roger Tokhiem, "Schaum's Outline of Digital Principles", McGraw Hill publication,3rd Edition, 1994.

Web References

1. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2. https://nptel.ac.in/courses/117/105/117105080/
3. https://nptel.ac.in/courses/106/105/106105163/
4. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
5. http://www.ee.surrey.ac.uk/Projects/CAL/digital-logic/gatesfunc/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	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
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		5	5	5	75	100

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

2. A. 3. 72

Department	English	Programme: B.Tech.						
Semester	II	Course Category: HS			*End Semester Exam Type: TE			
Course Code	U23ENBC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Communicative English - II	2	-	2	3	50	50	100

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Draft effective written communication in professional environment	K2
	CO2 Apply the mechanics of creative writing with precision and clarity	K3
	CO3 Acquire language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation	K2
	CO4 Develop language fluency and gain self-confidence	K3
	CO5 Express thoughts and ideas with clarity and focus	K2

UNIT - I	**Business Correspondence**	**Periods:10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing, Report Writing- Official and Demi Official Letters : Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, Inplant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**
UNIT - II	**Functional Writing Skills**	**Periods:10**	
Four Modes of Writing, Sentence Structure , Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**
UNIT - III	**Etiquettes**	**Periods:10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**
UNIT - IV	**Communication Practice-II**	**Periods:15**	
List of Exercises **Listening:** Letter writing tips **Speaking:** Just a Minute, Impromptu Speech, Contemporary Issues **Reading:** Variety of examples for Modes of Writing **Writing:** Different types of letters			**CO4**
UNIT - V	**Interpersonal Communication-II**	**Periods:15**	
List of Exercises **Listening:** Videos on different types of Etiquettes **Speaking:** Team Presentation, Negotiation Skills **Reading:** Phrases and Clauses **Writing:** Free writing on any given topic, Paraphrasing Practice			**CO5**

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

Text Books

1. PC Das, "Letter Writing including Official and Business Letters", New Central Book Agency, 2020.
2. Kumar, Sanjay, Pushpalatha," Communication Skills". Oxford University Press, 2018.
3. Raman, Meenakshi & Sangeetha Sharma," Communication Skills", New Delhi: OUP,2018.

Reference Books

1. Sahukar, Nimeran , Bhalla, Prem,, "The book of Etiquettes and Manners".PustakMahal Publisher, New Delhi; 1st Edition 2009.
2. Gerson Sharon J, Steven M. Gerson, "Technical Writing Process and Product", Pearson Education Pvt. Ltd. 3rd Edition, 2009.
3. Grussendorf, Marion, "English for Presentations". Oxford University Press, Oxford, 2007.
4. Seely John, "The Oxford Guide to Writing and Speaking", Oxford University Press, 2006.
5. R.C. Sharma, Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill &Co.Ltd., New Delhi, 2001.

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1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteljo

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

Theory

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	10		5	5	75	60
	20(to be weighted for 10 marks)				(to be weighted for 50 marks)	

Practical

Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30(to be weighted for 10 marks)		30 marks		
Listening (L)*	10	Listening (L)*	10	40
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

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

2. A. 3. 24

Department	Mechanical Engineering	Programme: B.Tech.						
Semester	I/II	Course Category: ES				*End Semester Exam Type: LE		
CourseCode	U23ESPC02	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Design Thinking and IDEA Lab	-	-	2	1	50	50	100
(Common to ALL Branches)								
Prerequisite	Basic Knowledge of Science							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.	K2
	CO2 Develop proficiency in ideation techniques to generate creative and innovative solutions for various design challenges and problems	K3
	CO3 Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.	K3
	CO4 Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.	K4
	CO5 Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects	K4

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team-Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

List of Lab Activities and Experiments

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

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

Text Books

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.

2.A.3.75

Reference Books

1. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004
2. The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018.
3. The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan, Weldon Owen; 2017.
4. The Art of Electronics. 3rd edition. Paul Horowitz and Winfield Hill. Cambridge University Press.
5. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill.
6. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education.
7. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill.
8. Venuvinod, PK., MA. W., Rapid Prototyping – Laser Based and Other Technologies, Kluwer
9. Chapman W.A.J, "Workshop Technology", Volume I, II, III, CBS Publishers and Distributors, 5th Edition,2002.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_mg72

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Methods

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

2. A. 3. 76

Department	Artificial Intelligence and Data Science	Programme: B.Tech						
Semester	II	Course Category: ES				End Semester Exam Type: LE		
Course Code	U23ADPC01	Periods/Week			Credit	MaximumMarks		
		L	T	P	C	CAM	ESE	TM
Course Name	Programming in Python Laboratory	0	0	2	1	50	50	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 common Python functionality and features used for data science.	K2
	CO2 Query Data Frame structures for cleaning and processing.	K2
	CO3 Configure your programming environment	K3
	CO4 Experiment the concept using data visualization.	K3
	CO5 Analyze real time datasets,	K3

List of Exercises

1. Build a python program to implement Fibonacci series.
2. Build a python program to get a range of numbers from user and to separate even numbers and odd numbers respectively.
3. Build a function in Python to check duplicate letters. It must accept a string, i.e., a sentence. The function should return True if the sentence has any word with duplicate letters, else return False.
4. Build a program to perform arithmetic operations using lambda function.
5. Build a Python program that takes a list of numbers as input and returns a new list containing only the even numbers from the input list.
6. Build a python program to create a class called Car with attributes Company, model, and year. Implement a method that returns the age of the car in years.
7. Build a python program to create a base class called Shape that has a method called area which returns the area of the shape (set it to 0 for now). Then, create two derived classes Rectangle and Circle that inherit from the Shape class to calculate the area of derived classes.
8. Build a python program to implement aggregation using Numpy.
9. Build a python program to perform Indexing and Sorting.
10. Build a python program to perform Handling of missing data.
11. Build a python program to perform usage of Pivot table using Titanic datasets
12. Build a python program to perform use of eval () and query ()
13. Build a python program to perform Scatter Plot
14. Build a python program to perform 3D plotting
15. Implement an application to process a real time data.

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

Reference Books

1. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk, "Python Social Media Analytics", Packt Publishing, 2017.
3. Jake VanderPlas, "Python Data Science Handbook - Essential Tools for Working with Data", O'Reily Media Inc, 2016.
4. Zhang.Y, "An Introduction to Python and Computer Programming", Springer Publications, 2016.
5. Wesley J Chun, "Core Python Programming", Pearson Education, 2nd Edition, 2006.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

* TE – Theory Exam, LE – Lab Exam

2.A.3.77

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

2. A. 3. 78

Department	**Computer Science and Engineering**	Programme: **B.Tech.**						
Semester	**II/III**	Course Category: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23CSPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Structures Laboratory**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches except CSBS and FT)

Prerequisite	Basic Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyse the algorithm's / program's efficiency in terms of time and space complexity.	**K3**
	CO2 Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3 Solve the problems of searching and sorting techniques.	**K3**
	CO4 Solve problems in linear Data Structures.	**K4**
	CO5 Solve problems in non-linear Data Structures.	**K4**

List of Exercises:

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. a) Delete an element from list b) Search for a key element in list c) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder b) Inorder c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.
11. Write a C program to implement the Set operations.
    a) Union b) Intersection c) Difference.

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

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Tenebaum Aaron M, "Data Structures using C', Pearson Publisher, 1st Edition, 2019.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India 1st Edition, 2017.
4. Reema Thareja, "Data structures using C", Oxford University, 2nd Edition, 2014.
5. Gav.pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013.

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069

* TE – Theory Exam, LE – Lab Exam

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

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

Evaluation Method

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

2. A. 3. 80

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 functions	**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. HDL code to realize all the logic gates
2. Design and Simulation of adder, Serial Binary Adder, Multi Precession Adder, Carry Look Ahead Adder.
3. Design of 2-to-4 decoder
4. Design of 8-to-3 encoder (without and with parity)
5. Design of flip flops: SR, D, JK, T
6. Design of a N- bit Register of Serial- in Serial –out, Serial in parallel out, Parallel in Serial out and Parallel in Parallel Out.
7. Design of ALU to Perform – ADD, SUB, AND-OR, 1's and 2's Compliment,
8. Design of ALU to Perform – Multiplication, and Division.
9. Memory unit design and perform memory operations.
10. 8-bit simple ALU design
11. 8-bit simple CPU design
12. Interfacing of CPU and Memory

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

Reference Books

1. J. Bhasker, "Verilog Hdl Synthesis, a Practical Primer", Trade Paperback, 2018.
2. Massimo Alioto, Elio Consoli, Gaetano Palumbo, "Flip-Flop Design in Nanometer CMOS",Springer, 2015.
3. Charles Platt, "Make: More Electronics",Make:community, 2014.
4. M K Gooroochurn," Introduction to Digital Logic & Boolean Algebra",Paperback, 2018.
5. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "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.3.81

COs/POs/PSOs Mapping

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

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ANNEXURE III

INDUSTRY INSTITUTE INTERACTION

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INDUSTRY INSTITUTE INTERACTION

Internship Details 2019-2023 Batch

S.No.	Reg.No	Name of the Student	Compnay	Starting Date	End Date	Stipend
1	19TD0194	PANNEERSELVAM C	ZOHO	30.05.2022	30.06.2022	20,000
2	19TD0210	RAVI SHANKAR. M	ZOHO	30.05.2022	30.09.2022	20,000
3	19TD0164	KARTHIKEYAPASSUPATHY R	ZOHO	30.05.2022	30.09.2022	20,000
4	19TD0217	SAMHITHA A	ZOHO	30.05.2022	30.09.2022	20,000
5	19TD0197	PAVITHRA R	ZOHO	30.05.2022	30.09.2022	20,000
6	19TD0140	GOWTHAMI .S	ZOHO	30.05.2022	30.09.2022	20,000
7	19TD0270	VIJI D	ZOHO	30.05.2022	30.09.2022	20,000
8	19TD0195	PARKAVI. R	ZOHO	30.05.2022	30.06.2022	20,000
9	19TD0136	GAYATHRI C	ZOHO	30.05.2022	30.09.2022	20,000
10	19TD0229	SHANKAR ANAND. R	ZOHO	03.10.2022	15.11.2022	20,000
11	19TD0106	ALAN XAVIER MARTIAL. A	ZOHO	03.10.2022	15.11.2022	20,000
12	19TD0237	SOMESHVAR .V	ZOHO	03.10.2022	15.11.2022	20,000
13	19TD0177	MAGESH. R	ZOHO	03.10.2022	15.11.2022	20,000
14	19TD0246	SUDHERSANAN K	ZOHO	03.10.2022	15.11.2022	20,000
15	19TD0180	MITHRA .C	ZOHO	03.10.2022	15.11.2022	20,000
16	19TD0145	HARSHAVARTHINI S	ZOHO	03.10.2022	15.11.2022	20,000
17	19TD0102	ABHIRAM.P	Virtusa	27.06.2022	15.11.2020	8,000
18	19TD0261	VADAPALLI SRIDIVYA	Virtusa	27.06.2022	15.11.2020	8,000
19	19TD0109	ANAND NARAYANAN. S	KAAR	27.06.2022	15.11.2020	5,000
20	19TD0114	ASHATHULLA .J	KAAR	27.06.2022	15.11.2020	5,000
21	19TD0220	SARAN .G	KAAR	27.06.2022	15.11.2020	5,000
22	19TD0276	YOKESH KUMAR.M	FORD	27.06.2022	15.11.2020	5,000
23	19TD0211	RENITHA.K	CARATLANE	27.06.2022	15.11.2020	5,000
24	19TD0213	SAI KISHORE RAO. K	CARATLANE	27.06.2022	15.11.2020	5,000

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GUEST LECTURES

S.NO	DATE	TITLE	RESOURCE PERSON	YEAR	BATCH
1	19.11.2022	The Technologies Will Rule The Future World	K. Krishnakumar, Yes Software Technology, CEO,Puducherry.	II	2021-25
2	19.11.2022	Project Management in Industries	Mr.N.M.Jeevanatham, Developer, ZOHO Cooperation Mr.A.Nevinkumar, Developer, TCS Chennai.	III	2020-24
3	17.12.2022	Applications of Python Programming	Dr.N.Sivakumar, Assistant Professor, Department of Computer Science and Engineering, Puducherry Technological University.	I	2022-26
4	17.12.2022	OOPS Concepts	Dr.N.Sivakumar, Assistant Professor, Department of Computer Science and Engineering, Puducherry Technological University.	II	2021-25
5	03/12/2022	Advance Operating Systems	Shakin Bsnu Haleem, Design Engineer Specialist, Ipswich,UK.	II	2021-25
6	10.12.2022	An Industrial Approach for Problem Solving	Sathisk Kanna.M Data Engineer, TCS Chennai.	II	2021-25
7	10.12.2022	PPY-Modern python application development in practice.	A.Aasaimani, Exela Technologies, Chennai.	I	2022-25
8	24.12.2022	ACD- Automat's usage in compiler designing.	Nithyanandan.S Software Engineer, Texas Instruments.	II	2021-25
9	04.01.2022	Client Server Technology	Vasanth, System Admin,SMVEC(w)	IV	2019-23
10	07.01.2023	Block chain Cryptography	M.Anandkrishnan, Managing Director, Yes soft (w)Technology,Pondichherry	IV	2019-23
11	19.11.2022.	PHP Development	Dr.M. Geetha, Assistant Professor, Pondicherry University, Puducherry.	III	2020-24

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Industrial Visit

BATCH	YEAR	SEMESTER	TOTAL STUDENTS	INDUSTRY NAME	LOCATION	DATE OF VISIT
2020-2024	III	VI	170	Sniqsys Technosphere	Kazhakoottam, TVM - 695584	21-04-2023
2021-2025	II	IV	165	Spectrum Softtech Solutions Pvt. Ltd.,	Kochi - 682 011, Kerala, INDIA	05.05.2023
2021-2025	II	IV	165	Nestsoft Technologies	Infopark, Kochi, Ernakulam (District), Kerala,	05.05.2023
2022-2026	I	II	170	CodeBind Technologies	Gandhipuram, Coimbatore.	02.06.2023

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ANNEXURE – IV

Details of Examiners for Question Paper Setter and Evaluators

2.A.3.91

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE
(An Autonomous Institution)
(Approved by AICTE, New Delhi & Affiliated to Pondicherry University)
(Accredited by NBA-AICTE, New Delhi, ISO 9001:2000 Certified Institution & Accredited by NAAC with "A" Grade)
Madagadipet, Puducherry - 605 107

Department of Computer Science and Engineering

Details of Examiners for Question Paper Setter and Evaluators

Sl.No	Name of the Examiner	Specialization	Designation, Department and Institution in which currently working	Contact number and mail id
1	Dr. K. RAJA	Computer Graphics, Computer Networks, Multimedia	Assistant Professor / IT, Annamalai University, Chidambaram	9894304053, rajak_cdm@yahoo.co.in
2	Dr.B.MURUGANANTHAM	Artificial Intelligence, Service Oriented Architecture, Webservices	Associate .Professor / CSE SRM Institute of Science and Technology, Chennai.	9940023373, muruganb@srmist.edu.in
3	Dr. V.TAMIZHAZHAGAN	Wireless Networks	Assistant Professor / IT, Annamalai University, Chidambaram	8925122220 rvtamizh@gmail.com
4	Dr. D. JAGANATHAN	Artificial Intelligence, Computer Networks	Assistant Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	9994524148 djagannathan@veltech.edu.in
5	Mr. V. PRABHU	DBMS, Data Structures	Assistant Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	9597739629 vprabhu@veltech.edu.in

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6	Dr. LAKSHMI DHEVI	Internet of Things, Compute Organization, Computer Graphics	Assistant Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	9551145796 blakshmidhevi@veltech.edu.in
7	Dr.MANJUNATHAN	Database Management Systems, Operating Systems	Assistant Professor / CSE, Vel Tech Rangarajan Dr. Sagunthala R & D institute of Science and Tecnology, Chennai	9791060024 nmanjunathan@veltech.edu.in
8	Dr. A. RAMACHANDRAN	Digital Design, Computer Design, Web Technology	Assistant Professor and Head (i/c), Department of Computer Science and Engineering, University College of Engineering, Panruti.	9790900771 ramautpc@gmail.com, ram@ucep.edu.in
9	Dr. C. NAVANEETHAN	Java, Python, Artificial Intelligence, Data Structures	Associate Professor / CSE Department of Software and Systems Engineering, School of Information Technology & Engineering, VIT, Vellore - 632014	9962327007 navaneethan.c@vit.ac.in
10	Dr. G. GUNASEKARAN.	Artificial Intelligence, AR & VR, Compiler Design	Associate Professor / CSE Department of Smart Computing, School of Information Technology & Engineering, VIT, Vellore - 632014	9443049982 ggunasekaran@vit.ac.in

2.A.3.95

11	Dr. AMRITHA SARAVANAN	Data Structures, Operating Systems	Associate Professor / CSE Department of CSE, University college of Engineering, Villupuram	9791555778 aasaravanan777@gmail.com
12	Dr. BALAJI. N	Computer Networks, Cloud Computing	Professor and Head, Department of CSE, Sri Venkateswara College of Engineering and Technology, Puducherry.	9944199803 nbalajime1983@gmail.com

2.A.3.97

Annexure V

(M.Tech - Curriculum and Syllabus)

2.A.3.99

SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

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

PUDUCHERRY – 605107

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.TECH.

COMPUTER SCIENCE AND ENGINEERING

(REGULATIONS - 2023)

CURRICULUM AND SYLLABI

9. A. 3. 101

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 create a productive learning and research environment for graduates to become highly dynamic, competent, ethically responsible, professionally knowledgeable in the field of computer science and engineering to meet the industrial needs on par with global standards.

MISSION

M1: Quality Education: Empowering the students with the necessary technical skills through quality education to grow professionally.

M2: Innovative Research: Advocating the innovative research ideas by incorporating with industries for developing products and services.

M3: Placement and Entrepreneurship: Advancing the education by strengthening the Industry-academic relationship through hands-on training to seek placement in the top most industries or to develop a start-ups.

M4: Ethics and Social Responsibilities: Stimulating professional behaviour and good ethical values to improve the leadership skills and social responsibilities.

2.A.3.102

PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research:
An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Technical Skill:
An ability to write and present a substantial technical report/document.

PO3: Expertise in Academics:
Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Problem solving:
An ability to discriminate, analyzes, evaluate and synthesize the technologies to provide solution for multidimensional engineering problems.

PO5: Usage of Modern Tools:
Create, select, learn 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: Ethical Practices and Social Responsibility:
Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Technical Knowledge: To acquire a comprehensive knowledge in computer science engineering concepts and apply them for the investigation of real world problems.

PEO2: Research and Development: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions.

PEO3: Leadership: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions

PEO4: Professional Behavior: To deliver graduates to design and implement solutions for rapidly changing computing problems and information system environments to adapt innovation.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Technical Knowledge in Computer Science and Engineering: Graduates with the ability to apply basic knowledge of Computer Science in solving the critical problems.

PSO2: Multidisciplinary Competency: Ability to convert innovative ideas into research or society oriented projects through current trending technologies.

PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical business skills with the contemporary trends in the industry.

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STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	6
2	Basic Sciences(BS)	3
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	25
5	Professional Electives (PE)	18
6	Open Electives (OE)	-
7	Project Work and Internship(PA)	20
8	Ability Enhancement Courses (AEC)	-
9	Mandatory courses (MC)	-
Total		**72**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	4	2	-	-	6
2	Basic Sciences(BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	11	14	-	-	25
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	-
7	Project Work and Internship(PA)			8	12	20
8	Ability Enhancement Courses (AEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

** AEC, MC Credits are not included for CGPA calculation*

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CURRICULUM

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23MAT103	Mathematical Foundation of Formal Approach	BS	2	1	0	3	40	60	100
2	P23CSTD01	Advanced Data Structures and Algorithms	PC	3	0	0	3	40	60	100
3	P23CST102	Cloud and Big Data Analytics	PC	3	0	0	3	40	60	100
4	P23CSTD02	Speech and Language Processing	PC	3	0	0	3	40	60	100
5	P23HSTC01	Research Methodology and IPR	HS	2	0	0	2	40	60	100
6	P23CSE1XX	Professional Elective – I *	PE	3	0	0	3	40	60	100
Practical										
7	P23CSP101	Advanced Data Structures and Algorithms Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC01	Technical Report Writing and Seminar	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC1XX	Certification Course-I #	AEC	0	0	4	-	100	-	100
10	P23ACT10X	Audit Course-I**	AEC	0	0	2	-	100	-	100
							21	590	410	1000

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23CST203	Advanced Software Engineering and Testing	PC	3	0	0	3	40	60	100
2	P23CST204	Adhoc and Wireless Sensor Networks	PC	3	0	0	3	40	60	100
3	P23CST205	Advanced Operating Systems	PC	3	0	0	3	40	60	100
4	P23CST206	Advanced Python Programming	PC	3	0	0	3	40	60	100
5	P23CSE2XX	Professional Elective - II	PE	3	0	0	3	40	60	100
6	P23CSE2XX	Professional Elective - III	PE	3	0	0	3	40	60	100
Practical										
7	P23CSP202	Advanced Python Programming Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC02	Seminar on ICT a hands on approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC2XX	Certification Course-II #	AEC	0	0	4	-	100	-	100
10	P23ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

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SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23CSE1XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P23CSE1XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P23CSE1XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Project Work										
4	P23CSW301	Project Phase - I	PA	0	0	12	6	50	50	100
5	P23CSW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
6	P23CSC301	NPTEL/SWAYAM/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P23CSW403	Project Phase - II	PA	0	0	24	12	50	50	100
							12	50	50	100

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

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

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

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

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ANNEXURE- I

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	P23CSE101	Programming for Data Science
2	P23CSE102	Cyber Attacks Detection and Prevention Systems
3	P23CSE103	Bio-Inspired Computing
4	P23CSE104	Block Chain and Crypto currency
5	P23CSE105	IoT Applications Engineering
Professional Elective-II		
1	P23CSEC01	Information Visualization
2	P23CSE206	Malware Analysis
3	P23CSEC02	Soft Computing
4	P23BDEC01	Neural Networks
5	P23CSE207	Smart Sensing for IoT
Professional Elective-III		
1	P23CSEC03	Text, Web and Social Media Analytics
2	P23CSEC04	Data Storage Technologies and Networks
3	P23CSE208	Reinforcement Learning
4	P23CSE209	Mobile Application and Development
5	P23CSE210	Wireless Sensor Networks and IoT
Professional Elective-IV		
1	P23BDEC03	Analytics of Things
2	P23CSE311	Cloud Security and Analytics
3	P23CSE312	Pattern Recognition
4	P23CSEC05	Game Design and Augmented Reality
5	P23CSE313	IoT Security and Trust
Professional Elective-V		
1	P23CSEC06	Image and Video Analytics
2	P23CSE314	Web Application Security
3	P23CSE315	Cognitive Science
4	P23CSE316	Cloud Application Development and Management
5	P23CSE317	Intelligent Internet of Things
Professional Elective-VI		
1	P23CSE318	Big Data Technologies
2	P23CSE319	Digital Forensics
3	P23CSE320	Knowledge Engineering and Expert Systems
4	P23BDTD01	NoSQL Databases
5	P23CSE321	Industrial IoT

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ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P23XXCX01	Adobe Photoshop
2	P23XXCX02	Adobe Animate
3	P23XXCX03	Adobe Dreamweaver
4	P23XXCX04	Adobe After Effects
5	P23XXCX05	Adobe Illustrator
6	P23XXCX06	Adobe InDesign
7	P23XXCX07	Autodesk AutoCAD -ACU
8	P23XXCX08	Autodesk Inventor - ACU
9	P23XXCX09	Autodesk Revit - ACU
10	P23XXCX10	Autodesk Fusion 360 - ACU
11	P23XXCX11	Autodesk 3ds Max - ACU
12	P23XXCX12	Autodesk Maya - ACU
13	P23XXCX13	Cloud Security Foundations
14	P23XXCX14	Cloud Computing Architecture
15	P23XXCX15	Cloud Foundation
16	P23XXCX16	Cloud Practitioner
17	P23XXCX17	Cloud Solution Architect
18	P23XXCX18	Data Engineering
19	P23XXCX19	Machine Learning Foundation
20	P23XXCX20	Robotic Process Automation / Medical Robotics
21	P23XXCX21	Advance Programming Using C
22	P23XXCX22	Advance Programming Using C ++
23	P23XXCX23	C Programming
24	P23XXCX24	C++ Programming
25	P23XXCX25	CCNP Enterprise: Advanced Routing
26	P23XXCX26	CCNP Enterprise: Core Networking
27	P23XXCX27	Cisco Certified Network Associate - Level 2
28	P23XXCX28	Cisco Certified Network Associate- Level 1
29	P23XXCX29	Cisco Certified Network Associate- Level 3
30	P23XXCX30	Fundamentals Of Internet of Things
31	P23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT
32	P23XXCX32	Java Script Programming
33	P23XXCX33	NGD Linux Essentials
34	P23XXCX34	NGD Linux I
35	P23XXCX35	NGD Linux II
36	P23XXCX36	Advance Java Programming

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37	P23XXCX37	Android Programming / Android Medical App Development
38	P23XXCX38	Angular JS
39	P23XXCX39	Catia
40	P23XXCX40	Communication Skills for Business
41	P23XXCX41	Coral Draw
42	P23XXCX42	Data Science Using R
43	P23XXCX43	Digital Marketing
44	P23XXCX44	Embedded System Using C
45	P23XXCX45	Embedded System with IOT / Arduino
46	P23XXCX46	English For IT
47	P23XXCX47	Plaxis
48	P23XXCX48	Sketch Up
49	P23XXCX49	Financial Planning, Banking and Investment Management
50	P23XXCX50	Foundation Of Stock Market Investing
51	P23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P23XXCX52	IOT Using Python
53	P23XXCX53	Creo (Modelling & Simulation)
54	P23XXCX54	Soft Skills, Verbal, Aptitude
55	P23XXCX55	Software Testing
56	P23XXCX56	MX-Road
57	P23XXCX57	CLO 3D
58	P23XXCX58	Solid works
59	P23XXCX59	Staad Pro
60	P23XXCX60	Total Station
61	P23XXCX61	Hydraulic Automation
62	P23XXCX62	Industrial Automation
63	P23XXCX63	Pneumatics Automation
64	P23XXCX64	Agile Methodologies
65	P23XXCX65	Block Chain
66	P23XXCX66	Devops
67	P23XXCX67	Artificial Intelligence
68	P23XXCX68	Cloud Computing
69	P23XXCX69	Computational Thinking
70	P23XXCX70	Cyber Security
71	P23XXCX71	Data Analytics
72	P23XXCX72	Databases
73	P23XXCX73	Java Programming
74	P23XXCX74	Networking
75	P23XXCX75	Python Programming

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76	P23XXCX76	Web Application Development (HTML, CSS, JS)
77	P23XXCX77	Network Security
78	P23XXCX78	MATLAB
79	P23XXCX79	Azure Fundamentals
80	P23XXCX80	Azure AI (AI-900)
81	P23XXCX81	Azure Data (DP -900)
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P23XXCX84	Microsoft Power Platform (PI-900)
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P23XXCX86	Microsoft Excel
87	P23XXCX87	Microsoft Excel Expert
88	P23XXCX88	Securities Market Foundation
89	P23XXCX89	Derivatives Equinity
90	P23XXCX90	Research Analyst
91	P23XXCX91	Portfolio Management Services
92	P23XXCX92	Cyber Security
93	P23XXCX93	Cloud Security
94	P23XXCX94	PMI – Ready
95	P23XXCX95	Tally – GST & TDS
96	P23XXCX96	Advance Tally
97	P23XXCX97	Associate Artist
98	P23XXCX98	Certified Unity Programming
99	P23XXCX99	VR Development

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ANNEXURE-III

AUDIT COURSES

(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P23ACTX01	English for Research Paper Writing
2	P23ACTX02	Disaster Management
3	P23ACTX03	Sanskrit for Technical Knowledge
4	P23ACTX04	Value Education
5	P23ACTX05	Constitution of India
6	P23ACTX06	Pedagogy Studies
7	P23ACTX07	Stress Management by Yoga
8	P23ACTX08	Personality Development Through Life Enlightenment Skills
9	P23ACTX09	Unnat Bharat Abhiyan

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Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester	I			Course Category : **BS**		*End Semester Exam Type: **TE**	
Course Code	P23MAT103	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Mathematical Foundation of Formal Approach	2	1	-	3	40	60	100

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

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

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

Text Books

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

Reference Books

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

Web References

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

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

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Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	I	Course Category : PC			*End Semester Exam Type: TE			
Course Code	P23CSTD01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Advanced Data Structures and Algorithms	3	-	-	3	40	60	100

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

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

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

Text Books

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

Reference Books

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

Web References

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

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

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Department	Computer Science and Engineering	Programme: **M.Tech.**					
Semester	I	Course Category : **PC**			*End Semester Exam Type: **TE**		
Course Code	P23CST102	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Cloud and Big Data Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

UNIT-I	**Introduction**	**Periods: 9**
Introduction to Cloud Computing- The Evolution of Cloud Computing – Hardware Evolution – Internet Software Evolution – Server Virtualization - Cloud Services - Cloud Service Administration - Cloud Data Management.		**CO1**

UNIT-II	**Cloud Infrastructure**	**Periods: 9**
Cloud Infrastructure: Introduction - Advancing towards a Utility Model – Evolving IT infrastructure – Evolving Software Applications – Continuum of Utilities- Standards and Working Groups - Standards Bodies and Working Groups – Service Oriented Architecture – Business Process Execution Language – Interoperability Standards for Data Center Management - Utility Computing Technology – Virtualization – Hyper Threading – Blade Servers - Automated Provisioning - Policy Based Automation – Application Management – Evaluating Utility Management Technology - Virtual Test and development Environment - Data Center Challenges and Solutions - Automating the Data Center.		**CO2**

UNIT-III	**Network Virtualization and Geo-Distributed Cloud**	**Periods: 9**
Cloud computing and server virtualization-networking of virtual machines inside hypervisor – Docker – software defined network – Network virtualization in multi-tenant data centers - VL2 - NVP – Geo distributed cloud data centers		**CO3**

UNIT-IV	**Introduction To Big Data and Hadoop**	**Periods: 9**
Types of Digital Data - Introduction to Big Data - Big Data Analytics - History of Hadoop - Apache Hadoop - Analysing Data with Unix tools - Analyzing Data with Hadoop - Hadoop Streaming - Hadoop Echo System - IBM Big Data Strategy - Introduction to Ionosphere Big Insights and Big Sheets.		**CO4**

UNIT-V	**HDFS (Hadoop Distributed File System) and Map Reduce**	**Periods: 9**
The Design of HDFS - HDFS Concepts - Command Line Interface - Hadoop file system interfaces - Data flow - Data Ingest with Flume and Scoop and Hadoop archives - Hadoop I/O: Compression – Serialization Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run – Failures - Job Scheduling - Shuffle and Sort - Task Execution - Map Reduce Types and Formats - Map Reduce Features.		**CO5**

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

Text Books

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

Reference Books

1. John W. Rittinghouse and James F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, Taylor & Francis Group, Boca Raton London New York, 2010.
2. Alfredo Mendoza, "Utility Computing Technologies, Standards, and Strategies", Artech House INC, 2007.
3. Bunker and Darren Thomson, "Delivering Utility Computing", John Wiley & Sons Ltd, 2006.
4. Tom White, "Hadoop : The Definitive Guide", O'reily Media, Third Edition, 2012.
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2. www.redhat.com/en/topics/cloud-computing/what-is-cloud-infrastructure
3. www.digitalocean.com/community/tutorials/an-introduction-to-big-data-concepts-and-terminology
4. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/
5. https://www.tutorialspoint.com/hadoop/hadoop_big_data_overview.htm

* TE – Theory Exam, LE – Lab Exam

A. A. 3. 121

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.122

Department	Computer Science and Engineering	Programme : M.Tech.					
Semester	I	Course Category :PC			*End SemesterExamType:TE		
Course Code	P23CSTD02	Periods/Week			Credit	MaximumMarks	
		L	T	P	C	CAM	ESE	TM
Course Name	Speech and Language Processing	3	0	0	3	40	60	100

Prerequisite	No prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the basics of NLP	K3
	CO2 Apply the basic ML and DL techniques for NLP	K3
	CO3 Understand and realize the advanced NLP Techniques.	K2
	CO4 Make use of Language understanding, Generation and Information Retrieval	K3
	CO5 Apply ethics to be followed while building NLP Applications and how to use NLP Libraries	K3

UNIT – I	Introduction	Periods:9
Phases of NLP, Text Preprocessing: Tokenization, Stemming and Lemmatization, Pos Tagging, Named Entity Recognition. NLP Feature Engineering, Word Count Vector, Word Sense Disambiguation		CO1
UNIT – II	**Language Modelling**	**Periods:9**
N -gram Models, Hidden Markov Models, Maximum Likelihood Estimation. Supervised, Unsupervised and Semi Supervised Learning. Text Classification and Sentiment Analysis, Topic Modelling and Clustering, Word Embeddings, RNN & LSTMs for NLP, CNN for NLP.		CO2
UNIT – III	**Advanced NLP Techniques**	**Periods:9**
Sequence- to -Sequence Models, Attention Mechanisms, Transformer Architecture: BERT, GPT		CO3
UNIT – IV	**Language Understanding and Generation, Information Retrieval**	**Periods:9**
Text Generation, Question Answering, Dialogue Systems and Chatbots. Machine Translation, Cross Lingual Transfer Learning. Text Indexing and Search, Text Summarization.		CO4
UNIT – V	**NLP Tools, Libraries, Applications, Ethics**	**Periods:9**
Bias and Fairness in NLP, Privacy Concerns in NLP Applications. NP libraries: NLTK, Spacy, Tensor Flow, Pytorch. NLP Applications: Sentiment Analysis, Named Entity Recognition in Real World Data Sets, Text Classification for Various Domains.		CO5

LecturePeriods:45	TutorialPeriods:0	PracticalPeriods:-0	TotalPeriods:45

Text Books

1. Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" ,13th Edition, The MIT Press Cambridge, Massachusetts London, England, 2018
2. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 16th edition, Prentice Hall, 2021.
3. Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application".PACKT publisher, 2018

Reference Books

1. NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second 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, MITPress 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

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1. https://www.udemy.com/course/chatbot/
2. https://gtuematerial.in/natural-language-processing-3170723/
3. https://chatbotsmagazine.com/understanding-the-need-for-nlp-in-your-chatbot-78ef2651de84?gi=ecca664b642a
4. https://www.ultimate.ai/blog/ai-automation/how-nlp-text-based-chatbots-work
5. https://www.javatpoint.com/nlp

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 123

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	3	2	2	2	2
2	2	3	3	3	2	1	2	2	1
3	2	3	3	2	1	-	2	2	1
4	2	2	3	2	3	2	2	3	1
5	3	2	2	3	3	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		15	10	5	60	100

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

2.A-3-124

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	I	Course Category : **HS**			*End Semester Exam Type: **TE**			
Course Code	**P23HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology and IPR**	**2**	**-**	**-**	**2**	**40**	**60**	**100**
(Common to all M.Tech Courses)								
Prerequisite	No prerequisite needed							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Gain Knowledge to formulate the research problem.	K2
CO2	Understand the concepts to carry out the literature review, ethics and research analysis.	K2
CO3	Explain the way of writing technical paper and presentation methods.	K2
CO4	Ability to understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.	K2
CO5	Ability to understand about IPR and filing patents in R & D.	K3

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

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

Text Books

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

Reference Books

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

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

* TE – Theory Exam, LE – Lab Exam

2.A.3.125

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 126

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **LE**			
Course Code	**P23CSP101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms Laboratory**	**-**	**-**	**4**	**2**	**50**	**50**	**100**

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

List of Experiments:

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

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

Reference Books

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

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

2.A.3.127

Evaluation Method

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

2.A.3.128

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

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

List of Experiments:

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filte	• provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-known journals and conferences, in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview, Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered	4th week	6% (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? • Conclude with limitations/issues not addressed by the paper (from the perspective of survey)	6th week	8% (The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

Reading and notes for next 5 papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6%(Clarity, purpose and conclusion) 6% Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11th week	10% (this component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	5% (conclusions)
Final Draft	Complete the final draft of your paper	13th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Repor
Seminar	A brief 15 slides on your paper	14th & 15th week	10% (based on presentation and Vivavoce)
Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 4 5**	**Total Periods: 45**

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

2.A.3.130

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **AEC**			*End Semester Exam Type: -			
Course Code	**P23CSC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

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

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

2. A. 3. 131

Department	Computer Science and Engineering	Programme: **M.Tech.**					
Semester	II	Course Category : **PC**			*End Semester Exam Type: **TE**		
Course Code	**P23CST203**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Software Engineering and Testing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Software Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Illustrate Software Engineering Lifecycle Models	**K3**
	CO2 Perform Project management and cost estimation	**K3**
	CO3 Make use of the System Analysis and Design concepts	**K4**
	CO4 Illustrate different testing techniques.	**K3**
	CO5 Make use of different levels of testing in their software.	**K4**

UNIT-I	**Introduction**	**Periods: 9**
Software engineering concepts – Development activities – Software lifecycle models - Classical Waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management.		**CO1**
UNIT-II	**Software Requirement Specification**	**Periods: 9**
Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram		**CO2**
UNIT-III	**Architecture and Design**	**Periods: 9**
Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command– Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client-server - Tiered -Pipe and filter.- User interface design		**CO3**
UNIT-IV	**Testing Techniques and Testing Tools**	**Periods: 9**
Testing Techniques – Verification vs Validation – Software Testing Methodologies – White Box, Black Box and Grey Box – Static and Dynamic Techniques – Informal Reviews, Walkthroughs, Technical Reviews, Inspection – Structural Techniques, Black Box Techniques, Experienced Based Techniques. Testing Tools: Selenium – Jmeter		**CO4**
UNIT-V	**Levels of Testing**	**Periods: 9**
Levels of Testing – Test Case Design – Building Test Cases – Test data mining – Test execution – Test reporting – Functional Testing – Unit, Integration, System, Acceptance, Regression, Retest – Non Functional Testing – Performance, Memory, Scalability, Compatibility, Security, Cookie, Session, Recovery, Adhoc, Risk Based Testing.		**CO5**

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

Text Books

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

Reference Books

1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearson Education, 2004.
2. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3. Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
4. Len Bass, Ingo Weber and Liming Zhu, —DevOps: A Software Architect's Perspectivell, Pearson Education, 2016
5. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007

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https://nptel.ac.in/courses/106/105/106105150/
https://onlinecourses.nptel.ac.in/noc19_cs71/preview
https://www.coursera.org/lecture/introduction-software-testing/stages-of-software-testing-process-UMOpe
https://cosmolearning.org/courses/introduction-to-software-engineering/video-lectures/
https://freevideolectures.com/course/2318/software-engineering

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	3	1	1
2	3	3	3	2	-	-	3	1	1
3	3	3	3	2	2	-	3	1	1
4	3	3	3	2	2	-	3	1	1
5	3	3	3	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		15	10	5	60	100

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

2.A.3.134

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	II	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23CST204**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Adhoc and Wireless Sensor Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Wireless Network	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify different issues in wireless ad hoc and sensor networks.	**K1**
	CO2 Analyze protocols developed for ad hoc and sensor networks.	**K4**
	CO3 Identify and understand security issues in ad hoc and sensor networks.	**K1**
	CO4 Build the routing mechanism and improving QoS.	**K3**
	CO5 Apply Channel allocation strategy to improve the connectivity in Ad-Hoc Networks.	**K3**

UNIT-I	**Introduction**	**Periods: 9**	
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel - mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs): concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.			**CO1**
UNIT-II	**MAC Protocols for Ad Hoc Wireless Networks**	**Periods: 9**	
Issues in designing a MAC Protocol - Classification of MAC Protocols - Contention based protocols - Contention based protocols with Reservation Mechanism - Contention based protocols with Scheduling Mechanisms – Multi channel MAC - IEEE 802.11.			**CO2**
UNIT-III	**Routing Protocols Transport Layer in Ad hoc Networks**	**Periods: 9**	
Issues in designing a routing and Transport Layer protocol for Ad hoc networks - proactive routing, reactive routing (on-demand) - hybrid routing - Classification of Transport Layer solutions -TCP over Ad hoc wireless Networks.			**CO3**
UNIT-IV	**Wireless Sensor Networks (WSNS) and MAC Protocols**	**Periods: 9**	
Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies - MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC - IEEE 802.15.4.			**CO4**
UNIT-V	**WSN Routing, Localization and QOS**	**Periods: 9**	
Issues in WSN routing – OLSR - Localization – Indoor and Sensor Network Localization - absolute and relative localization, triangulation - QOS in WSN - Energy Efficient Design – Synchronization - Transport Layer issues			**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, Third Edition, 2008.
2. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, First Edition, 2007.
3. Al-Sakib Khan Pathan, Shafiullah Khan, Nabil Ali Alrajeh, "Wireless Sensor Networks Current Status and Future Trends", CRC Press, 2016.

Reference Books

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company, Second Edition, 2006.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
3. Holger Karl and Andreas Willig "Protocols and Architectures for Wireless Sensor Networks", Wiley, Third Edition, 2005. 4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, Fourth Edition, 2007.
5. Anna Hac, "Wireless Sensor Network Designs", John Wiley, Second Edition,2003.

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1. https://nptel.ac.in/courses/106105160/
2. https://en.wikipedia.org/wiki/Wireless_ad_hoc_network
3. https://shodhganga.inflibnet.ac.in/bitstream/10603/77730/12/12_chapter_02.pdf

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 135

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	-	-	-	-	-	-	-
2	3	2	3	3	-	1	-	2	-
3	3	1	3	3	-	1	2	2	-
4	1	1	2	3	3	1	-	2	-
5	2	1	2	3	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	10		15	10	5	60	100

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

2. A. 3. 136

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	II	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	P23CST205	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Operating Systems**	3	-	-	3	40	60	100

Prerequisite	Basics of Operating Systems	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the functionality of an operating system by reading its internal source.	**K2**
	CO2 Revise any algorithm present in an internal system namely system calls.	**K1**
	CO3 Describe the implementation of inter process communication.	**K2**
	CO4 Modify and use the data structures of the windows operating system.	**K3**
	CO5 Identify the different features of real time and mobile operating systems.	**K3**

UNIT-I	**Introduction to Kernel**	**Periods: 9**
Introduction to Kernel - Architecture of the UNIX operating system - System concepts - Data structures. Buffer Cache: Buffer header - Structure of Buffer pool - Reading and writing disk blocks. Files INODES - Structure of a regular file - Directories- Super block- Inode assignment.		**CO1**
UNIT-II	**System Calls**	**Periods: 9**
System calls: OPEN-Read – Close – Write – Create – CHMOD – CHOWN – Pipes - Mounting and Unmounting. Process: Layout the system memory – Context - Process control - process creation – signals - Process scheduling – time - clock.		**CO2**
UNIT-III	**Inter- Process Communications**	**Periods: 9**
Inter-Process Communications: Process tracing- System V IPC-Shared Memory - Semaphores. Network Communications: Socket programming – Sockets – descriptors – Connections - Socket elements - Stream and Datagram Sockets.		**CO3**
UNIT-IV	**Windows Operating System**	**Periods: 9**
Windows Operating system: versions - Concepts and tools - Windows internals - System Architecture - Requirements and design goals - Operating system mode l- Architecture overview - Key system components. System mechanisms: Trap dispatching - object manager – Synchronization - System worker threads -Windows global flags - Local procedural calls - Kernel event tracing.		**CO4**
UNIT-V	**Real Time and Mobile Operating Systems**	**Periods: 9**
Basic Model of Real Time Systems – Characteristics - Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems - Micro Kernel Design - Client Server Resource Access - Processes and Threads -Memory Management - File system – TinyOS – Architecture - Applications		**CO5**

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

Text Books

1. Maurice J. Bach, "The Design of the Unix Operating System", Prentice Hall of India, First Edition 1991.
2. Brian Catlin, Jamie Hanrahan, Mark E. Russinovich, David A. Solomon and Alex Ionescu "Windows Internals, Book 1 – User Mode 7ed (Developer Reference)", Microsoft Press, Seventh Edition, 2014.
3. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, Fifth Edition, 2019.

Reference Books

1. Daniel P. Bovet and Marco Cesati, "Understanding the Linux Kernel", O'Reilly Publications, Third Edition, 2005.
2. Harold Abelson, Gerald Jay Sussman and Julie Sussman, "Structure and Interpretation of Computer Programs", Universities Press, Second Edition, 2013.
3. Michael Beck, Harald Bohme, MirkoDziadzka, Ulrich Kunitz, Robert Magnus, Dirk Verworner, "Linux Kernel Internals", Addison-Wesley, Third Edition, 2017.
4. Robert Love, "Linux Kernel Development", Addison-Wesley, Third Edition, 2010.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System concepts, John Wiley & Sons, Tenth Edition (kindle edition), 2018.

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1. http://www.softpanorama.org/Internals/index.shtml
2. https://www.udemy.com/course/understanding-the-internals-of-the-unix-kernel-architecture/
3. https://www.britannica.com/technology/Windows-OS
4. https://www.tutorialspoint.com/operating_system/index.htm
5. https://www.geeksforgeeks.org/operating-systems/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 138

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	II	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	P23CST206	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Python Programming**	3	-	-	3	40	60	100

Prerequisite	Basics of Python Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Object Oriented Concepts using Python.	**K2**
	CO2 Implement Graphical User Interface using Tkinter Package.	**K3**
	CO3 Paraphrase Python and MySQL connectivity and manipulations.	**K2**
	CO4 Demonstrate Network Programming with Python.	**K3**
	CO5 Implement Web Application Development using Django.	**K4**

UNIT-I	**OOPS in Python**	**Periods: 9**	
Classes and Objects - Constructor - Encapsulation - Inheritance. Polymorphism: Method Overloading - Method Overriding - Operator Overloading. Static Methods and Class Methods - Abstraction - Composition - Aggregation - Association			**CO1**
UNIT-II	**GUI in Python (TKINTER)**	**Periods: 9**	
Introduction to Tkinter: Canvas - Widgets - Layout Management - Dialogs and Message Boxes - Frames and Containers - Menus. Event Handling: Event-driven Programming. Customizing Widgets - Building Multi-window Applications			**CO2**
UNIT-III	**Python Database Connectivity**	**Periods: 9**	
Installing MySQL Connector - Connecting to MySQL Database - Prepared Statements - Parameterized Queries - Fetching Data - Transactions - CRUD Processes			**CO3**
UNIT-IV	**Network Programming**	**Periods: 9**	
Socket Programming - Networking with Sockets - TCP/IP Communication - UDP Communication - HTTP Requests - WebSocket Programming - Networking Protocols - DNS Resolution - Network Monitoring.			**CO4**
UNIT-V	**Web Application Development (DJANGO)**	**Periods: 9**	
Django Basics - Forms and Form Handling - Django Admin - User Authentication and Authorization - Static Files and Media Handling - Middleware - Working with APIs - Session Management.			**CO5**

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

Text Books

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press, 2nd Edition, 2019.
2. Alan D. Moore, "Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter", Packt Publishing, 1st Edition, 2018.
3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", Apress, 3rd Edition, 2014.
4. William S. Vincent, "Django for Beginners: Build websites with Python and Django", Leanpub, 3rd Edition, 2021.

Reference Books

1. John Zelle, Franklin, "Python Programming: An Introduction to Computer Science", Beedle & Associates Inc., 3rd Edition, 2016.
2. Albert Lukaszewski, "MySQL for Python", Packt Publishing, 1st Edition, 2010.
3. Abhishek Ratan, "Python Network Programming: Conquer all your networking challenges with the powerful Python language", Packt Publishing, 2nd Edition, 2017.
4. Burkhard Meier,"Python GUI Programming Cookbook: Develop functional and responsive user interfaces with tkinter and PyQt5", Packt Publishing, 1st Edition, 2019.
5. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th Edition, 2013.

Web References

https://docs.python.org/3/tutorial/classes.html
https://www.tutorialspoint.com/python3/python_gui_programming.htm
https://dev.mysql.com/doc/connector-python/en/
https://www.tutorialspoint.com/python3/python_networking.htm
https://docs.djangoproject.com/

* TE – Theory Exam, LE – Lab Exam

2.A.3.139

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A-3. 140

Department	Computer Science and Engineering			Programme: **M.Tech.**				
Semester	II			Course Category : **PC**		*End Semester Exam Type: **LE**		
Course Code	**P23CSP202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Python Programming Laboratory**	-	-	4	2	50	50	100

Prerequisite	Basics of Python Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Object Oriented Concepts using Python.	**K2**
	CO2 Implement Graphical User Interface using Tkinter Package.	**K3**
	CO3 Paraphrase Python and MySQL connectivity and manipulations.	**K2**
	CO4 Demonstrate Network Programming with Python.	**K3**
	CO5 Implement Web Application Development using Django.	**K4**

List of Experiments:

1. Create classes for BankAccount, SavingsAccount, and CheckingAccount and implement methods for deposit, withdrawal, balance inquiry, and interest calculation.
2. Create classes for Employee, Payroll, and Salary and implement methods for calculating employee salaries, generating pay slips and managing payroll records using Inheritance.
3. Create a graphical calculator with buttons for numeric input, arithmetic operations, and a display to show the result.
4. Develop a GUI-based to-do list application where users can add, delete, and manage their tasks.
5. Develop a Python program to fetch the records from a table in MySQL and display in python console.
6. Develop a CRUD program using Python-MySql connectivity.
7. Create a client-server based chat application where multiple clients can connect to a server and exchange messages.
8. Build a network port scanner program that scans a given IP address or range of IP addresses to detect open ports on remote machines.
9. Create a fully functional blogging platform where users can register, create blog posts, add comments, and browse through published posts.
10. Develop an e-commerce store application with features like product listings, user authentication, shopping cart management, and secure payment integration.

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

Reference Books

1. Eric Matthes, "Python Crash Course: A Hands-On, Project-Based Introduction to Programming", No Starch Press, 2nd Edition, 2019.
2. Alan D. Moore, "Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter", Packt Publishing, 1st Edition, 2018.
3. Brandon Rhodes and John Goerzen, "Foundations of Python Network Programming", Apress, 3rd Edition, 2014..
4. Burkhard Meier,"Python GUI Programming Cookbook: Develop functional and responsive user interfaces with tkinter and PyQt5", Packt Publishing, 1st Edition, 2019.
5. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th Edition, 2013.

Web References

https://docs.python.org/3/tutorial/classes.html
https://www.tutorialspoint.com/python3/python_gui_programming.htm
https://dev.mysql.com/doc/connector-python/en/
https://www.tutorialspoint.com/python3/python_networking.htm
https://docs.djangoproject.com/

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 141

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

2.A.3.142

Department	Computer Science and Engineering			Programme: **M.Tech.**				
Semester	II			Course Category : **HS**		*End Semester Exam Type: **LE**		
Course Code	**P23HSPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Seminar on ICT: A Hands-On Approach**	-	-	4	2	100	-	100
(Common to all M.Tech Programmes)								
Prerequisite	No Prerequisite needed							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Select a topic, narrowing the topic into presentation.	K2
CO2	State an objective and use the relevant ICT tools to make the presentation effective.	K3
CO3	Study the topic and understanding the contributions and prepare report.	K2
CO4	Prepare a working demo.	K3
CO5	Prepare conclusions based on the reading of the topic and giving final Presentation.	K4

List of Experiments:

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

ICT skills
- Understand ICT workflow in the respective domain choosed.
- Manage multitasking.
- Deal with main issues using tech in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Scope
- Perspective in order to design activities in class.
- Understand the process of creating audiovisuals.

Teaching tools
- Different ways to create audiovisual activities.
- Handle audiovisual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study on the assigned topic and prepare a report, running to 30 or 40 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee (comprising of the Head of the Department and two faculty members) for a total of 100 marks.

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

2.A.3.143

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Attendance		
	Presentation using ICT	Report	viva			
Marks	50	30	10	10	-	100

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **AEC**			*End Semester Exam Type: -			
Course Code	**P23CSC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

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

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

2. A. 3. 145

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	I	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	P23CSE101	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Programming for Data Science**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Data Science	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the need for data science and solve basic problems using Python built-in data types and their methods.	**K2**
	CO2 Employ efficient storage and data operations using NumPy arrays.	**K3**
	CO3 Apply powerful data manipulations using Pandas	**K3**
	CO4 Identify and execute basic syntax and programs in R	**K2**
	CO5 Exploit the graph using ggplot2	**K3**

UNIT-I	**Introduction to Data Science and Python Programming**	**Periods: 9**
Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.		**CO1**
UNIT-II	**Introduction to NumPy**	**Periods: 9**
NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic		**CO2**
UNIT-III	**Data Manipulation with Pandas**	**Periods: 9**
Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping Entries -Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.		**CO3**
UNIT-IV	**Introduction to Data Science and R Programming**	**Periods: 9**
R for Basic Math- Arithmetic- Logarithms and ExponentialsE-Notation- Assigning Objects- Vectors- Creating a Vector- Sequences, Repetition, Sorting, and Lengths- Subsetting and Element Extraction- Vector-Oriented Behaviour		**CO4**
UNIT-V	**Basic Plotting**	**Periods: 9**
Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis LabelsColor-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an Existing Plot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms-- READING AND WRITING FILES- R-Ready Data Sets- Contributed Data Sets-Reading in External Data Files- Writing Out Data Files and Plots- Ad Hoc Object Read/Write Operations		**CO5**

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

Text Books

1. Tilman M.Davies,"The Book of R - A First Programming and Statistics" Library of Congress Cataloging-in-Publication Data,2016.
2. Bruce, Peter, and Andrew Bruce. Practical statistics for data scientists: 50 essential concepts. " O'Reilly Media, Inc.", 2017.
3. Steven Keller, "R Programming for Beginners", CreateSpace Independent Publishing Platform 2016.

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1. Roger D. Peng,"R Programming for Data Science"Lean Publishing, 2016.
2. Hadley Wickham, Garrett Grolemund," R for Data Science",OREILLY Publication,2017
3. Kun Ren ,"Learning R Programming", Packt Publishing,2016
4. Dodge, Yadolah, ed. Statistical data analysis and inference. Elsevier, 2014.
5. Ismay, Chester, and Albert Y. Kim. Statistical Inference via Data Science: A Modern Dive into R and the Tidyverse. CRC Press, 2019.

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https://www.tutorialspoint.com/python3/python_gui_programming.htm
https://dev.mysql.com/doc/connector-python/en/
https://www.tutorialspoint.com/python3/python_networking.htm

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 147

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A.3. 148

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	I	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	P23CSE102	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Cyber Attack Detection and Prevention Systems**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite			
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Understand Intrusion Detection and Prevention System	**K2**
	CO2	Illustrate Network Intrusion Detection and Prevention System	**K3**
	CO3	Make use of Network behavior analysis	**K3**
	CO4	Exploit SNORT IDS	**K4**
	CO5	Make use of IDPS Technologies	**K3**

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

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

Text Books

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

Reference Books

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

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https://www.mygreatlearning.com/blog/types-of-cyber-attacks/
https://cybersecurityguide.org/resources/coding-for-cybersecurity/
https://www.codingninjas.com/studio/library/cyber-attacks-and-their-types

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 149

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 150

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	I	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSE103	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Bio-Inspired Computing	3	-	-	3	40	60	100

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

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

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

Text Books

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

Reference Books

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

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* TE – Theory Exam, LE – Lab Exam

M.Tech. Computer Science and Engineering

2. A. 3. 151

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 152

Department	Computer Science and Engineering			Programme: M.Tech.			
Semester	I			Course Category: PE		*End Semester Exam Type: TE	
Course Code	P23CSE104	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Block Chain and Crypto Currency	3	-	-	3	40	60	100

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

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

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

Text Books

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

Reference Books

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

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2. https://bitcoin.org/bitcoin.pdf
3. https://www.geeksforgeeks.org/introduction-to-crypto-terminologies
4. https://complyadvantage.com/knowledgebase/crypto-regulations/cryptocurrency-regulations-india
5. https://www.proofpoint.com/us/threat-reference/encryption

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.154

Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSE105**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**IOT Applications Engineering**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of IoT	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the IoT networking components with respect to OSI layer.	**K2**
	CO2 Build schematic for IoT solutions	**K3**
	CO3 Make use of Cloud computation and Bigdata Analytics	**K3**
	CO4 Illustrate IoT Security	**K3**
	CO5 Make use of IoT Applications	**K3**

UNIT-I	**Introduction**	**Periods: 9**
Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open source hardwares, Examples of IoT infrastructure,		**CO1**
UNIT-II	**IOT Protocols and Softwares**	**Periods: 9**
MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT protocol Architecture, Selection of Wireless technologies -6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, LiFi, WiDi		**CO2**
UNIT-III	**Cloud Computation and BigData Analytics**	**Periods: 9**
Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Introduction to big data analytics and Hadoop.		**CO3**
UNIT-IV	**IOT Security**	**Periods: 9**
Need for encryption, standard encryption protocol, light weight cryptography, Quadruple Trust Model for IoT-A – Threat Analysis and model for IoT-A, Cloud security		**CO4**
UNIT-V	**IOT Applications**	**Periods: 9**
Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0		**CO5**

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

Text Books

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014
3. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.

Reference Books

1. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally "Internet of Things A Hands-on-Approach" Arshdeep Bahga & Vijay Madisetti, 2014.
2. Asoke K Talukder and Roopa R Yavagal, "Mobile Computing," Tata McGraw Hill, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010
4. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010
5. Jonathan Follett, "Designing for Emerging - UX for Genomics, Robotics, and the Internet of Things Technologies", O'Reilly, 2014.

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https://www.geeksforgeeks.org/edge-computing/
https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot/
https://digimat.in/nptel/courses/video/106105166/L02.html

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.156

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	II	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSEC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Information Visualization	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Analyze the different data types, visualization types to bring out the insight.	K3
	CO2 Make use of Visualization Techniques	K3
	CO3 Illustrate different Visual Analytics	K2
	CO4 Make use of Data Visualization Tools	K3
	CO5 Demonstrate Visualization dashboard creations	K2

UNIT-I	Introduction	Periods: 9	
Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis:Four Levels for Validation. Statistical charts (Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart- Frequency Polygon - Box plot - Scatter plot - Regression curves			CO1
UNIT-II	**Visualization Techniques**	**Periods: 9**	
Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques -multidimensional techniques - visualizing cluster analysis – K-means and Hierarchical Cluster techniques.			CO2
UNIT-III	**Data Visualization and Visual Analytics**	**Periods: 9**	
Time Series data visualization – Text data visualization – Spatial Data Visualization - Networks and Trees - Heat Map – Tree Map - Map Color and Other Channels Manipulate View – Visual Attributes - Multivariate data visualization – Geometric projection techniques - Icon-based techniques - Pixel-oriented techniques - Hierarchical techniques - Scatterplot matrix - Hyper box - Trellis display - Parallel coordinates			CO3
UNIT-IV	**Data Visualization Tools**	**Periods: 9**	
Tableau functions and logics: Marks and Channels-Arrange Tables- Arrange Spatial Data- Facets into multiple views			CO4
UNIT-V	**Visualization Dashboard Creations**	**Periods: 9**	
Data Dashboard- Taxonomies- User Interaction- Organizational Functions-Dashboard Design – Worksheets - Workbooks – Workbook Optimization - Protection and common mistakes. Dashboard creation using visualization tool use cases: Finance-marketing-insurance-healthcare			CO5

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

Text Books

1. Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.
2. Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021
3. Dr. Chun-hauh Chen, W. K. Hardle, A. Unwin, Handbook of Data Visualization, 1st edition, Springer publication, Germany, 2008.

Reference Books

1. Ben Fry, Visualizing Data, 1st edition, O'Reilly Media, United States, 2008.
2. Avril Coghlan, A little book of R for multivariate analysis, 1st edition, Welcome Trust Sanger Institute,United Kingdom, 2013.
3. Colin Ware,Information Visualization Perception for Design,2 nd Edition ,Elsevier Science,2019
4. Riccardo Mazza,Introduction to Information Visualization,1st EditionSpringer London,2009
5. Claus O. Wilke,undamentals of Data Visualization,O'Reilly MediaInc,2019

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https://www.youtube.com/watch?v=_YfHDbADy4s
https://www.nobledesktop.com/learn/data-visualization/video-tutorials

* TE – Theory Exam, LE – Lab Exam

2.A.3.157

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.158

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	II	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSE206	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Malware Analysis	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand basics of Malware	K2
	CO2 Make use of Basic Analysis	K3
	CO3 Illustrate Static and Dynamic Analysis	K3
	CO4 Apply Malware functionalities	K4
	CO5 Illustrate Anti reverse Engineering	K3

UNIT-I	Malware Basics	Periods: 9	
General Aspect of Computer infection program , Non Self Reproducing Malware, How does Virus Operate?, Virus Nomenclature, Worm Nomenclature, Recent Malware Case Studies			CO1
UNIT-II	**Basic Analysis**	**Periods: 9**	
Antivirus Scanning, x86 Disassembly, Hashing, Finding Strings, Packed Malware, PE File Format, Linked Libraries & Functions, PE Header File & Section			CO2
UNIT-III	**Advanced Static and Dynamic Analysis**	**Periods: 9**	
IDA Pro, Recognizing C code constructs, Analyzing malicious windows program, Debugging, OllyDbg, Kernel Debugging with WinDbg, Malware Focused Network Signatures			CO3
UNIT-IV	**Malware Functionalities**	**Periods: 9**	
Malware Behavior, Covert Malware Launch, Data Encoding, Shellcode Analysis			CO4
UNIT-V	**Anti-Reverse Engineering**	**Periods: 9**	
Anti-Disassembly, Anti-Debugging, Anti-virtual machine techniques, Packers and Unpacking			CO5

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

Text Books

1. Michael Sikorski, Andrew Honig, "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software", 2012
2. Monnappa K A "Learning Malware Analysis: Explore the Concepts, Tools, and Techniques to Analyze and Investigate Windows Malware" 2018
3. Alexey Kleymenov and Amr Thabet," Mastering Malware Analysis: The Complete Malware Analyst's Guide to Combating Malicious Software, APT, Cybercrime, and IoT Attacks",2019

Reference Books

1. Dylan Barker, "Malware Analysis Techniques: Tricks for the triage of adversarial software", Packt Publishing, Limited, 2021.
2. Abhijit Mohanta and Anoop Saldanha, "Malware Analysis and Detection Engineering: A Comprehensive Approach to Detect and Analyze Modern Malware" Apress, 2020
3. Michael Ligh, Blake Hartstein, Steven Adair, Matthew Richard, "Malware Analyst's Cookbook and DVD: Tools and Techniques for Fighting Malicious Code"2010
4. Victor Marak,"Windows Malware Analysis Essentials", 2015
5. Mihai Christodorescu, Somesh Jha, Douglas Maughan, Dawn Song, Cliff Wang, "Malware Detection", Springer Science & Business Media, 2007.

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http://resources.infosecinstitute.com/malware-analysis-basic-dynamic-techniques/
http://www.remux.org
https://www.youtube.com/watch?v=qA0YcYMRWyI
https://perception-point.io/guides/malware/malware-detection-7-methods-and-security-solutions-that-use-them/

* TE – Theory Exam, LE – Lab Exam

2.A.3.159

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 160

Department	Computer Science and Engineering			Programme: M.Tech.			
Semester	II			Course Category : PE		*End Semester Exam Type: TE	
Course Code	P23CSEC02	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Soft Computing	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Apply neural networks, bidirectional associative memories and adaptive resonancetheory for solving different engineering problems	K2
	CO2 Identify and describe soft computing techniques and build supervised learning and unsupervised learning networks	K3
	CO3 Apply fuzzy logic and reasoning to handle uncertainty and solve various engineeringproblems.	K2
	CO4 Apply genetic algorithms to combinatorial optimization problems.	K2
	CO5 Evaluate and compare solutions by various soft computing approaches for a given problem	K3

UNIT-I	Introduction to Soft Computing	Periods: 9
Soft computing vs. hard computing, evolution of soft computing, features and types of softcomputing, applications of soft computing, basics of machine learning.		CO1

UNIT-II	Neural Networks and Back PropagationNetworks	Periods: 9
Basic concepts of Neural Networks, Model of Artificial Neuron, Neural Network Architectures, Characteristics of neural networks, Learning Methods, Early neural network architectures, Application domains. Back propagation network (BPN), Back propagation Learning, Applications of BPN, Parameter selection, Variations of Back propagation Algorithms		CO2

UNIT-III	Associative Memory Networks	Periods: 9
Auto correlators, hetero correlators: Kosko's discrete Bi-direction associative memory (BAM), Exponential BAM, Application of Character Recognition		CO3

UNIT-IV	Unsupervised Learning: Adaptive Resonance Theory	Periods: 9
Adaptive Resonance Theory (ART), Classical ART Networks, Simplifies ART Architecture, Features, algorithms and Illustration of ART1 and ART2 model, Related Applications		CO4

UNIT-V	Fuzzy Sets and Fuzzy Relations	Periods: 9
Fuzzy versus Crisp, Crisp Sets, Fuzzy sets, Membership functions, fuzzy set operations, properties of Fuzzy sets, Crisp Relations, Fuzzy relations – Fuzzy Cartesian product, Operations of Fuzzy Relations		CO5

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

Text Books

1. S, Rajasekaran& G.A. VijayalakshmiPai, "Neural Networks, Fuzzy systems and evolutionary algorithms: Synthesis and Applications", PHI Publication, 2nd Ed. 2017
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley and Sons, 3rd ed, 2011.
3. S.N. Sivanandam& S.N. Deepa, "Principles of Soft Computing", Wiley Publications, 3rd ed,2018.

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1. Jang, Jyh-Shing Roger, Chuen-Tsai Sun, and EijiMizutani. "Neuro-fuzzy and soft computing- a computational approach to learning and machine intelligence" Pearson, 1997.
2. Kosko, B., Neural Networks and Fuzzy Systems: A Dynamical Systems Approach toMachine Intelligence, PHI Publication, 1994.
3. George J. Klir,Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice Hall, 2015
4. Rich E andKnight K, Artificial Intelligence, McGraw Hill Education; 3rd ed, 2017.
5. Haykin, "Neural Networks and Learning Machines", Pearson Education Inc., 3rd Ed 2008.

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2. https://www.includehelp.com/soft-computing/
3. https://www.educba.com/soft-computing-techniques/
4. https://nptel.ac.in/courses/106105173
5. https://www.youtube.com/watch?v=a63JT0OFeys

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 161

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.162

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester	II	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	P23BDEC01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Neural Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basic Physics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basics of ANN and comparison with Human brain.	**K3**
	CO2 Understand the role of neural networks in engineering, artificia intelligence, and cognitive modelling.	**K2**
	CO3 Understand the concepts and techniques of neural networks throughthe study of the most important neural network models.	**K3**
	CO4 Evaluate whether neural networks are appropriate to a particular application.	**K2**
	CO5 Apply neural networks to particular application, and to know whatsteps to take to improve performance.	**K2**

UNIT-I	**Introduction**	**Periods: 9**
A Neural Network-Human Brain- Models of a Neuron-Neural Networks viewed as Directed Graphs-Network Architectures-Knowledge Representation-Artificial Intelligence and Neural Networks. Learning Process: Error Correction Learning- Memory Based Learning-Hebbian Learning, Competitive- Boltzmann Learning-Credit Assignment Problem- Memory- Adaption- Statistical Natureof the Learning Process.		**CO1**
UNIT-II	**Single Layer Perceptrons**	**Periods: 9**
Adaptive Filtering Problem- Unconstrained Organization Techniques- Linear Least Square Filters- Least Mean Square Algorithm-Learning Curves- Learning Rate Annealing Techniques- Perceptron –Convergence Theorem- Relation Between Perceptron and Bayes Classifier for a Gaussian Environment. Multilayer Perceptron: Back Propagation Algorithm XOR Problem- Heuristics-Output Representation and Decision Rule-Computer Experiment- Feature Detection		**CO2**
UNIT-III	**Back Propagation**	**Periods: 9**
Back Propagation and Differentiation- Hessian Matrix- Generalization- Cross Validation- NetworkPruning Techniques-Virtues and Limitations of Back Propagation Learning- Accelerated Convergence-Supervised Learning.		**CO3**
UNIT-IV	**Self-Organization Maps (SOM)**	**Periods: 9**
Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of FeatureMap, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.		**CO4**
UNIT-V	**NEURO DYNAMICS**	**Periods: 9**
Dynamical Systems-Stability of Equilibrium States, Attractors-Neuro Dynamical Models - Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models- restricted boltzmen machine.		**CO5**

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

Text Books

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.
3. Neural Networks A Classroom Approach -Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

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1. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd 2005
4. Introduction to Artificial Neural Systems - J.M. Zurada, Jaico Publications 1994.
5. Artificial Neural Networks- B. Yegnanarayana, Pill, New Delhi 1998.

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https://www.investopedia.com/terms/n/neuralnetwork.asp
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https://link.springer.com/10.1007/978-3-642-20617-7_6563

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	1			-	1	3
2	3	3	2	1			-	1	3
3	3	3	2	1			-	1	3
4	3	3	2	1			-	1	3
5	3	3	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
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

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

2. A. 3. 164

Department	Computer Science and Engineering			Programme: M.Tech.			
Semester	II			Course Category : PE		*End Semester Exam Type: TE	
Course Code	P23CSE207	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Smart Sensing for IOT	3	-	-	3	40	60	100

Prerequisite	Basics of sensor and IoT	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved	K1
	CO2 Make use of IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing	K3
	CO3 Market forecast for IoT devices with a focus on sensors	K2
	CO4 Make use of IoT Developments	K3
	CO5 Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi	K4

UNIT-I	Introduction	Periods: 9	
Internet of Things Promises–Definition– Scope–Sensors for IoT Applications–Structure of IoT– IoT Map Device			CO1
UNIT-II	**Seven Generations of IOT Sensors to Appear**	**Periods: 9**	
Industrial sensors – Description & Characteristics–First Generation – Description & Characteristics–Advanced Generation – Description & Characteristics–Integrated IoT Sensors – Description & Characteristics–Polytronics Systems – Description & Characteristics–Sensors' Swarm – Description & Characteristics–Printed Electronics – Description & Characteristics–IoT Generation Roadmap			CO2
UNIT-III	**Technological Analysis**	**Periods: 9**	
Wireless Sensor Structure–Energy Storage Module–Power Management Module–RF Module–Sensing Module			CO3
UNIT-IV	**IOT Development Examples**	**Periods: 9**	
ACOEM Eagle – EnOcean Push Button – NEST Sensor – Ninja Blocks -Focus on Wearable Electronics			CO4
UNIT-V	**IOT Projects**	**Periods: 9**	
Creating the sensor project - Preparing Raspberry Pi - Clayster libraries - Hardware- Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data - Creating the actuator project- Hardware - Interfacing the hardware - Creating a controller - Representing sensor values - Parsing sensor data - Calculating control states - Creating a camera - Hardware -Accessing the serial port on Raspberry Pi - Interfacing the hardware - Creating persistent default settings - Adding configurable properties - Persisting the settings - Working with the current settings - Initializing the camera			CO5

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

Text Books

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 - 2024',Yole Développement Copyrights ,2014
2. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
3. OvidiuVermesan Peter Friess,'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

Reference Books

1. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014
2. Charalampos Doukas, "Building Internet of Things with the Arduino", Create space Publishers, 2012.
3. Donald Norris, "The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and Beagle Bone Black", Mc.Graw Hill, First Edition, 2015.
4. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Thing – Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.

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1. https://www.wired.co.uk/article/internet-of-things-what-is-explained-iot
2. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/
3. https://www.geeksforgeeks.org/edge-computing/
4. https://www.i-scoop.eu/internet-of-things-guide/edge-computing-iot
5. https://www.techtarget.com/iotagenda/definition/smart-sensor

* TE – Theory Exam, LE – Lab Exam

2.A.3.165

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 166

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester	II			Course Category : **PE**		*End Semester Exam Type: **TE**	
Course Code	P23CSEC03	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Text, Web and Social Media Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**
Prerequisite								

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Understand Text Mining	K2
	CO2	Illustrate Web Mining	K3
	CO3	Make use of Social Network Analysis	K2
	CO4	Exploit Social Media Mining	K3
	CO5	Make use of Sentimental Mining	K3

UNIT-I	**Introduction to Text Mining**	**Periods: 9**
Text Representation- tokenization, stemming, stop words, TF-IDF, Feature Vector Representation, NER, N-gram modeling. Text Clustering, Text Classification, Topic Modeling-LDA,HDP		**CO1**
UNIT-II	**Introduction to Web-Mining**	**Periods: 9**
Inverted indices and Boolean queries. PLSI, Query optimization, page ranking. Web Crawling-Crawler Algorithms, Implementation Issues, Evaluation, Session & visitor Analysis, Visitor Segmentation, Analysis of Sequential & Navigational Patterns, Predictions based on web user transactions.		**CO2**
UNIT-III	**Fundamentals of Social Network Analysis**	**Periods: 9**
Social Network Perspective, Fundamentals concepts in Network Analysis: Sociogram, Sociometry. Social Network Data: Types of Networks: One-Mode, Two-Mode, Affiliation, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Notations for Social Network Data: Graphs, Directed, Singed, Valued graphs, Multigraph, Relations and Matrices		**CO3**
UNIT-IV	**Social Media Mining**	**Periods: 9**
Introduction to Social Media Network Essentials of Social graphs, Social Networks, Models, Information Diffusion in Social Media. Behavioral Analytics, Influence and Homophily, Recommendation in Social Media		**CO4**
UNIT-V	**Sentimental Mining**	**Periods: 9**
Sentiment classification feature based opinion mining, comparative sentence and relational mining, Opinion spam		**CO5**

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

Text Books

1.Bing Liu, "Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data", Springer, Second Edition, 2011.
2.Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, "Social Media Mining – An Introduction", Cambridge University Press, 2014.
3.Bing Liu, "Sentiment Analysis and Opinion Mining", Morgan & Claypool Publishers, 2012.

Reference Books

1. Nitin Indurkhya, Fred J Damerau, "Handbook of Natural Language Process", 2nd Edition, CRC Press, 2010.
2. Matthew A.Russell, "Mining the social web", 2nd edition- O'Reilly Media, 2013.

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1. https://machinelearninggeek.com/text-analytics-for-beginners-using-python-nltk/
2. https://towardsdatascience.com/a-guide-text-analysis-text-analytics-text-mining-f62df7b78747
3. https://www.tutorialspoint.com/web_analytics/index.html
4. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm
5. https://www.simplilearn.com/web-analytics-guide-for-newbies-article

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 167

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2-A-3-168

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	II	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSEC04	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Data Storage Technologies and Networks	3	-	-	3	40	60	100

Prerequisite		
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the basic concepts of Storage Technologies. (K2)	K1
	CO2 Identify the Storage Items and its Operations. (K2)	K3
	CO3 Understand the Networked Storage like DAS, SAN and NAS. (K3)	K4
	CO4 Learn the concepts related to Information Availability. (K3)	K3
	CO5 Ability to describe Storage Security and Virtualization. (K3)	K3

UNIT-I	Introduction to Storage Technology	Periods: 9	
Data Proliferation and the varying value of data with time and usage - Sources of data and states of data creation - Data center requirements and Evolution to accommodate storage needs - Overview of basic storage management skills and activities - The Five Pillars of Technology - Overview of Storage Infrastructure Components - Evolution of storage - Information Lifecycle Management concept - Data Categorization within an Enterprise - Storage and Regulations.			CO1
UNIT-II	**STORAGE SYSTEMS ARCHITECTURE**	**Periods: 9**	
Intelligent disk subsystems overview - Contrast of integrated vs. modular arrays - Component architecture of intelligent disk subsystems - Disk physical structure components – properties - performance and specifications - Logical partitioning of disks - RAID and parity algorithms - hot sparing - Physical vs. logical disk organization - protection and back end management - Array caching properties and algorithms - Front end connectivity and queuing properties - Front end to host storage provisioning - mapping and operation - Interaction of file systems with storage - Storage system connectivity protocols.			CO2
UNIT-III	**NETWORKED STORAGE**	**Periods: 9**	
JBOD – DAS – SAN - NAS and CAS evolution - Direct Attached Storage (DAS) environments: elements - connectivity and management. Storage Area Networks (SAN): Elements and Connectivity - Fiber Channel principles - Standards and Network management principles - SAN management principles. Network Attached Storage (NAS): elements - connectivity options - connectivity protocols (NFS, CIFS, FTP) and management principles - IP SAN elements - Standards (iSCSI, FCIP, iFCP) - connectivity principles - security and management principles. Content Addressable Storage (CAS): elements, connectivity options – Standards and management principles.			CO3
UNIT-IV	**INFORMATION AVAILABILITY**	**Periods: 9**	
Business Continuity and Disaster Recovery Basics - Local business continuity techniques - Remote business continuity techniques - Disaster Recovery principles and techniques Managing and Monitoring Management philosophies (holistic vs. system and component) - Industry management standards (SNMP, SMI-S, CIM) - Standard framework applications - Key Management Metrics (thresholds, availability, capacity, security, performance) - Metric Analysis Methodologies and Trend Analysis - Provisioning and Configuration change planning - Problem reporting - prioritization and handling techniques.			CO4
UNIT-V	**SECURING STORAGE AND STORAGE VIRTUALIZATION**	**Periods: 9**	
Define storage security - List the critical security attributes for information systems - Describe the elements of a shared storage model and security extensions - Define storage security domains - List and analyze the common threats in each domain - Identify different virtualization technologies - Describe block-level and file level virtualization technologies and processes.			CO5

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

Text Books

1. Marc Farley Osborne, "Building Storage Networks", Tata Mcgraw Hill, 2006.
2. EMC, Hopkinton and Massachusetts, "Information Storage and Management Storing, Managing, and Protecting Digital Information", Wiley, 2008.
3. Robert Spalding, "Storage Networks: The Complete Reference", Tata Mcgraw Hill, 2002.

Reference Books

1. Gerald J Kowalski, Mark T Maybury, "Information Storage and Retrieval Systems - Theory and Implementation", BS Publications, 2006.
2. Thejendra BS, "Disaster Recovery & Business Continuity", Shroff Publishers & Distributors, 2008.
3. Barb Goldworm, Anne Skamarock, "Blade Servers & Virtualization", Wiley India.
4. Meeta Gupta, "Storage Area Network Fundamentals", Pearson Education Limited, 2006.
5. John Chirillo, Scott Blaul, "Storage Security Protecting SANs, NAS and DAS", Wiley, 2003.

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1. https://www.youtube.com/watch?v=bzEaDPu09vY
2. https://www.snia.org/education/storage_networking_primer/san/what_san
3. http://www.ittoday.info/ITPerformanceImprovement/Articles/2013-01Schulz.html
4. https://www.igi-global.com/dictionary/information-availability/14353
5. https://searchstorage.techtarget.com/definition/storage-virtualization

* TE – Theory Exam, LE – Lab Exam

M.Tech. Computer Science and Engineering

2. A. 3. 169

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 170

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	II	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSE208	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Reinforcement Learning	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Implement in-code common algorithms following code standards and libraries used in RL	K3
	CO2 Understand and work with approximate solutions.	K1
	CO3 Explore imitation learning tasks and solutions.	K3
	CO4 Learn how to define RL tasks and the core principals behind the RL, including policies, value functions.	K3
	CO5 Understand and work with tabular methods to solve classical control problems.	K3

UNIT-I	Reinforcement Learning Primitives	Periods: 9
Introduction and Basics of RL, Defining RL Framework, Probability Basics: Probability Axioms,Random Variables, Probability Mass Function, Probability Density Function, CumulativeDistribution Function and Expectation. Introduction to Agents, Intelligent Agents – ProblemSolving – Searching, Logical Agents.		CO1
UNIT-II	**Markov Decision Process and Dynamic Programming**	**Periods: 9**
Markov Property, Markov Chains, Markov Reward Process (MRP), Bellman Equations for MRP,Dynamic Programming: Polices (Evaluation, Improvement, Iteration, Valuelteration),Asynchronous Dynamic Programming, Generalized Policy Iteration, Efficiency of Dynamic Programming		CO2
UNIT-III	**Monte Carlo Methods and Temporal Difference Learning**	**Periods: 9**
Monte Carlo: Prediction, Estimation of Action Values, Control and Control without ExploringStarts, Off-Policy Control, Temporal Difference Prediction:TD(0), SARSA: On-Policy Tcontrol, Q-Learning: Off-Policy TD control, Games, Afterstates, and Other Special Cases.		CO3
UNIT-IV	**Deep Reinforcement Learning**	**Periods: 9**
Deep Q-Networks, Double Deep-Q Networks(DQN, DDQN, Dueling DQN, Prioritized Experience Replay). Policy Optimization in RL Introduction to Policy-based Methods, Vanilla Policy Gradient, REINFORCE Algorithm andStochastic Policy Search, Asynchronous Actor-Critic and Asynchronous Advantage Actor-Critic(A2C, A3C), Advanced Policy Gradient (PPO, TRPO, DDPG)		CO4
UNIT-V	**Multi Agent in RL**	**Periods: 9**
Multi-Agent Learning, Meta-learning, Partially Observable Markov Decision Process, Ethics inRL, Applying RL for Real-World Problems.		CO5

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

Text Books

1.Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An Introduction", Second Edition, MIT Press, 2019.
2.Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach.", Pearson Education Limited, 2016.
3.Michael Wooldridge, "An Introduction to Multi Agent Systems", John Wiley, 2002.

Reference Books

1. Ian Goodfellow, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2017.
2. Marco Wiering, Martijn van Otterlo(Ed),"Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012.
3. Keng, Wah Loon, Graesser, Laura, "Foundations of Deep Reinforcement Learning: Theory and Practice in Python", Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
5. RagavVenkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018

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https://www.learndatasci.com/tutorials/reinforcement-q-learning-scratch-python-openai-gym/
https://www.analyticsvidhya.com/blog/2017/01/introduction-to-reinforcement-learning-implementation/
https://www.tensorflow.org/agents/tutorials/0_intro_rl

* TE – Theory Exam, LE – Lab Exam

2.A.3.171

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 172

Department	Computer Science and Engineering	Programme: M.Tech.						
Semester	II	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23CSE209	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Mobile Application and Development	3	-	-	3	40	60	100

Prerequisite	No Prerequisite required	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Identify the requirements for mobile applications development.	K2
	CO2 Illustrate the challenges in mobile application interface and development.	K3
	CO3 Extend the concept of web components to involve for mobile application development.	K4
	CO4 Make use of Android SDK and iOS SDK for platform integration.	K3
	CO5 Develop various real time mobile applications.	K4

UNIT-I	Application Foundation and Interfaces	Periods: 9
Introduction to mobile applications – Importance of mobile strategies – Cost of development – Mobile myths – Market and business drivers for mobile applications – Mobile web presence – Mobile applications – Benefits of a mobile app – Introduction to Interfaces – Mobile user interface design – Understanding mobile application users – Understanding mobile information design – Understanding mobile platforms – Using the tools of mobile interface design.		CO1
UNIT-II	**Web Components**	**Periods: 9**
Choosing a mobile web option – Adaptive mobile websites – Dedicated mobile websites – Mobile web apps with HTML5 – Design patterns for mobile applications – Advanced web service techniques for mobile devices.		CO2
UNIT-III	**Android Software Development**	**Periods: 9**
Android toolkit - Java for android - components of an Android Application. Eclipse Concepts and Terminology - Eclipse Views and Perspective - Eclipse and Android - Effective java for Android Building a View - Fragments and Multiplatform Support – Drawing - Handling and Persisting Data.		CO3
UNIT-IV	**Platform Integration**	**Periods: 9**
Development practices – Android fundamentals – Android SDK – Common interactions – Offline storage – iOSSDK – Debugging iOS apps – Objective - C basics – iOS features.		CO4
UNIT-V	**Application Development**	**Periods: 9**
Using google maps – GPS – Wi-Fi and WiMAX – Integration with social media applications – Foldable displays – Centralized storage – Mobile commerce.		CO5

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

Text Books

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.
2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Dream Tech, 2012.
3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.

Reference Books

1. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.
2. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, "Android Programming: The Big Nerd Ranch Guide", Big Nerd Ranch LLC, Third edition, 2017.
3. Reto Meier, "Professional android Development", Wiley-India Edition, 2012.
4. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, Second edition, 2011.
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd, 2010.

Web References

1. https://www.keycdn.com/blog/web-development-tools
2. https://www.comentum.com/guide-to-web-application-development.html
3. http://developer.android.com/develop/index.html
4. https://www.stclaircollege.ca/programs/mobile-applications-development
5. https://www.fingent.com/blog/mobile-application-development-your-ultimate-guide/

* TE – Theory Exam, LE – Lab Exam

2.A.3.173

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	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		15	10	5	60	100

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

2.A.3.174

Department	Computer Science and Engineering	Programme: **M.Tech.**					
Semester	II	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	P23CSE210	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Wireless Sensor Networks and IOT**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand basic sensor network concepts	**K1**
	CO2 Know physical layer issues, understand and analyze Medium Access Control Protocols	**K2**
	CO3 Comprehend network and transport layer characteristics and protocols and implement conventional protocols	**K3**
	CO4 Understand the network management and Middleware services	**K1**
	CO5 Analyze Middleware and Security issues	**K3**

UNIT-I	**Fundamentals of Sensor Networks**	**Periods: 9**
Introduction to computer and wireless sensor networks and Overview of the syllabus- Motivation for a network of Wireless Sensor nodes- Sensing and sensors-challenges and constraints - node architecture-sensing subsystem, processor subsystem-communication interfaces- prototypes, Application of Wireless sensors- Introduction of Tiny OS Programming and TOSSIM Simulator.		**CO1**
UNIT-II	**Communication Characteristics And Deployment Mechanisms**	**Periods: 9**
Wireless Transmission Technology and systems-Radio Technology Primer-Available Wireless Technologies - Hardware- Telosb, Micaz motes- Time Synchronization- Clock and the Synchronization Problem - Basics of time synchronization-Time synchronization protocols - Localization- Ranging Techniques- Range based Localization-Range Free Localization- Event driven Localization		**CO2**
UNIT-III	**MAC Layer**	**Periods: 9**
Overview-Wireless Mac Protocols-Characteristics of MAC protocols in Sensor networks – Contention free MAC Protocols-characteristics- Traffic Adaptive Medium Access-Y-MAC, Low energy Adaptive Clustering - Contention based MAC Protocols-Power Aware Multi-Access with signaling, Sensor MAC-Timeout MAC-Data gathering MAC- Case study –Implementation and Analysis of MAC player protocol in TinyOS.		**CO3**
UNIT-IV	**Routing in Wireless Sensor Networks**	**Periods: 9**
Design Issues in WSN routing- Data Dissemination and Gathering-Routing Challenges in WSN - Flooding-Flat Based Routing – SAR, Directed Diffusion, Hierarchical Routing- LEACH, PEGASIS - Query Based Routing- Negotiation Based Routing-Geographical Based Routing- Transport layer- Transport protocol Design issues- Performance of Transport Control Protocols.Case study- Implementation and analysis of Routing protocol or transport layer protocol in Tiny OS		**CO4**
UNIT-V	**Middleware and Security Issues**	**Periods: 9**
WSN middleware principles-Middleware architecture-Existing middleware - operating systems for wireless sensor networks-performance and traffic management - Fundamentals of network security-challenges and attacks - Protocols and mechanisms for security. Case study- Handling attacks in Tiny OS		**CO5**

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

Text Books

1. Waltenegus Dargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011
2. Kazem Sohraby, Daniel manoli , "Wireless Sensor networks- Technology, Protocols and Applications", Wiley InterScience Publications 2010.
3. Bhaskar Krishnamachari , " Networking Wireless Sensors", Cambridge University Press, 2005

Reference Books

1. C.S Raghavendra, Krishna M.Sivalingam, Taiebznati , "Wireless Sensor Networks", Springer Science 2004.
2. Jun Zheng, Abbas Jamalipour," Wireless Sensor Networks: A Networking Perspective", Wiley-IEEE Press,2009
3. Ibrahiem M. M. El Emary, S. Ramakrishnan,"Wireless Sensor Networks: From Theory to Applications", 2013
4. Robert Faludi," Building Wireless Sensor Networks", O'Reilly Media, Inc. 2010.
5. A Swami," Wireless Sensor Networks - Signal Processing and Communications Perspectives",2007.

Web References

https://www.geeksforgeeks.org/wireless-sensor-network-wsn/
https://www.electronicshub.org/wireless-sensor-networks-wsn/
https://www.tutorialspoint.com/what-are-wireless-sensor-networks
https://www.save9.com/internet-and-wireless-networks/wireless-sensor-networks/
https://www.ilovephd.com/what-is-the-difference-between-wsn-and-iot/

* TE – Theory Exam, LE – Lab Exam

2.A.3.175

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 176

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	**P23ACTX01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**English for Research Paper Writing**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand that how to improve your writing skills and level of readability.	**K2**
	CO2 Learn about what to write in each section.	**K1**
	CO3 Understand the skills needed when writing a Title.	**K2**
	CO4 Understand the skills needed when writing the Conclusion.	**K2**
	CO5 Ensure the good quality of paper at very first-time submission.	**K3**

UNIT-I	**Introduction to Research Paper Writing**	**Periods: 6**	
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.			**CO1**
UNIT-II	**Presentation Skills**	**Periods: 6**	
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.			**CO2**
UNIT-III	**Title Writing Skills**	**Periods: 6**	
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.			**CO3**
UNIT-IV	**Result Writing Skills**	**Periods: 6**	
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.			**CO4**
UNIT-V	**Verification Skills**	**Periods: 6**	
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission.			**CO5**

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

Reference Books

1. Adrian Wallwork, "English for Writing Research Papers", Springer, New York, Dordrecht Heidelberg London, 2011.
2. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
3. Goldbort R, "Writing for Science", Yale University Press (Available on Google Books), 2006.
4. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book, 1998.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2. A. 3. 178

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	**P23ACTX02**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Disaster Management**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Ability to summarize basics of disaster.	**K1**
	CO2 Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	**K2**
	CO3 Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	**K3**
	CO4 Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	**K3**
	CO5 Ability to develop the strengths and weaknesses of disaster management approaches.	**K3**

UNIT-I	**Introduction**	**Periods: 6**	
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.			**CO1**
UNIT-II	**Repercussions of Disasters and Hazards**	**Periods: 6**	
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.			**CO2**
UNIT-III	**Disaster Prone Areas in India**	**Periods: 6**	
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.			**CO3**
UNIT-IV	**Disaster Preparedness and Management**	**Periods: 6**	
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.			**CO4**
UNIT-V	**Risk Assessment**	**Periods: 6**	
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival			**CO5**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Goel S. L., "Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. NishithaRai, Singh A.K, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2007.
3. Sahni, Pardeep Et.Al. , "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2.A.3.179

2. A. 3. 180

Department	Computer Science and Engineering	Programme: **M.Tech.**						
Semester		Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	P23ACTX03	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sanskrit for Tecnical Knowledge**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understanding basic Sanskrit language.	**K2**
	CO2 Write sentences	**K2**
	CO3 Know the order and roots of Sanskrit.	**K3**
	CO4 Know about technical information about Sanskrit literature	**K3**
	CO5 Understand the technical concepts of Engineering.	**K2**

UNIT-I	**Alphabets**	**Periods: 6**
Alphabets in Sanskrit.		**CO1**
UNIT-II	**Tenses and Sentences**	**Periods: 6**
Past/Present/Future Tense - Simple Sentences.		**CO2**
UNIT-III	**Order and Roots**	**Periods: 6**
Order - Introduction of roots of Engineering-Electrical, Mechanical, Architecture, Mathematics.		**CO3**
UNIT-IV	**Sanskrit Literature**	**Periods: 6**
Technical information about Sanskrit Literature.		**CO4**
UNIT-V	**Technical Concepts of Engineering**	**Periods: 6**
Technical concepts		**CO5**

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

Reference Books

1. Dr. Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, New Delhi.
2. Prathama Deeksha, Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, "Teach Yourself Sanskrit", New Delhi Publication.
3. Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi, 2017

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2. A. 3. 181

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	**P23ACTX04**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Value Education**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Knowledge of self-development.	**K2**
	CO2 Learn the importance of Human values.	**K1**
	CO3 Developing the overall personality.	**K3**
	CO4 Developing Character and Competence	**K3**

UNIT-I	**Values and Self Development**	**Periods: 6**	
Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.			**CO1**
UNIT-II	**Cultivation of Values**	**Periods: 6**	
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline			CO2
UNIT-III	**Personality Development**	**Periods: 6**	
Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.			**CO3**
UNIT-IV	**Character Development**	**Periods: 6**	
Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role.			**CO4**

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

Reference Books

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2. A. 3. 183

Department	Computer Science and Engineering			Programme: **M.Tech.**				
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**		
Course Code	P23ACTX05	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Constitution of India**	**2**	**-**	**-**		**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite		
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	**K3**
	CO2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	**K3**
	CO3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections.	**K3**
	CO4 Discuss the passage of the Hindu Code Bill of 1956.	**K3**
	CO5 Discuss the administration and Election commission	**K3**

UNIT-I	**History of Making of The Indian Constitution**	**Periods: 6**	
History, Drafting Committee, (Composition & Working).			**CO1**
UNIT-II	**Philosophy of The Indian Constitution**	**Periods: 6**	
Preamble, Salient Features.			**CO2**
UNIT-III	**Contours of Constitutional Rights and Duties**	**Periods: 6**	
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.			**CO3**
UNIT-IV	**Organs of Governance**	**Periods: 6**	
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.			**CO4**
UNIT-V	**Local Administration and Election Commission**	**Periods: 6**	
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.			**CO5**

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

Reference Books

1. "The Constitution of India, 1950(Bare Act), Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1 st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. Suresh Soni, "India's Glorious Scientific Tradition" Ocean books (P) Ltd., New Delhi, 2017.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2.A.3.185

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	**P23ACTX06**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Pedagogy Studies**	**2**	**-**	**-**		**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?	**K2**
	CO2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	**K2**
	CO3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	**K2**
	CO4 Illustrate Professional development	**K3**
	CO5 Identify Research gaps and Future Directions	**K3**

UNIT-I	**Introduction and Methodology**	**Periods: 6**	
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.			CO1
UNIT-II	**Thematic Overview**	**Periods: 6**	
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.			**CO2**
UNIT-III	**Evidence on The Effectiveness of Pedagogical Practices**	**Periods: 6**	
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies			**CO3**
UNIT-IV	**Professional Development**	**Periods: 6**	
Professional development: alignment with classroom practices and follows up support – Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes			**CO4**
UNIT-V	**Research Gaps and Future Directions**	**Periods: 6**	
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.			**CO5**

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

Reference Books

1. Ackers J, Hardman,F, "Classroom interaction in Kenyan primary schools, Compare", 31(2): 245- 261, 2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies", 36(3):361-379, 2004.
3. Akyeampong K, "Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report", London, DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33(3): 272–282, 2013.
5. Alexander RJ, "Culture and pedagogy: International comparisons in primary education", Oxford and Boston: Blackwell, 2001.
6. Chavan M, "Read India: Amass scale, rapid, 'learning to read' campaign", 2003.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2. A. 3. 188

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	P23ACTX07	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Stress Management by Yoga	**2**	**-**	**-**		**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Develop healthy mind in a healthy body thus improving social health also	**K2**
	CO2 Improve efficiency.	**K2**
	CO3 Understand Asan and Pranayam	**K2**
	CO4 Apply Asanas	**K4**
	CO5 Apply Pranayam	**K4**

UNIT-I	Introduction	**Periods: 6**	
Definitions of Eight parts of yoga. (Ashtanga).			**CO1**
UNIT-II	**Do`s and Don't's in Life**	**Periods: 6**	
Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.			**CO2**
UNIT-III	**Asan and Pranayam**	**Periods: 6**	
Asan and Pranayam - Various yoga poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam.			**CO3**
UNIT-IV	**Asan Practices**	**Periods: 6**	
Practice on Various yoga poses			**CO4**
UNIT-V	**Pranayam Practices**	**Periods: 6**	
Practice on various pranayam			**CO5**

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

Reference Books

1. Janardan Swami Yoga bhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama Publication Department, Kolkata

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2.A.3.189

2. A. 3. 1870

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	P23ACTX08	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Personality **Development through Life Enlightenment Skills**	**2**	**-**	**-**		**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion **of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.	**K3**
	CO2 The person who has studied Geeta will lead the nation and mankind to peace and prosperity.	**K1**
	CO3 Study of Neet is hatakam will help in developing versatile personality of students.	**K3**

UNIT-I	**Periods: 6**	
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's) 4-Verses 18, 38,39 Chapter18 – Verses37,38,63.		**CO1**
UNIT-II	**Periods: 12**	
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3- Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.model – shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 – Chapter.		**CO2**
UNIT-III	**Periods: 12**	
Statements of basic knowledge – Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18 - Personality of role.		**CO3**

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

Reference Books

1. Gopinath, Rashtriya Sanskrit Sansthanam P, "Bhartrihari's Three Satakam, Niti-sringar- vairagya", New Delhi,2010.
2. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2.A.3.191

Department	Computer Science and Engineering			Programme: **M.Tech.**			
Semester				Course Category : **AC**		*End Semester Exam Type: **TE**	
Course Code	P23ACTX09	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Unnat Bharath **Abhiyan**	**2**	**-**	**-**		**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite								

Course Outcomes	On completion **of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Gain an understanding of rural life, culture and social realities	**K3**
	CO2 Develop a sense of empathy and bonds of mutuality with local community	**K1**
	CO3 Appreciate significant contributions of local communities to Indian society and economy	**K3**
	CO4 Learn to value the local knowledge and wisdom of the community	**K3**
	CO5 Identify opportunities for contributing to community's socio-economic improvements.	**K3**

UNIT-I	Appreciation **of Rural Society**	**Periods: 6**	
Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.			**CO1**
UNIT-II	Understanding **Rural Economy and Livelihood**	**Periods: 6**	
Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.			**CO2**
UNIT-III	RURAL INSTITUTIONS	**Periods: 6**	
Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.			**CO3**
UNIT-IV	RURAL DEVELOPMENT PROGRAMMES	**Periods: 6**	
History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.			**CO4**
UNIT-V	FIELD BASED **PRACTICAL ACTIVITIES**	**Periods: 6**	
Visit MGNREGS project sites. Swachh Bharat project sites, Conduct Mission Antyodaya surveys, Interactive community exercise with local leaders, Panchayat functionaries, Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps, Participate in Gram Sabha meetings, Visit local Anganwadi Centre, Conduct soil health test, drinking water analysis.			**CO5**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Singh, Katar, "Rural Development : Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, "Sustainable Development Goals", 2015.
4. M.P.Boraian, "Best Practices in Rural Development", Shanlax Publishers, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2. A. 3. 193

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Annexure VI
Computer Science Engineering
(Big Data Analytics)

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SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)

Puducherry

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

PUDUCHERRY – 605107

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.TECH.

COMPUTER SCIENCE ENGINEERING (BIG DATA ANALYTICS)

(REGULATIONS - 2023)

CURRICULUM AND SYLLABI

2.A.3.197

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 create a productive learning and research environment for graduates to become highly dynamic, competent, ethically responsible, professionally knowledgeable in the field of computer science and engineering to meet the industrial needs on par with global standards.

MISSION

M1: Quality Education: Empowering the students with the necessary technical skills through quality education to grow professionally.

M2: Innovative Research: Advocating the innovative research ideas by incorporating with industries for developing products and services.

M3: Placement and Entrepreneurship: Advancing the education by strengthening the Industry-academic relationship through hands-on training to seek placement in the top most industries or to develop a start-ups.

M4: Ethics and Social Responsibilities: Stimulating professional behaviour and good ethical values to improve the leadership skills and social responsibilities.

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PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research:
An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Technical Skill:
An ability to write and present a substantial technical report/document.

PO3: Expertise in Academics:
Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Problem solving:
An ability to discriminate, analyzes, evaluate and synthesize the technologies to provide solution for multidimensional engineering problems.

PO5: Usage of Modern Tools:
Create, select, learn 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: Ethical Practices and Social Responsibility:
Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Technical Knowledge: To acquire a comprehensive knowledge in computer science engineering concepts and apply them for the investigation of real world problems.

PEO2: Research and Development: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions.

PEO3: Leadership: To prepare graduates who will demonstrate analytical, research, design and implementation skills offering techno-commercially feasible and socially acceptable solutions

PEO4: Professional Behavior: To deliver graduates to design and implement solutions for rapidly changing computing problems and information system environments to adapt innovation.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Technical Knowledge in Computer Science and Engineering: Graduates with the ability to apply basic knowledge of Computer Science in solving the critical problems.

PSO2: Multidisciplinary Competency: Ability to convert innovative ideas into research or society oriented projects through current trending technologies.

PSO3: Employability: Acquire placement in highly reputed industries or accomplish new technical business skills with the contemporary trends in the industry.

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STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM

Sl.No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	6
2	Basic Sciences (BS)	3
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	25
5	Professional Electives (PE)	18
6	Open Electives (OE)	-
7	Project Work and Internship (PA)	20
8	Ability Enhancement Courses (AEC)	-
9	Mandatory courses (MC)	-
Total		**72**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	4	2	-	-	6
2	Basic Sciences(BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	11	14	-	-	25
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	-
7	Project Work and Internship(PA)			8	12	20
8	Ability Enhancement Courses (AEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

** AEC, MC Credits are not included for CGPA calculation*

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CURRICULUM

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

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23BDT204	Mining Massive Data	PC	3	0	0	3	40	60	100
2	P23BDT205	Streaming Data Analytics	PC	3	0	0	3	40	60	100
3	P23BDT206	Big Data SQL with Hive	PC	3	0	0	3	40	60	100
4	P23BDTD01	No SQL Databases	PC	3	0	0	3	40	60	100
5	P23BDE2XX	Professional Elective - II*	PE	3	0	0	3	40	60	100
6	P23BDE2XX	Professional Elective - III*	PE	3	0	0	3	40	60	100
Practical										
7	P23BDP202	Big Data SQL with Hive Laboratory	PC	0	0	4	2	50	50	100
8	P23HSPC02	Seminar on ICT a hands on approach	HS	0	0	4	2	100	-	100
Ability Enhancement Course										
9	P23CSC2XX	Certification Course-II #	AEC	0	0	4	-	100	-	100
10	P23ACT20X	Audit Course-II**	AEC	0	0	2	-	100	-	100
							22	590	410	1000

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SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P23CSE3XX	Professional Elective – IV *	PE	3	0	0	3	40	60	100
2	P23CSE3XX	Professional Elective – V *	PE	3	0	0	3	40	60	100
3	P23CSE3XX	Professional Elective – VI *	PE	3	0	0	3	40	60	100
Project Work										
4	P23CSW301	Project Phase – I	PA	0	0	12	6	50	50	100
5	P23CSW302	Internship	PA	0	0	0	2	100	-	100
Ability Enhancement Course										
6	P23CSC301	NPTEL/SWAYAM/MOOC	AEC	0	0	0	-	100	-	100
							17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P23CSW403	Project Phase – II	PA	0	0	24	12	50	50	100
							12	50	50	100

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

BS- Basic Sciences

PC – Professional Core

PE – Professional Elective

HS - Humanities and Social Sciences

PA - Professional Activity

CC- Common Course

AC- Audit Course

AEC - Ability Enhancement Course

CREDIT DISTRIBUTION

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

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

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ANNEXURE- I
PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title
Professional Elective-I		
1	P23BDE101	Data Driven Decision Making
2	P23BDEC01	Neural Networks
3	P23BDE102	Multicore Architectures
4	P23CSTD01	Advanced Data Structures and Algorithms
5	P23BDE103	Machine Learning
Professional Elective-II		
1	P23CSEC01	Information Visualization
2	P23CSEC03	Text, Web and Social Media Analytics
3	P23CSTD02	Speech and Language Processing
4	P23BDEC02	Web Analytics and Development
5	P23BDE204	Expert System and Decision Making
Professional Elective-III		
1	P23BDE205	Information Retrieval
2	P23BDE206	Supply Chain Analytics
3	P23BDE207	Cryptography and Information Security
4	P23BDE208	Semantic Web and Knowledge Management
5	P23BDE209	Artificial Intelligence
Professional Elective-IV		
1	P23BDE310	Optimization Techniques for Analytics
2	P23CSEC04	Data Storage Technologies and Networks
3	P23BDE311	Models of Computation
4	P23CSEC02	Soft Computing
5	P23BDE312	Deep Learning
Professional Elective-V		
1	P23BDE313	Blockchain Technology
2	P23BDE314	Speech Recognition
3	P23ADEC01	Agile and Software Project Management
4	P23CSEC05	Game Design and Augmented Reality
5	P23CSEC06	Image and Video Analytics
Professional Elective-VI		
1	P23BDE315	Graphs – Algorithms and Mining
2	P23BDE316	Real-Time Systems
3	P23BDE317	Social Network Analysis
4	P23BDEC03	Analytics of Things
5	P23BDE318	User Interface/ User Experience Design

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ANNEXURE- II

ABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P23XXCX01	Adobe Photoshop
2	P23XXCX02	Adobe Animate
3	P23XXCX03	Adobe Dreamweaver
4	P23XXCX04	Adobe After Effects
5	P23XXCX05	Adobe Illustrator
6	P23XXCX06	Adobe InDesign
7	P23XXCX07	Autodesk AutoCAD -ACU
8	P23XXCX08	Autodesk Inventor – ACU
9	P23XXCX09	Autodesk Revit – ACU
10	P23XXCX10	Autodesk Fusion 360 – ACU
11	P23XXCX11	Autodesk 3ds Max – ACU
12	P23XXCX12	Autodesk Maya – ACU
13	P23XXCX13	Cloud Security Foundations
14	P23XXCX14	Cloud Computing Architecture
15	P23XXCX15	Cloud Foundation
16	P23XXCX16	Cloud Practitioner
17	P23XXCX17	Cloud Solution Architect
18	P23XXCX18	Data Engineering
19	P23XXCX19	Machine Learning Foundation
20	P23XXCX20	Robotic Process Automation / Medical Robotics
21	P23XXCX21	Advance Programming Using C
22	P23XXCX22	Advance Programming Using C ++
23	P23XXCX23	C Programming
24	P23XXCX24	C++ Programming
25	P23XXCX25	CCNP Enterprise: Advanced Routing
26	P23XXCX26	CCNP Enterprise: Core Networking
27	P23XXCX27	Cisco Certified Network Associate - Level 2
28	P23XXCX28	Cisco Certified Network Associate- Level 1
29	P23XXCX29	Cisco Certified Network Associate- Level 3
30	P23XXCX30	Fundamentals Of Internet of Things
31	P23XXCX31	Internet Of Things / Solar and Smart Energy System with IoT
32	P23XXCX32	Java Script Programming
33	P23XXCX33	NGD Linux Essentials

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34	P23XXCX34	NGD Linux I
35	P23XXCX35	NGD Linux II
36	P23XXCX36	Advance Java Programming
37	P23XXCX37	Android Programming / Android Medical App Development
38	P23XXCX38	Angular JS
39	P23XXCX39	Catia
40	P23XXCX40	Communication Skills for Business
41	P23XXCX41	Coral Draw
42	P23XXCX42	Data Science Using R
43	P23XXCX43	Digital Marketing
44	P23XXCX44	Embedded System Using C
45	P23XXCX45	Embedded System with IOT / Arduino
46	P23XXCX46	English For IT
47	P23XXCX47	Plaxis
48	P23XXCX48	Sketch Up
49	P23XXCX49	Financial Planning, Banking and Investment Management
50	P23XXCX50	Foundation Of Stock Market Investing
51	P23XXCX51	Machine Learning / Machine Learning for Medical Diagnosis
52	P23XXCX52	IOT Using Python
53	P23XXCX53	Creo (Modelling & Simulation)
54	P23XXCX54	Soft Skills, Verbal, Aptitude
55	P23XXCX55	Software Testing
56	P23XXCX56	MX-Road
57	P23XXCX57	CLO 3D
58	P23XXCX58	Solid works
59	P23XXCX59	Staad Pro
60	P23XXCX60	Total Station
61	P23XXCX61	Hydraulic Automation
62	P23XXCX62	Industrial Automation
63	P23XXCX63	Pneumatics Automation
64	P23XXCX64	Agile Methodologies
65	P23XXCX65	Block Chain
66	P23XXCX66	Devops
67	P23XXCX67	Artificial Intelligence
68	P23XXCX68	Cloud Computing
69	P23XXCX69	Computational Thinking

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70	P23XXCX70	Cyber Security
71	P23XXCX71	Data Analytics
72	P23XXCX72	Databases
73	P23XXCX73	Java Programming
74	P23XXCX74	Networking
75	P23XXCX75	Python Programming
76	P23XXCX76	Web Application Development (HTML, CSS, JS)
77	P23XXCX77	Network Security
78	P23XXCX78	MATLAB
79	P23XXCX79	Azure Fundamentals
80	P23XXCX80	Azure AI (AI-900)
81	P23XXCX81	Azure Data (DP -900)
82	P23XXCX82	Microsoft 365 Fundamentals (SS-900)
83	P23XXCX83	Microsoft Security, Compliance and Identity (SC-900)
84	P23XXCX84	Microsoft Power Platform (PI-900)
85	P23XXCX85	Microsoft Dynamics Fundamentals 365 – CRM
86	P23XXCX86	Microsoft Excel
87	P23XXCX87	Microsoft Excel Expert
88	P23XXCX88	Securities Market Foundation
89	P23XXCX89	Derivatives Equinity
90	P23XXCX90	Research Analyst
91	P23XXCX91	Portfolio Management Services
92	P23XXCX92	Cyber Security
93	P23XXCX93	Cloud Security
94	P23XXCX94	PMI – Ready
95	P23XXCX95	Tally – GST & TDS
96	P23XXCX96	Advance Tally
97	P23XXCX97	Associate Artist
98	P23XXCX98	Certified Unity Programming
99	P23XXCX99	VR Development

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ANNEXURE-III

AUDIT COURSES

(Common to all M.Tech Programme)

Sl. No.	Course Code	Course Title
1	P23ACTX01	English for Research Paper Writing
2	P23ACTX02	Disaster Management
3	P23ACTX03	Sanskrit for Technical Knowledge
4	P23ACTX04	Value Education
5	P23ACTX05	Constitution of India
6	P23ACTX06	Pedagogy Studies
7	P23ACTX07	Stress Management by Yoga
8	P23ACTX08	Personality Development Through Life Enlightenment Skills
9	P23ACTX09	Unnat Bharat Abhiyan

9.A.3.209

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **BS**			*End Semester Exam Type: **TE**		
Course Code	**P23MAT104**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Mathematical Foundations for Data Analytics**	**2**	**1**	**-**	**3**	**40**	**60**	**100**

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

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

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

Text Books

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

Reference Books

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

Web References

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

* TE – Theory Exam, LE – Lab Exam

2.A.3.211

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.212

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PC**			*End Semester Exam Type: **TE**			
Course Code	**P23BDT101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Big Data Acquisition**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand Big Data Acquisition	**K2**
	CO2 Able to collect and store Big Data from various sources	**K4**
	CO3 Make use of Pig Scripts- Extract, Transform and Load the data on HDFS	**K3**
	CO4 Able to write Hive Scripts- Extract, Transform, Load and Analyze the data present in HDFS	**K3**
	CO5 Able to extract and process semi and un-structured data using HBase	**K4**

UNIT- I	**Introduction to Big Data Acquisition**	**Periods:9**
Big data framework – fundamental concepts of Big Data Management and analytics – Current challenges and trends in Big Data Acquisition-. Map Reduce Algorithm- Hadoop Storage [HDFS], Common Hadoop Shell commands - Anatomy of File Write and Read, Name Node, Secondary Name Node, and Data Node - Hadoop Configuration – Pig Configuration – Hive Configuration – Hbase Configuration.		**CO1**
UNIT- II	**Data Collection and Transmission**	**Periods:9**
Big data collection – Strategies – Types of Data Sources – Structured Vs Unstructured data – ELT vs ETL – storage infrastructure requirements – Collection methods – Log files – sensors – Methods for acquiring network data (Libcap-based and zero-copy packet capture technology) – Specialized network monitoring softwares (Wireshark, Smartsniff and Winnetcap) – Mobile equipments, Transmission methods, Issues.		**CO2**
UNIT- III	**Introduction to Apache Pig**	**Periods:9**
Introduction - Pig features - Pig Architecture - Pig Execution modes, Pig Grunt shell and Shell commands. Pig Latin Basics: Data model, Data Types, Operators – Pig Latin Commands - Load & Store , Diagnostic Operators, Grouping, Cogroup, Joining, Filtering, Sorting, Splitting - Built-In Functions, User define functions. Pig Execution Modes: Batch Mode – Embedded Mode – Pig Execution in Batch Mode –Use cases - Map Reduce programs with Pig – Pig Vs SQL		**CO3**
UNIT- IV	**Hive and HiveQL**	**Periods:9**
Introduction - Hive Features - Hive architecture -Hive Meta store - Hive data types - Hive Tables - Table types - Creating database, Altering database, Create table, alter table, Drop table, Built-In Functions - Built- In Operators, User defined functions(UDFs), View, Pig Vs Hive. HiveQL–Introduction, HiveQL Select, HiveQL – MapReduce using HiveQL OrderBy Group By Joins, LIMIT, Distribute By , Cluster By - Sorting And Aggregation – Partitioning: Static & Dynamic partitioning – Index Creation - Bucketing – Analysis of MapReduce execution – Hive Optimization – Setting Hivng Parameters. Comparison between MapReduce, Hive QL and SQL. UseCase: Implementation of Map Reduce programs with HiveQL.		**CO4**
UNIT- V	**HBase and its Features**	**Periods:9**
HBasics, Features of HBase, Concepts, Clients, Example, Hbase Versus RDBMS, Limitations of HBase Big Data Privacy And Applications: Data Masking – Privately identified Information (PII) – Privacy preservation in Big Data – Popular Big Data Techniques and tools –Applications Social Media Analytics – Fraud Detection.		**CO5**

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

Text Books

1. Philip Russom, Colin White, and Ted Friedman, "Data Warehousing in the Age of Big Data", Morgan Kaufmann, 1st edition, 2013.
2. Kuan-Ching Li, Hai Jiang, and Albert Y. Zomaya, "Big Data: Algorithms, Analytics, and Applications" CRC Press, 1st edition, 2015.
3. Martin Atzmueller and Andreas Hotho, "Big Data Analytics: From Strategic Planning to Enterprise Integration withTools, Techniques,NoSQL, and Graph", Morgan Kaufmann, 1st edition, 2015
4. Martin Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and MaintainableSystems", O'ReillyMedia, 1st edition, 2017.

Reference Books

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Aplications", John Wiley & Sons, 2014.
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
4. Min Chen. Shiwen Mao, Yin Zhang. Victor CM Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer, 2014.

2.A.3.213

5. Michael Minelli, Michele Chambers Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends", John Wiley & Sons, 2013.

Web References

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.214

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

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

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

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

Text Books

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

Reference Books

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

Web References

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

* TE – Theory Exam, LE – Lab Exam

9.A.3.215

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A-3.215

Department	Computer Science Engineering (Big Data Analytics)	Programme : M.Tech.					
Semester	I	Course Category :PC			*End SemesterExamType:TE		
Course Code	P23BDT103	Periods/Week			Credit	MaximumMarks	
		L	T	P	C	CAM	ESE	TM
Course Name	Big Data Frameworks	3	0	0	3	40	60	100

Prerequisite	Basics of Big Data	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Discuss the challenges and their solutions in Big Data.	K2
	CO2 Understand and work on Hadoop Framework and eco systems.	K2
	CO3 Analyze the Big Data using Map-reduce programming in both Hadoop and Spark framework.	K3
	CO4 Demonstrate spark programming with different programming languages.	K3
	CO5 Demonstrate the graph algorithms and live streaming data in Spark.	K3

UNIT- I	Introduction to Big Data	Periods:9
Data Storage and Analysis - Characteristics of Big Data – Big Data Analytics - Typical Analytical Architecture – Requirement for new analytical architecture – Challenges in Big Data Analytics – Need of big dataframeworks.		CO1
UNIT- II	**Hadoop Ecosystem**	**Periods:9**
Hadoop – Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with ot he system - Hadoop Components – Hadoop 1 vs Hadoop 2 – Hadoop Daemon's – HDFS Commands Map Reduce Programming: I/O formats Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs, Hadoop ecosystem technologies Serialization: AVRO, Co-ordination: Zookeeper, Databases: HBase, Hive, Scripting language: Pig, Streaming: Flink, Storm.		CO2
UNIT- III	**Spark Framework**	**Periods:9**
Introduction to GPU Computing, CUDA Programming Model, CUDA API, Simple Matrix, Multiplication in CUDA, CUDAMemory Model, Shared Memory Matrix Multiplication, Additional CUDA API Features- Introduction to spark, Spark architecture and Components semantic web .		CO3
UNIT- IV	**Data Analysis with Spark Shell**	**Periods:9**
Writing Spark Application - Spark Programming in Scala, Python, R, Java - Application Execution. SQL Context – Importingand Saving data – Data frames – using SQL – GraphX overview – Creating Graph – Graph Algorithms.		CO4
UNIT- V	**Spark Streaming**	**Periods:9**
Overview – Transformation Operations in Spark, Spark Streaming Architecture, Errors and Recovery – Streaming Source – Streaming live data with spark		CO5

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

Text Books

1. Viktor Mayer-Schönberger and Kenneth Cukier,"Big Data: A Revolution That Will Transform How We Live, Work, and Think" Houghton Mifflin Harcourt, 2013
2. Nathan Marz and JamesWarren, "Big Data: Principles and Best Practices of Scalable Realtime Data Systems", Manning Publications, 2015
3. Bill Chambers and Matei Zaharia,"Spark: The Definitive Guide" O'Reilly Media Year: 2018

Reference Books

1. Mike Frampton, "Mastering Apache Spark", Packt Publishing,2015.
2. TomWhite,"Hadoop:TheDefinitiveGuide",O'Reilly,4thEdition,2015.
3. Nick Pentreath, Machine Learning with Spark, Packt Publishing, 2015.
4. Mohammed Guller, Big Data Analytics with Spark, Apress,2015
5. Donald Miner, Adam Shook, "Map Reduce Design Pattern", O'Reilly, 2012.

Web References

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

* TE – Theory Exam, LE – Lab Exam

2.A.3.216

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	3	2	2	2	2
2	2	3	3	3	2	1	2	2	1
3	1	3	3	2	1	2	2	2	1
4	2	2	3	2	3	2	2	3	1
5	3	2	2	3	3	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		15	10	5	60	100

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

2.D.3.217

Department	Computer Science Engineering (Big Data Analytics)			Programme: **M.Tech.**			
Semester	I	Course Category : **HS**			*End Semester Exam Type: **TE**		
Course Code	P23HSTC01	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Research Methodology and IPR**	2	-	-	2	40	60	100

(Common to all M.Tech Courses)

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

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

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

Text Books

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

Reference Books

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

Web References

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

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 218

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 219

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.					
Semester	I	Course Category : PC			*End Semester Exam Type: LE		
Course Code	P23BDP101	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Big Data Computing Laboratory	-	-	4	2	50	50	100

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

List of Experiments:

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

   111115 | 222 | 0 | 1 | 0

   111113 | 225 | 1 | 0 | 0

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

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

Reference Books

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

2. A. 3. 220

Web References

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

(Common to all M.Tech Programme)

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

List of Experiments:

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

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

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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Department	**Computer Science and Engineering**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **AEC**			*End Semester Exam Type: **-**			
Course Code	**P23CSC1XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	**-**	**-**	**4**	**-**	**100**	**-**	**100**

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

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

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.						
Semester	II	Course Category : PC			*End Semester Exam Type: TE			
Course Code	P23BDT204	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Mining Massive Data	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Recollecting fundamentals of data mining.	K2
	CO2 Apply the concept of Map reduce and data streams for storing and processing ofmassive data sets.	K3
	CO3 Analyze the issues underlying the effective applications of massive datasets.	K3
	CO4 Evaluate different clustering algorithms and analyze variousdecomposition techniques.	K3
	CO5 Make use of Clustering techniques	K3

UNIT- I	Data Mining	Periods:9
Introduction, Statistical Modeling, Machine Learning, Computational Approaches to Modeling, Feature Extraction, Statistical Limits on Data Mining, Hash Functions, Indexes, Natural Logarithms, Power Laws.		CO1
UNIT- II	**Map Reduce and Software Stack**	**Periods:9**
. Distributed File Systems, Map Reduce, Algorithms Using Map Reduce, Extensions to Map Reduce, Complexity Theory for Map Reduce.		CO2
UNIT- III	**Mining Data Streams**	**Periods:9**
The Stream Data Model, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, CountingOnes in a Window, Decaying Windows.		CO3
UNIT- IV	**Frequent Item Sets**	**Periods:9**
The Market-Basket Model, Market Baskets and the A-Priori Algorithm, Handling Larger Datasets in MainMemory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.		CO4
UNIT- V	**Clustering**	**Periods:9**
Introduction to Clustering Techniques, Hierarchical Clustering, K-means Algorithms, The CURE Algorithm, Clustering in Non-Euclidean Spaces, and Clustering for Streams and Parallelism. Dimensionality Reduction: Eigen values and Eigenvectors of Symmetric Matrices, Principal-Component Analysis, Singular-Value Decomposition, CUR Decomposition		CO5

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

Text Books

1. Jure Leskovec, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Datasets", Standford Press,2011.
2. Nick Pentreath, "Machine Learning with Spark", Packt Publishing,2015
3. Olivier Chapelle, Bernhard Scholkopf, Alexander Zien "Semi-Supervised Learning", TheMITPress, 2006.

Reference Books

1. Ron Bekkerman, Mikhail Bilenko, John Langford "Scaling Up Machine Learning: Parallel And Distributed Approaches",Cambridge University Press, 2012.
2. Jimmy Lin, Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan ClaypoolPublishers, 2010.
3. Hennessy, J.L. and Patterson, D.A., 2011. Computer architecture: a quantitative approach. Elsevier.
4. Chandramani Tiwary "Learning Apache Mahout", Packt Publishing, 2015.
5. Fuchen Sun, Kar-Ann Toh, Manuel Grana Romay, KezhiMao,"Extreme LearningMachines 2013: Algorithms andApplications", Springer, 2014.

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1. https://www.youtube.com/watch?v=waaN9069O3I
2. https://www.ibm.com/cloud/learn/nosql-databases
3. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
4. https://www.geeksforgeeks.org/introduction-to-nosql/
5. https://www.javatpoint.com/nosql-databa

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	3	2	3	3	3	1	1
2	3	3	3	2	3	2	3	1	1
3	3	3	3	2	2	2	3	1	1
4	3	3	3	2	2	2	3	1	1
5	3	3	3	2	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		15	10	5	60	100

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

2.A.3.237

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.					
Semester	II	Course Category : PC			*End Semester Exam Type: TE		
Course Code	P23BDT205	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Streaming Data Analytics	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Recognize the characteristics of data streams that make it useful to solve real-world problems.	K2
	CO2 Identify and apply appropriate algorithms for analyzing the data streams for variety of problems	K3
	CO3 Implement different algorithms for analyzing the data streams	K3
	CO4 Identify the metrics and procedures to evaluate a model	K3
	CO5 Knowledge for handling and analyzing streaming data.	K3

UNIT- I	Introduction and Data Streams	Periods:9
Characteristics of the data streams, Challenges in mining data streams Requirements and principlesfor realtime processing, Concept drift Incremental learning. **Data Streams** Counting the Number of Distinct Values in a Stream, Bounds of Random Variables, Poisson Processes,Maintaining Simple Statistics from Data Streams, Sliding Windows, Data Synopsis.		CO1

UNIT- II	Clustering from Data Streams	Periods:9
Clustering Examples: Basic Concepts, Partitioning Clustering - The Leader Algorithm, Single Passk-Means, Micro Clustering, Clustering Variables: A Hierarchical Approach		CO2

UNIT- III	Evaluating Streaming Algorithms	Periods:9
Evaluation Issues, Design of Evaluation Experiments, Evaluation Metrics, Error Estimators using a Single Algorithm and a Single Dataset, Comparative Assessment, The 0-1 loss function, Evaluation Methodology in Non-Stationary Environments The Page-Hinkley Algorithm		CO3

UNIT- IV	Frequent Pattern Mining	Periods:9
Mining Frequent Item sets from Data Streams- Landmark Windows, Mining Recent Frequent Item sets, Frequent Item sets at Multiple Time Granularities Sequence Pattern Mining- Reservoir Sampling for Sequential Pattern Mining over datastreams.		CO4

UNIT- V	Complex Event Processing	Periods:9
Introduction to Complex Event Processing, Features of CEP, Need for CEP, CEP Architectural Layers, Scaling CEP,Events, Timing and Causality, Event Patterns, Rules and Constraint, STRAWEPL, Complex Events and Event Hierarchies.		CO5

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

Text Books

1. Joao Gama, "Knowledge Discovery from Data Streams", CRC Press, 2010.
2. David Luckham, "The Power of Events: An Introduction to Complex Event Processing in Distributed Enterprise Systems",Addison Wesley, 2002.
3. Charu C. Aggarwal, "Data Streams: Models And Algorithms", Kluwer Academic Publishers, 2007.

Reference Books

1. Tom White "Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
2. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos,"Understanding Big Data:Analytics forEnterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", CUP,2012.
4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012.
5. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.

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3. business.html 3.https://www.tibco.com/reference-center/what-is-streaming-analytics
4.https://learn.microsoft.com/en-us/azure/stream-analytics/stream-analytics-use-reference-data

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 239

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.						
Semester	II	Course Category : PC			*End Semester Exam Type: TE			
Course Code	P23BDT206	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Big Data SQL with Hive	3	-	-	3	40	60	100

Prerequisite	Basics of Big Data	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Work with big data platform and explore the big data analytics techniques business applications.	K3
	CO2 Design efficient algorithms for mining the data from large volumes.	K3
	CO3 Analyze the HADOOP and Map Reduce technologies associated wbig data analytics.	K3
	CO4 Explore on Big Data applications Using Hive.	K3
	CO5 Understand the fundamentals of various big data analytics techniques.	K2

UNIT- I	Introduction To Big Data	Periods:9
Introduction to big data : Introduction to Big Data Platform – Challenges of Conventional Systems -Intelligentdata analysis – Nature of Data - Analytic Processes and Tools - Analysis vs Reporting.		CO1
UNIT- II	**Hive Concepts**	**Periods:9**
Frameworks: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zookeeper - IBM Infosphere Big Insights and Streams.		CO2
UNIT- III	**Hadoop Eco System**	**Periods:9**
Hadoop: History of Hadoop- the Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats-Map Reduce Features Hadoop environment.		CO3
UNIT- IV	**Big SQL and Hbase**	**Periods:9**
Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction		CO4
UNIT- V	**Hive and Hadoop Distributed File System**	**Periods:9**
Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQTables, QueryingData and User Defined Functions. The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.		CO5

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

Text Books

1. Da Ruan, Guoquing Chen, Etienne E.Kerre, Geert Wets, "Intelligent Data Mining", Springer,2007.
2. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, JamesGiles , David Corrigan, "Harness the Power ofBig Data The IBM Big DataPlatform", Tata McGraw Hill Publications, 2012.
3. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach",VPT, 2016

Reference Books

1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oraclepress.
3. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press,2012
4. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", JohnWiley & sons, 2012.
5. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and itsApplications (WILEY Big DataSeries)", John Wiley & Sons,2014

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2.https://www.classcentral.com/course/big-data-analysis-9506
3.https://intellipaat.com/big-data- hadoop-training/
4.https://www.simplilearn.com/big-data-and-analytics/big-data-and-hadoop-training
5.https://www.edureka.co/comprehensive-hive

* TE – Theory Exam, LE – Lab Exam

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COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

Department	Computer Science Engineering(Big Data Analytics)	Programme: M.Tech.						
Semester	II	Course Category : PC			*End Semester Exam Type: TE			
Course Code	P23BDTD01	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	No SQL Databases	3	-	-	3	40	60	100

Prerequisite	Basics of SQL and Databases	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explain the detailed architecture, Database properties and storage requirements.	K2
	CO2 Differentiate and identify right database models for real time applications.	K3
	CO3 Outline Key value architecture, characteristics, and Design Schema and implementCRUD operations, distributed data operations.	K2
	CO4 Compare data ware housing schemas and implement various column store internals.	K3
	CO5 Choose and implement advanced columnar data model functions for the realtime Applications.	K4

UNIT- I	Introduction to NoSQL	Periods:9	
Data base revolutions: First generation, second generation, third generation, Managing Transactions and Data Integrity, ACID and BASE for reliable database transactions, speeding Performance by strategic use of RAM, SSD, and disk, achieving horizontal scalability with Data base sharing, Brewers CAP theorem.			CO1
UNIT- II	**NoSQL Data Architecture Patterns**	**Periods:9**	
NoSQL Data model: Aggregate Models- Document Data Model- Key-Value Data Model Columnar Data Model, Graph Based Data Model Graph Data Model, NoSQL system ways to handle big data problems, Moving Queries to data, not data to the query, hash rings to distribute the data on clusters, replication to scale reads, Database distributed queries to Data nodes.			CO2
UNIT- III	**Key Value Data Stores and Document Oriented Database**	**Periods:9**	
Essential features of key value Databases, Properties of keys, Characteristics of Values, Key-Value Database Data Modeling Terms, Key-Value Database. Document, Collection, Naming, CRUD operation, querying, indexing, Replication, Sharing.			CO3
UNIT- IV	**Columnar Data Model – I and II**	**Periods:9**	
Data warehousing schemas: Comparison of columnar and row-oriented storage, Column-store Architectures: C-Store and Vector-Wise, Column-store internals and, Inserts/updates/deletes. Advanced techniques: Vectorized Processing Compression, Write penalty, Operating Directly on Compressed Data Late Materialization Joins , Group-by, Aggregation and Arithmetic Operations.			CO4
UNIT- V	**Data Modeling with Graph**	**Periods:9**	
Comparison of Relational and Graph Modeling, Property Graph Model Graph Analytics: Link analysis algorithm- Web as a graph, Page Rank- Markov chain, page rank computation, Topic specific page rank (Page Ranking Computation techniques: iterative processing, Random walk distribution Querying Graphs: Introduction to Cypher, case study: Building a Graph Database Application- community detection			CO5
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Dan Sullivan Sullivan, "NoSQL for Mere Mortals", Addison-Wesley, 2015.
2. Christopher D.manning, Prabhakar Raghavan, Hinrich Schutze, "An introduction to Information Retrieval", Cambridge University Press,2008.
3. Daniel Abadi, Peter Boncz and Stavros Harizopoulas, "The Design and Implementation of Modern Column-Oriented Database Systems", Now Publishers,2013.

Reference Books

1. Elmasri and Navathe , "Fundamentals of Database Systems", Pearson Education 2013.
2. Sadalage P & Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Wiley Publications, 1st Edition, 2019.
3. Perkins, Eric Redmond, Jim Wilson, Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQLMovement, 2nd Edition, Pragmatic Bookshelf, 2018.
4. Andreas Meier, Michael Kaufmann, "SQL & Nosql Databases",Repro Books, 2019
5. Guy Harrison, "Next Generation Database: NoSQL and big data", Apress, 2015.

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2. https://www.geeksforgeeks.org/introduction-to-nosql/

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3. https://www.javatpoint.com/nosql-databa
4. https://intellipaat.com/nosql-cassandra-hbase-training/
5. https://www.udemy.com/nosql/online-cours

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.243

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PC**			*End Semester Exam Type: **LE**			
Course Code	**P23BDP202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Big Data SQL with Hive Laboratory**	**-**	**-**	**4**	**2**	**50**	**50**	**100**
Prerequisite	Basics of Big Data and SQL							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 To Describe the key issues in Big Data Management and experiment with the Hadoop framework	**K2**
	CO2 To Explain the structure and unstructured data by using NoSQL commands.	**K3**
	CO3 To Apply scientific computing algorithms for finding similar items and clustering	**K2**
	CO4 To Test fundamental enabling techniques and scalable algorithms for data stream mining	**K3**
	CO5 To Develop problem solving and critical thinking skills infundamental enable techniques like Hadoop & MapReduce.	**K4**

List of Experiments:

1. Installation of Hadoop Framework, it's components and study the HADOOP ecosystem.
2. Write a program to implement word count program using MapReduce
3. Experiment on Hadoop Map-Reduce / PySpark: -Implementing simple algorithms in Map-Reduce: Matrix multiplication.
4. Install and configure MongoDB/ Cassandra/ HBase/ Hypertable to executeNoSQL Commands.
5. Implementing DGIM algorithm using any Programming Language/ Implement BloomFilter using any programming language
6. Implement and Perform Streaming Data Analysis using flume for data capture, PYSpark / HIVE for data analysisof twitter data, chat data, weblog analysis etc.
7. Implement any one Clustering algorithm (K-Means/CURE) using Map-Reduce.
8. Implement Page Rank Algorithm using Map-Reduce.
9. Installation of Single Node Hadoop Cluster on Ubuntu
10. Hadoop Programming: Word Count MapReduce Program Using Eclipse
11. Implementing Matrix Multiplication Using One Map-Reduce Step.
12. Implementing Relational Algorithm on Pig.
13. Implementing database operations on Hive.
14. Implementing Bloom Filter using Map-Reduce
15. Implementing Frequent Item set algorithm using Map-Reduce.
16. Implementing Clustering algorithm using Map-Reduce
17. Implementing Page Rank algorithm using Map-Reduce
18. Mini Project:

    Few topics for Projects:
    a. Twitter data analysis
    b. Fraud Detection
    c. Text Mining
    d. Equity Analysis etc.

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

Reference Books

1. Tom White,"Hadoop: The Definitive Guide", O'Reilley, Third Edition, 2012.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Vignesh Prajapati ,"Big data analytics with R and Hadoop" , SPD 2013.
4. E. Capriolo, D. Wampler, and J. Rutherglen ,"Programming Hive", O'Reilley, 2012.

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2. https://www.ibm.com/cloud/learn/nosql-databases
3. https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp
4. https://www.geeksforgeeks.org/introduction-to-nosql/
5. https://www.javatpoint.com/nosql-databa

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **HS**			*End Semester Exam Type: **LE**			
Course Code	**P23HSPC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Seminar on ICT: A Hands-On Approach**	-	-	4	2	100	-	100

(Common to all M.Tech Programmes)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Select a topic, narrowing the topic into presentation.	**K2**
	CO2 State an objective and use the relevant ICT tools to make the presentation effective.	**K3**
	CO3 Study the topic and understanding the contributions and prepare report.	**K2**
	CO4 Prepare a working demo.	**K3**
	CO5 Prepare conclusions based on the reading of the topic and giving final Presentation.	**K4**

List of Experiments:

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

ICT skills

- Understand ICT workflow in the respective domain choosed.
- Manage multitasking.
- Deal with main issues using tech in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Scope

- Perspective in order to design activities in class.
- Understand the process of creating audiovisuals.

Teaching tools

- Different ways to create audiovisual activities.
- Handle audiovisual editors.
- Collaborative working.
- Individualize learning experience.
- Get instant feedback from students.

Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study on the assigned topic and prepare a report, running to 30 or 40 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee (comprising of the Head of the Department and two faculty members) for a total of 100 marks.

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

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 246

COs/POs/PSOs Mapping

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

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

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Attendance		
	Presentation using ICT	Report	viva			
Marks	50	30	10	10	-	100

2.A.3.247

Department	**Computer Science and Engineering (Big DataAnalytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **AEC**			*End Semester Exam Type: -			
Course Code	**P23CSC2XX**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Ability Enhancement Courses**	-	-	**4**	-	**100**	-	**100**

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

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

9. A. 3. 24

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDE101**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Data Driven Decision Making**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Big Data	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand data in decision making	**K2**
	CO2 Make use of data preprocessing	**K3**
	CO3 Analyze decision making concepts	**K2**
	CO4 Illustrate ML for decision making	**K3**
	CO5 Make use of Data visualization	**K3**

UNIT – I	**Introduction to Data-Driven Decision Making**	**Periods:9**
Understanding the role of data in decision making – Importance of data – driven decision making in various domains – Types of data and data sources – Data collection methods and techniques		**CO1**
UNIT – II	**Data Preprocessing and Exploratory Data Analysis**	**Periods:9**
Data cleaning and data quality assessment – Handling missing data and outliers – Data transformation and normalization techniques – Exploratory Data Analysis (EDA) for understanding data distributions and patterns		**CO2**
UNIT – III	**Statistical Concepts for Decision Making**	**Periods:9**
Probability theory and distributions – Statistical inference and hypothesis testing – Correlation and regression analysis – Understanding p-values and confidence intervals		**CO3**
UNIT – IV	**Machine Learning for Decision Making**	**Periods:9**
Introduction to machine learning algorithms – Supervised, unsupervised, and reinforcement learning – Model training, evaluation, and validation – Feature selection and engineering for better decision-making models		**CO4**
UNIT – V	**Data Visualization and Communication of Results**	**Periods:9**
Principles of Data Visualization– Data visualization techniques and tools – Design principles for effective data visualizations – Storytelling with data: Presenting results to stakeholders – Ethical considerations in data- driven decision making		**CO5**

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

Text Books

1. "Data Science for Business" by Foster Provost and Tom Fawcett
2. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling" by Ralph Kimball and Margy Ross
3. "Python for Data Analysis" by Wes McKinney
4. "Statistical Inference" by George Casella and Roger L. Berger
5. "Data Points: Visualization That Means Something" by Nathan Yau

Reference Books

1. "Data Science from Scratch: First Principles with Python" by Joel Grus
2. "Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and KennethCukier
3. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy
4. "Data-Driven: Creating a Data Culture" by Hilary Mason and DJ Patil
5. "Applied Predictive Modeling" by Max Kuhn and Kjell Johnson

Web References

1. https://www.oreilly.com/library/view/data-science-for/9781449374280/
2. https://www.wiley.com/en- us/The+Data+Warehouse+Toolkit%3A+The+Definitive+Guide+to+Dimensional+Modeling%2C+4th+Edition-p-9781119425822
3. https://www.oreilly.com/library/view/python-for-data/9781491957653/
4. https://www.cengage.com/c/statistical-inference-2e-casella/9780534243128/
5. https://www.wiley.com/en-us/Data+Points%3A+Visualization+That+Means+Something-p-9781118462195

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.25

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDEC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Neural Networks**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basics of ANN and comparison with Human brain.	**K3**
	CO2 Understand the role of neural networks in engineering, artificia intelligence, and cognitive modelling.	**K2**
	CO3 Understand the concepts and techniques of neural networks throughthe study of the most important neural network models.	**K3**
	CO4 Evaluate whether neural networks are appropriate to a particular application.	**K2**
	CO5 Apply neural networks to particular application, and to know whatsteps to take to improve performance.	**K2**

UNIT- I	**Introduction**	**Periods: 9**
A Neural Network-Human Brain- Models of a Neuron-Neural Networks viewed as Directed Graphs-Network Architectures-Knowledge Representation-Artificial Intelligence and Neural Networks. Learning Process: Error Correction Learning- Memory Based Learning-Hebbian Learning, Competitive- Boltzmann Learning-Credit Assignment Problem- Memory- Adaption- Statistical Natureof the Learning Process.		**CO1**

UNIT- II	**Single Layer Perceptrons**	**Periods: 9**
Adaptive Filtering Problem- Unconstrained Organization Techniques- Linear Least Square Filters- Least Mean Square Algorithm-Learning Curves- Learning Rate Annealing Techniques- Perceptron –Convergence Theorem- Relation Between Perceptron and Bayes Classifier for a Gaussian Environment. Multilayer Perceptron: Back Propagation Algorithm XOR Problem- Heuristics-Output Representation and Decision Rule-Computer Experiment- Feature Detection		**CO2**

UNIT- III	**Back Propagation**	**Periods: 9**
Back Propagation and Differentiation- Hessian Matrix- Generalization- Cross Validation- NetworkPruning Techniques-Virtues and Limitations of Back Propagation Learning- Accelerated Convergence-Supervised Learning.		**CO3**

UNIT- IV	**Self-Organization Maps (SOM)**	**Periods: 9**
Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of FeatureMap, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.		**CO4**

UNIT- V	**NEURO DYNAMICS**	**Periods: 9**
Dynamical Systems-Stability of Equilibrium States, Attractors-Neuro Dynamical Models - Manipulation of Attractors as a Recurrent Network Paradigm Hopfield Models – Hopfield Models- restricted boltzmen machine.		**CO5**

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

Text Books

1. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.
2. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.
3. Neural Networks A Classroom Approach -Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.

Reference Books

1. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
2. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
3. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd 2005
4. Introduction to Artificial Neural Systems - J.M. Zurada, Jaico Publications 1994.
5. Artificial Neural Networks- B. Yegnanarayana, Pill, New Delhi 1998.

Web References

1. https://www.cs.rit.edu/~lr/courses/nn/main.html
2. https://www.inspirenignite.com/up/neural-network
3. https://www.investopedia.com/terms/n/neuralnetwork.asp
4. https://www.mygreatlearning.com/blog/types-of-neural-networks/
5. https://link.springer.com/10.1007/978-3-642-20617-7_6563

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 252

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.253

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.						
Semester	I	Course Category : PE			*End Semester Exam Type: TE			
Course Code	P23BDE102	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Multicore Architectures	3	1	-	4	40	60	100

Prerequisite	No Prerequisite Needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Describe multicore architectures and identify their characteristics andchallenges.	K3
	CO2 Identify the issues in programming Parallel Processors.	K3
	CO3 Make use of OpenMP and MPI.	K2
	CO4 Design parallel programming solutions to common problems.	K3
	CO5 Compare and contrast programming for serial processors and programmingforparallel.	K3

UNIT – I	Multi-Core Processors	Periods:9
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.		CO1
UNIT – II	**Parallel Program Challenges**	**Periods:9**
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks,semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).		CO2
UNIT – III	**Shared Memory Programming with OpenMP**	**Periods:9**
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions –Handling Data and Functional Parallelism – Handling Loops – Performance Considerations		CO3
UNIT – IV	**Distributed Memory Programming with MPI**	**Periods:9**
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation		CO4
UNIT – V	**Parallel Program Development**	**Periods:9**
Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and Comparison.		CO5

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

Text Books

1. "Computer Architecture: A Quantitative Approach" by John L. Hennessy and David A. Patterson.
2. "Parallel Computer Architecture: A Hardware/Software Approach" by David Culler, Jaswinder Pal Singh, andAnoop Gupta
3."Multicore Application Programming: For Windows, Linux, and Oracle Solaris" by Darryl Gove.
4."Programming Massively Parallel Processors: A Hands-on Approach" by David B. Kirk and Wen-mei W. Hwu.
5."Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers"by Barry

Reference Books

1. Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier,2021
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011 (unit 2)
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
4.Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
5. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

Web References

1. https://software.intel.com/content/www/us/en/develop/topics/multi-core.html
2. https://www.arm.com/resources/education/textbooks/computer-organization-and-design
3. https://developer.nvidia.com/cuda-zone
4. https://developer.amd.com/resources/
5. https://hpc.llnl.gov/training/tutorials

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.255

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	**I**	Course Category: **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSTD01**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Advanced Data Structures and Algorithms**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

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

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

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

Text Books

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

Reference Books

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, "Data Structures and Algorithms", Addison Wesley, Fifth Edition, 201
2. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley , Publishing Company, Sixth Edition, 2016.
3. Narasimha karumanchi, Data Structures and algorithms made easy, Fifth Edition, 2017
4. E. Horowitz, S.Sahni and Dinesh Mehta, "Fundamentals of Data structures in C++", University Press, Fourth Edition, 2005. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, Second Edition, 2002

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

* TE – Theory Exam, LE – Lab Exam

2.A.3.256

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.257

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	**I**	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23BDE103**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**MACHINE LEARNING**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Artificial Intelligence	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand and outline problems for each type of machine learning	K3
	CO2 Design a Decision tree and Random forest for an application	K3
	CO3 Implement Probabilistic Discriminative and Generative algorithms for an application andanalyze the results	K2
	CO4 Use a tool to implement typical Clustering algorithms for different types of applications.	K3
	CO5 Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.	K3

UNIT – I	**Introduction and Mathematical Foundations**	**Periods:9**
What is Machine Learning? Need –History – Definitions – Applications - Advantages, Disadvantages &Challenges -Types ofMachine Learning Problems – Mathematical Foundations - Linear Algebra & Analytical Geometry -Probability and Statistics-Bayesian Conditional Probability -Vector Calculus & Optimization - Decision Theory - Information theory		**CO1**
UNIT – II	**Supervised Learning**	**Periods:9**
Introduction-Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting -Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods –Decision Trees –ID3 – CART - Ensemble Methods –Random Forest - Evaluation of Classification Algorithms		**CO2**
UNIT – III	**Unsupervised Learning and Reinforcement Learning**	**Periods:9**
Introduction - Clustering Algorithms -K – Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction –Principal Component Analysis – Recommendation Systems - EM algorithm. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning		**CO3**
UNIT – IV	**Probabilistic Methods for Learning**	**Periods:9**
Introduction -Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks - Probabilistic Modellingof Problems -Inference in Bayesian Belief Networks – Probability Density Estimation - Sequence Models – Markov Models – Hidden Markov Models		**CO4**
UNIT – V	**Neural Networks and Deep Learning**	**Periods:9**
Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network –Back Propagation- Activation and Loss Functions- Limitations of Machine Learning – Deep Learning– Convolution Neural Networks – Recurrent Neural Networks – Use cases		**CO5**

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

Text Books

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", First Edition, 2013
2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012
3. Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014

Reference Books

1. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: FromTheory to Algorithms", Cambridge University Press, 2015
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
3. Hal Daumé III, "A Course in Machine Learning", 2017 (freely available online)5
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, 2009 (freely available online)
5. Aurélien Géron , Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems 2nd Edition, o'reilly, (2017)

2.A.3.25

Web References
1. https://nptel.ac.in/courses/106105077
2. https://scikit-learn.org/stable/documentation.html
3. https://www.tensorflow.org/learn
4. https://pytorch.org/docs/stable/index.html
5. http://cs229.stanford.edu/

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3.259

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSEC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Information Visualization**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze the different data types, visualization types to bring out the insight.	**K3**
	CO2 Make use of Visualization Techniques	**K3**
	CO3 Illustrate different Visual Analytics	**K2**
	CO4 Make use of Data Visualization Tools	**K3**
	CO5 Demonstrate Visualization dashboard creations	**K2**

UNIT-I	**Introduction**	**Periods: 9**	
Overview of data visualization - Data Abstraction - Task Abstraction - Dimensions and Measures - Analysis:Four Levels for Validation. Statistical charts (Bar Chart - stacked bar chart – Line Chart - Histogram - Pie chart- Frequency Polygon - Box plot - Scatter plot - Regression curves			**CO1**
UNIT-II	**Visualization Techniques**	**Periods: 9**	
Introduction to various data visualization tools - Scalar and point techniques - vector visualization techniques -multidimensional techniques - visualizing cluster analysis – K-means and Hierarchical Cluster techniques.			**CO2**
UNIT-III	**Data Visualization and Visual Analytics**	**Periods: 9**	
Time Series data visualization – Text data visualization – Spatial Data Visualization - Networks and Trees - Heat Map – Tree Map - Map Color and Other Channels Manipulate View – Visual Attributes - Multivariate data visualization – Geometric projection techniques - Icon-based techniques - Pixel-oriented techniques - Hierarchical techniques - Scatterplot matrix - Hyper box - Trellis display - Parallel coordinates			**CO3**
UNIT-IV	**Data Visualization Tools**	**Periods: 9**	
Tableau functions and logics: Marks and Channels-Arrange Tables- Arrange Spatial Data- Facets into multiple views			**CO4**
UNIT-V	**Visualization Dashboard Creations**	**Periods: 9**	
Data Dashboard- Taxonomies- User Interaction- Organizational Functions-Dashboard Design – Worksheets - Workbooks – Workbook Optimization - Protection and common mistakes. Dashboard creation using visualization tool use cases: Finance-marketing-insurance-healthcare			**CO5**

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

Text Books

1.Tamara Munzer, Visualization Analysis and Design, 1st edition, CRC Press, United States, 2015.
2.Michael Fry, Jeffrey Ohlmann, Jeffrey Camm, James Cochran, Data Visualization: Exploring and Explaining with Data, South-Western College Publishing, 2021
3. Sandra Rendgen," Information Graphics", Taschen America Llc,2012

Reference Books

1. Ben Fry, Visualizing Data, 1st edition, O'Reilly Media, United States, 2008.
2. Avril Coghlan, A little book of R for multivariate analysis, 1st edition, Welcome Trust Sanger Institute,United Kingdom, 2013.
3.Colin Ware,Information Visualization Perception for Design,2 nd Edition ,Elsevier Science,2019
4. Riccardo Mazza,Introduction to Information Visualization,1st EditionSpringer London,2009
5.Claus O. Wilke,undamentals of Data Visualization,O'Reilly MediaInc,2019

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1. https://www.tableau.com/
2. https://www.sciencedirect.com/science/article/pii/S2452414X19300573
3. https://study.com/academy/lesson/information-visualization-tools-techniques.html
4. https://www.youtube.com/watch?v=_YfHDbADy4s
5. https://www.nobledesktop.com/learn/data-visualization/video-tutorials

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A3.261

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	II	Course Category : **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23CSEC03**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Text, Web and Social Media Analytics**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand Text Mining	**K2**
	CO2 Illustrate Web Mining	**K3**
	CO3 Make use of Social Network Analysis	**K2**
	CO4 Exploit Social Media Mining	**K3**
	CO5 Make use of Sentimental Mining	**K3**

UNIT- I	**Introduction to Text Mining**	**Periods: 9**	
Text Representation- tokenization, stemming, stop words, TF-IDF, Feature Vector Representation, NER, N-gram modeling. Text Clustering, Text Classification, Topic Modeling-LDA,HDP			**CO1**
UNIT- II	**Introduction to Web-Mining**	**Periods: 9**	
Inverted indices and Boolean queries. PLSI, Query optimization, page ranking. Web Crawling-Crawler Algorithms, Implementation Issues, Evaluation, Session & visitor Analysis, Visitor Segmentation, Analysis of Sequential & Navigational Patterns, Predictions based on web user transactions.			**CO2**
UNIT- III	**Fundamentals of Social Network Analysis**	**Periods: 9**	
Social Network Perspective, Fundamentals concepts in Network Analysis: Sociogram, Sociometry. Social Network Data: Types of Networks: One-Mode, Two-Mode, Affiliation, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Notations for Social Network Data: Graphs, Directed, Singed, Valued graphs, Multigraph, Relations and Matrices			**CO3**
UNIT- IV	**Social Media Mining**	**Periods: 9**	
Introduction to Social Media Network Essentials of Social graphs, Social Networks, Models, Information Diffusion in SocialMedia. Behavioral Analytics, Influence and Homophily, Recommendation in Social Media			**CO4**
UNIT- V	**Sentimental Mining**	**Periods: 9**	
Sentiment classification feature based opinion mining, comparative sentence and relational mining, Opinion spam			**CO5**
Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Bing Liu, "Web Data Mining-Exploring Hyperlinks, Contents, and Usage Data", Springer, Second Edition, 2011.
2. Reza Zafarani, Mohammad Ali Abbasi and Huan Liu, "Social Media Mining – An Introduction", Cambridge UniversityPress, 2014.
3. Bing Liu, "Sentiment Analysis and Opinion Mining", Morgan & Claypool Publishers, 2012.

Reference Books

1. Nitin Indurkhya, Fred J Damerau, "Handbook of Natural Language Process", 2nd Edition, CRC Press, 2010.
2. Matthew A.Russell, "Mining the social web", 2nd edition- O'Reilly Media, 2013.
3. Gabor Szabo, Gungor Polatkan, P. Oscar Boykin, Antonios Chalkiopoulos,"Social Media Data Mining and Analytics", Willey, 2018
4. Ganis,Kohirkar," Social Media Analytics", Pearson Education India, 2016
5. Marshall Sponder," Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics", McGraw-Hill Education,2014

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1.https://machinelearninggeek.com/text-analytics-for-beginners-using-python-nltk/
2.https://towardsdatascience.com/a-guide-text-analysis-text-analytics-text-mining-f62df7b78747
3.https://www.tutorialspoint.com/web_analytics/index.html
4.https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm
5.https://www.simplilearn.com/web-analytics-guide-for-newbies-article

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.263

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23CSTD02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Speech and Language Processing**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

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

Prerequisite	Natural language processing, Machine Learning	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the basics of NLP	**K2**
	CO2 Apply the basic ML and DL techniques for NLP	**K3**
	CO3 Understand and realize the advanced NLP Techniques.	**K2**
	CO4 Understand the concept of NLU, NLG and apply the concept of Information Retrieval	**K2**
	CO5 Apply ethics to be followed while building NLP Applications and how to use NLP Libraries	**K3**

UNIT – I	**Introduction**	**Periods:9**	
Phases of NLP, Text Preprocessing: Tokenization, Stemming and Lemmatization, Pos Tagging, Named Entity Recognition. NLP Feature Engineering,Word Count Vector, Word Sense Disambiguation			**CO1**
UNIT – II	**Language Modelling**	**Periods:9**	
N -gram Models, Hidden Markov Models, Maximum Likelihood Estimation. Supervised, Unsupervised and Semi Supervised Learning.Text Classification and Sentiment Analysis, Topic Modelling and Clustering, Word Embeddings, RNN & LSTMs for NLP, CNN for NLP.			**CO2**
UNIT – III	**Advanced NLP Techniques**	**Periods:9**	
Sequence- to -Sequence Models, Attention Mechanisms, Transformer Architecture: BERT, GPT			**CO3**
UNIT – IV	**Language Understanding and Generation, Information Retrieval**	**Periods:9**	
Text Generation, Question Answering, Dialogue Systems and Chatbots. Machine Translation, Cross Lingual Transfer Learning. TextIndexing and Search, Text Summarization.			**CO4**
UNIT – V	**NLP Tools, Libraries, Applications, Ethics**	**Periods:9**	
Bias and Fairness in NLP, Privacy Concerns in NLP Applications. NP libraries: NLTK, Spacy, Tensor Flow, Pytorch. NLP Applications: Sentiment Analysis, Named Entity Recognition in Real World Data Sets, Text Classification for Various Domains.			**CO5**

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

Text Books

1.Christopher D. Manning and Hinrich Schutze, " Foundations of Natural Language Processing" ,13th Edition, The MIT Press Cambridge, Massachusetts London, England, 2018
2.Daniel Jurafsky and James H. Martin "Speech and Language Processing", 16th edition, Prentice Hall, 2021.
3.Rajesh Arumugam, Rajalingappa Shanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application".PACKT publisher, 2018

Reference Books

1.NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second 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, MITPress 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.

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1. https://www.udemy.com/course/chatbot/
2. https://gtuematerial.in/natural-language-processing-3170723/
3. https://chatbotsmagazine.com/understanding-the-need-for-nlp-in-your-chatbot-78ef2651de84?gi=ecca664b642a
4. https://www.ultimate.ai/blog/ai-automation/how-nlp-text-based-chatbots-work
5. https://www.javatpoint.com/nlp

* TE – Theory Exam, LE – Lab Exam

2.A.3.264

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	2	2	3	3	2	2	2	2
2	2	3	3	3	2	1	2	2	1
3	2	3	3	2	1	-	2	2	1
4	2	2	3	2	3	2	2	3	1
5	3	2	2	3	3	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		15	10	5	60	100

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

2.A.3.265

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	II	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDEC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Web Analytics and Development**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

(Common to M.Tech CSE(BDA) and AI&DS)

Prerequisite	Internet Programming	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the Web analytics platform, and their evolution.	**K2**
	CO2 Use the various Data Streams Data.	**K3**
	CO3 Know how the survey of capturing of data will benefit.	**K2**
	CO4 Understand Common metrics of web as well as KPI related concepts.	**K2**
	CO5 Apply various Web analytics versions in existence.	**K3**

UNIT – I	**Introduction**	**Periods:9**	
Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations			**CO1**
UNIT – II	**Data Collection**	**Periods:9**	
Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: Ecommerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.			**CO2**
UNIT – III	**Qualitative Analysis**	**Periods:9**	
Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, Understanding click stream data quality, identifying unique page definition, Using cookies, Link coding issues.			**CO3**
UNIT – IV	**Web Metrics**	**Periods:9**	
Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, new visits; Optimization (e-commerce, non-e- commerce sites): Improving bounce rates, Optimizing AdWords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.			**CO4**
UNIT – V	**Web Analytics 2.0**	**Periods:9**	
Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sourcesToolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends Analyzing competitive site overlap and opportunities. Google Analytics: Brie introduction and working, AdWords, BenchmarkingCategories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.			**CO5**

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

Text Books

1.Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed, 2012.

2.Jure Leskovec, Anand Rajaraman, and Jeffrey D. Ullman , "Mining of Massive Datasets" 2nd edition, Cambridge University Press, 2014

3.Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, WileyPublishing, Inc. 1st ed, 2010

References Books

1. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons,2002
2. Brian Clifton , "Advanced Web Metrics with Google Analytics" , Sybex, Third Edition, 2012
3. Jerri L. Ledford and Joe Teixeira , "Learning Web Analytics: A Beginner's Guide to Google Analytics", O'Reilly Media, 2010
Pedro Sostre ,"Web Analytics For Dummies" , For Dummies, Second Edition , 2012
4. Avinash Kaushik ,"Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity" , Sybex, 2nd Edition, 2009

Web References

1. https://www.mygreatlearning.com/courses/big-data-analytics-dse
2. https://intellipaat.com/big-data-hadoop-training/

2.A.3.266

3. https://www.edureka.co/comprehensive-hive

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	3	3	2	1	-	-	-	1	3
2	3	3	2	1	-	-	-	1	3
3	3	3	2	1	-	-	-	1	3
4	3	3	2	1	-	-	-	1	3
5	3	3	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
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	10		15	10	5	60	100

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

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.						
Semester	II	Course Category: PE			*End Semester Exam Type: TE			
Course Code	P23BDE204	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	Expert System and Decision Making	3	-	-	3	40	60	100

Prerequisite	Artificial Intelligence, Knowledge Representation	
Course Outcome	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Familiar with basic concepts of Expert System	K2
	CO2 Understanding the concepts of Expert System design	K2
	CO3 Key management concepts and their decision-making processes for the organization	K2
	CO4 Ability to develop corporate strategy, organizational development and change programs and ensure their implementation	K3
	CO5 Decision-making methods and technologies variety and their applications	K3

UNIT – I	Introduction to Expert Systems	Periods: 9
Introduction to Expert Systems-Basic activates of expect system-Interoperation, Prediction and diagnosis – Design, Planning and Monitor-Debugging Repair, instruction and control-Basic expects of Experts systems- Acquisition Modules frames of expert system, Knowledge base- Production rule, Sematic net and inference engine, Backward chaining and forward chaining.		CO1
UNIT – II	**Expert Systems Design and Development**	**Periods: 9**
Sources of uncertainty in rules, methods of dealing with uncertainty, Dempster-Shafer theory, theory of uncertainty based on fuzzy logic, commercial applications of fuzzy logic. How to select an appropriate problem, the stages in the development of an expert system, types of errors to expect in the development stages, the role of the knowledge engineer in the building of expert systems, the expected life cycle of an expert system, how to do a life cycle model.		CO2
UNIT – III	**Problem Solving and Decision Making.**	**Periods: 9**
Definition of the problem and potential causes for the problem-Identifying alternatives for approaches to resolve the problem. -Selecting an approach to resolve the problem. – Implementation of the best alternative. -Action plan.- Monitoring implementation of the plan. - Rational Versus Organic Approach to Problem Solving. -Discover Your Decision-Making Style.		CO3
UNIT – IV	**Decision Making Process**	**Periods: 9**
Disciplined decision-making process. -Formal decision-making method. -Time decisions. -Problem definition. -Requirements identification. -Goal establishment. -Evaluation criteria development. - General Decision–Making Process (scheme). -Paired Comparison Analysis.		CO4
UNIT – V	**Decision Making Methods**	**Periods: 9**
Decision Analysis techniques. -Pros and Cons Analysis. -Pros and Cons Analysis(example). - Kepner-Tregoe (K- T) Decision Analysis. -Kepner-Tregoe (K-T) Decision Analysis (example),K- Troubleshooting Methodology. - Determining pros and cons of franchising by using SWOT- analysis.		CO5

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

Text Books

1.Bratko, I., Prolog Programming for Artificial Intelligence (International Computer Science Series), Addison-Wesley Educational Publishers Inc; 4th edition, 2011.
2.Stuart Russel, Peter Norvig "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education 2009.
3. Rajasekaran. S.. Vijayalakshmi Pai. G.A. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India Private Limited, 2003

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1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning series), The MIT Press; second edition, 2009.
2. Nils J. Nilsson, the Quest for Artificial Intelligence, Cambridge University Press, 2009.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2009.
4. M. Tim Jones, Artificial Intelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc; 1 edition, 2008
5. Kevin Night, Elaine Rich, Nair B., "Artificial Intelligence (SIE)", McGraw Hill, 2008

2.A.3.268

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2. https://www.reddit.com/r/artificial/
3. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
4. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_expert_systems.htm
5. https://www.javatpoint.com/expert-systems-in-artificial-intelligence

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.269

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category : **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDE205**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Information Retrieval**	**3**	**-**	**-**	**3**	**0**		**00**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Build an Information Retrieval system using the available tools.	**K3**
	CO2 Identify and design the various components of an Information Retrievalsystem.	**K3**
	CO3 Categorize the different types of IR Models.	**K2**
	CO4 Apply machine learning techniques to text classification and clustering which is used for Efficient Information Retrieval.	**K3**
	CO5 Make use of Web Searching	**K3**

UNIT- I	**Introduction**	**Periods: 9**
Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open-Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR —IR Versus Web Search–Components of a Search engine.		**CO1**
UNIT- II	**Modeling**	**Periods: 9**
Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting — Scoring and Ranking – Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models –Structured Text Retrieval Models – Models for Browsing		**CO2**
UNIT-III	**Indexing**	**Periods: 9**
Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency		**CO3**
UNIT-IV	**Evaluation and Parallel Information Retrieval**	**Periods: 9**
Traditional Effectiveness Measures – Statistics in Evaluation – Minimizing Adjudication Effect – Nontraditional Effectiveness Measures – Measuring Efficiency – Efficiency Criteria –Queueing Theory – Query Scheduling – Parallel Information Retrieval – Parallel Query Processing – MapReduce		**CO4**
UNIT-V	**Searching the Web**	**Periods: 9**
Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries		**CO5**

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

Text Books

1.Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, "Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition, 2008.

2.Stefan Buttcher, Implementing and Evaluating Search Engines, The MIT Press, Cambridge,Massachusetts London, England, 2016.

3. Bing Liu," Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data",2007

Reference Books

1.Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books), Second Edition, 2011.
2.Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval in Practice",2010
3. David A. Grossman and Ophir Frieder,"Text Information Retrieval Systems",2008
4. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing",1999

Web References

1. https://www.mygreatlearning.com/courses/big-data-analytics-dse
2. https://intellipaat.com/big-data-hadoop-training/
3. https://www.edureka.co/comprehensive-hive

* TE – Theory Exam, LE – Lab Exam

2.A.3.270

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.					
Semester	II	Course Category: PE			*End Semester Exam Type: TE		
Course Code	P23BDE206	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Supply Chain Analytics	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understanding the supply chain analytics	K2
	CO2 Illustrate warehousing decisions	K2
	CO3 Analyze Inventory management	K3
	CO4 Make use of transportation network models	K3
	CO5 Analyze MCDM Models	K3

UNIT - I	Introduction	Periods:9	
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supplychains.			CO1
UNIT - II	**Warehousing Decisions**	**Periods:9**	
P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, SpaceDetermination and Layout Methods.			CO2
UNIT - III	**Inventory Management**	**Periods:9**	
Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT,Risk Analysis in Supply Chain, Risk pooling strategies.			CO3
UNIT - IV	**Transportation Network Models**	**Periods:9**	
Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Setcovering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.			CO4
UNIT - V	**MCDM Models**	**Periods:9**	
Analytic Hierarchy Process (AHP), Data Envelopment Analysis (DEA), Fuzzy Logic a Techniques, theanalytical network process (ANP), TOPSIS.			CO5

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

Text Books

1. Nada R. Sanders, "Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence", Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, "Supply Chain Network Design: Applying Optimization and Analytics to the Global Supply Chain", Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, "Networks Against Time: Supply Chain Analytics for Perishable Products", Springer, 2013.

Reference Books

1. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, "Analytics in Operations/Supply Chain Management" , I.K. International Publishing House Pvt. Ltd., 2016.
2. Gerhard J. Plenert, "Supply Chain Optimization through Segmentation and Analytics", CRC Press, Taylor & Francis Group, 2014.
3. T. A. S. Vijayaraghavan, "Supply Chain Analytics", Wiley, 2021.
4. Peter W Robertson," Supply Chain Analytics Using Data to Optimise Supply Chain Processes", Routledge, 2020

Web Referance

1. https://www.researchgate.net/publication/255621095_Guidebook_to_Decision-Making_Methods
2. https://docplayer.net/415860-Guide-to-cost-benefit-analysis-ofinvestment-projects.html
3. http://www.informs.org/Community/DAS
4. http://www.mindtools.com/pages/article/newTED_01.htm
5. http://managementhelp.org/groups/group-decision-making.htm

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 23

Department	Computer Science Engineering (Big Data Analytics)	Programme: M.Tech.					
Semester	II	Course Category: PE			*End Semester Exam Type: TE		
Course Code	P23BDE207	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	Cryptography and Information Security	3	-	-	3	40	60	100

Prerequisite	No Prerequisite needed	
Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Understand the fundamentals of networks security, security architecture, threats and vulnerabilities	K2
	CO2 Apply the different cryptographic operations of symmetric cryptographic algorithms	K3
	CO3 Apply the different cryptographic operations of public key cryptography	K2
	CO4 Understand various Security practices and System securitystandards	K2
	CO5 Understand the fundamentals of networks security, security architecture, threats and vulnerabilities	K2

UNIT- I	Introduction	Periods: 9	
Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory –product cryptosystem – cryptanalysis.			CO1
UNIT- II	**Block Cipher and Data EncryptionStandards**	**Periods: 9**	
Mathematics Of Symmetric Key Cryptography: Algebraic structures - Modular arithmetic-Euclid 's algorithm-Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.			CO2
UNIT- III	**Public Key Cryptography**	**Periods: 9**	
Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Euler's totientfunction, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic- Elliptic curve cryptography.			CO3
UNIT- IV	**Message Authentication and Integrity**	**Periods: 9**	
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics,Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509			CO4
UNIT- V	**Security Practice and System Security**	**Periods:9**	
Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls			CO5

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

Text Books

1.William Stallings, "Cryptography and Network Security: Principles and Practice", 4th edition, Pearson Education, India,2006
2.William Stallings," Network Security Essentials (Applications and Standards)", Pearson Education, India.,2000
3.Robert Bragg, Mark Rhodes, "Network Security: The complete reference", Tata Grawhill, India,2004

Reference Books

1.Charlie Kaufman, "Network Security: Private Communication in a Public World", 2nd edition, Prentice Hall of India,2002
2.Atul Kahate, "Cryptography and Network Security", 2nd edition, Tata Mc Grawhill, India.2008
3. Hugo Hoffman, "Cybersecurity, Cryptography and Network Security For Beginners"2020
4. Sunil Gupta," Introduction to Cryptography & Network Security", S.K. Kataria & Sons,2013
5. Savita Gandhi, Bhushan Trivedi ," Cryptography and Network Security", BPB Publications,2021.

Web References

1.https://www.mygreatlearning.com/courses/big-data-analytics-dse
2.https://intellipaat.com/big-data-hadoop-training/
3.https://www.edureka.co/comprehensive-hive

2.A.3.274

* TE – Theory Exam, LE – Lab Exam

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2.A.3.275

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**II**	Course Category: **PE**			*End Semester Exam Type: **TE**			
Course Code	**P23BDE208**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Semantic Web and Knowledge Management**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	Basics of Web	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate the semantic web technologies like Semantic Web technologies	**K1**
	CO2 Learn the various semantic web applications	**K3**
	CO3 Identify the architectures and challenges in building social networks	**K4**
	CO4 Use the knowledge management tools.	**K3**
	CO5 Develop knowledge management Applications.	**K3**

UNIT- I	**Introduction to Semantic**	**Periods: 9**	
Web Intelligence Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.			**CO1**
UNIT-II	**Semantic Web**	**Periods: 9**	
Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web – Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema, Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e- Learning, Semantic Bioinformatics, Knowledge Base, XML Based Web Services.			**CO2**
UNIT-III	**Introduction to Knowledge Management**	**Periods: 9**	
Introduction: An Introduction to Knowledge Management - The foundations of knowledge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management-Ethics.			**CO3**
UNIT-IV	**Creating The Culture of Learning and Knowledge**	**Periods: 9**	
Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.			**CO4**
UNIT-V	**Knowledge Management - The Tools**	**Periods: 9**	
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval -Information Coding in the Internet Environment - Repackaging Information.			**CO5**

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

Text Books

1 .Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2.Social Networks and the Semantic Web, Peter Mika, Springer, 2007.
3.Srikantaiah,T.K., Koenig, M., "Knowledge Management for the Information Professional" .

Reference Books

1. "Semantic Web Technologies, Trends and Research in Ontology Based Systems",.
2. Liyang Lu Chapman and Hall "Semantic Web and Semantic Web Services", CRC Publishers,
3. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly.
4. Michael C. Daconta,Leo J. Obrst, Kevin T. Smith,"The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management,2003.

Web References

1. https://www.mygreatlearning.com/courses/big-data-analytics-dse
2. https://intellipaat.com/big-data-hadoop-training/
3. https://www.edureka.co/comprehensive-hive

* TE – Theory Exam, LE – Lab Exam

2. A. 3. 276

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1	2	1	1	-	2	1	1	2	2
2	2	1	1	2	2	1	1	2	2
3	2	2	2	2	1	1	1	2	1
4	2	3	1	-	-	1	1	2	1
5	2	2	3	-	3	1	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		15	10	5	60	100

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

2.A.3.27

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**					
Semester	**II**	Course Category: **PE**			*End Semester Exam Type: **TE**		
Course Code	**P23BDE209**	Periods / Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**Artificial Intelligence**	**3**	**-**	**-**	**3**	**40**	**60**	**100**

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding Artificial Intelligence	**K2**
	CO2 Understand search and Constraint problems	**K2**
	CO3 Make use of Knowledge, Reasoning and Planing	**K3**
	CO4 Implement knowledge and reasoning	**K3**
	CO5 Apply Philosophy, Ethics and Safety of AI	**K4**

UNIT- I	**Introduction and Problem Solving**	**Periods: 9**	
Artificial Intelligence -Introduction - Problem-solving -Solving Problems by Searching – Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Local Search - Search in Partially Observable Environments			**CO1**
UNIT- II	**Adversarial Search and Constraint Satisfaction Problems**	**Periods: 9**	
Game Theory- Optimal Decisions in Games - Heuristic Alpha--Beta Tree Search- Monte Carlo Tree Search - Stochastic Games - Partially Observable Games - Limitations of Game Search Algorithms Constraint Satisfaction Problems (CSP)– Examples - Constraint Propagation Backtracking Search for CSPs - Local Search for CSP.			**CO2**
UNIT-III	**Knowledge, Reasoning and Planning**	**Periods: 9**	
First Order Logic – Inference in First Order Logic -Using Predicate Logic - Knowledge Representation - Issues -Ontological Engineering - Categories and Objects – Reasoning Systems for Categories - Planning -Definition - Algorithms -Heuristics for Planning -Hierarchical Planning			**CO3**
UNIT-IV	**Uncertain Knowledge and Reasoning**	**Periods: 9**	
Quantifying Uncertainty - Probabilistic Reasoning - Probabilistic Reasoning over Time 19 Probabilistic Programming –Making Simple Decisions - Making Complex Decisions - Case Based Reasoning – Explanation-Based Learning – Evolutionary Computation			**CO4**
UNIT-V	**Philosophy, Ethics and Safety of AI**	**Periods: 9**	
The Limits of AI – Knowledge in Learning –Statistical Learning Methods – Reinforcement Learning - Introduction to Machine Learning and Deep Learning -Can Machines Really Think? - Distributed AI Artificial Life-The Ethics of AI - Interpretable AI- Future of AI - AI Components -AI Architectures			**CO5**

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

Text Books

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 4th Edition, 2020.
2. Zhongzhi Shi "Advanced Artificial Intelligence", World Scientific; 2019.
3. Kevin Knight, Elaine Rich, Shivashankar B. Nair, "Artificial Intelligence", McGraw Hill Education; 3rd edition, 20174. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.

Reference Books

1.Richard E. Neapolitan, Xia Jiang, "Artificial Intelligence with an Introduction to Machine Learning", Chapman and Hall/CRC; 2nd edition,
2.Dheepak Khemani, "A first course in Artificial Intelligence", McGraw Hill Education Pvt Ltd., New Delhi, 2013.
3.Nils J. Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann Publishers Inc; Second Edition, 2003.
4. Max Tegmark, "Life 3.0: Being Human in the Age of Artificial Intelligence", Deckle Edge, 2017
5. Nick Bostrom," Superintelligence: Paths, Dangers, Strategies", Oxford University Press,2016.

Web References

1. https://www.mygreatlearning.com/courses/big-data-analytics-dse
2. https://intellipaat.com/big-data-hadoop-training/
3. https://www.edureka.co/comprehensive-hive

* TE – Theory Exam, LE – Lab Exam

2.A.3.278

COs/POs/PSOs Mapping

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

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

Evaluation Method

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

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

2. A. 3. 279

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**English for Research Paper Writing**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand that how to improve your writing skills and level of readability.	**K2**
	CO2 Learn about what to write in each section.	**K1**
	CO3 Understand the skills needed when writing a Title.	**K2**
	CO4 Understand the skills needed when writing the Conclusion.	**K2**
	CO5 Ensure the good quality of paper at very first-time submission.	**K3**

UNIT- I	**Introduction to Research Paper Writing**	**Periods: 6**	
Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.			**CO1**
UNIT- II	**Presentation Skills**	**Periods: 6**	
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.			**CO2**
UNIT- III	**Title Writing Skills**	**Periods: 6**	
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.			**CO3**
UNIT- IV	**Result Writing Skills**	**Periods: 6**	
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.			**CO4**
UNIT- V	**Verification Skills**	**Periods: 6**	
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission.			**CO5**

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

Reference Books

1. Adrian Wallwork, "English for Writing Research Papers", Springer, New York, Dordrecht Heidelberg London, 2011.
2. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
3. Goldbort R, "Writing for Science", Yale University Press (Available on Google Books), 2006.
4. Highman N, "Handbook of Writing for the Mathematical Sciences", SIAM. Highman's book, 1998.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

2. A. 3. 280

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Disaster Management**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Ability to summarize basics of disaster.	**K1**
	CO2 Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	**K2**
	CO3 Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	**K3**
	CO4 Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	**K3**
	CO5 Ability to develop the strengths and weaknesses of disaster management approaches.	**K3**

UNIT- I	**Introduction**	**Periods: 6**	
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.			**CO1**
UNIT- II	**Repercussions of Disasters and Hazards**	**Periods: 6**	
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.			**CO2**
UNIT- III	**Disaster Prone Areas in India**	**Periods: 6**	
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.			**CO3**
UNIT- IV	**Disaster Preparedness and Management**	**Periods: 6**	
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.			**CO4**
UNIT- V	**Risk Assessment**	**Periods: 6**	
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival			**CO5**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Goel S. L., "Disaster Administration and Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2007.
3. Sahni, Pardeep Et.Al. , "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

2.A.3.282

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Sanskrit for Tecnical Knowledge**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understanding basic Sanskrit language.	**K2**
	CO2 Write sentences	**K2**
	CO3 Know the order and roots of Sanskrit.	**K3**
	CO4 Know about technical information about Sanskrit literature	**K3**
	CO5 Understand the technical concepts of Engineering.	**K2**

UNIT- I	**Alphabets**	**Periods: 6**	
Alphabets in Sanskrit.			**CO1**
UNIT- II	**Tenses and Sentences**	**Periods: 6**	
Past/Present/Future Tense - Simple Sentences.			**CO2**
UNIT- III	**Order and Roots**	**Periods: 6**	
Order - Introduction of roots of Engineering-Electrical, Mechanical, Architecture, Mathematics.			**CO3**
UNIT- IV	**Sanskrit Literature**	**Periods: 6**	
Technical information about Sanskrit Literature.			**CO4**
UNIT- V	**Technical Concepts of Engineering**	**Periods: 6**	
Technical concepts			**CO5**

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

Reference Books

1. Dr. Vishwas, "Abhyaspustakam", Samskrita-Bharti Publication, New Delhi.
2. Prathama Deeksha, Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, "Teach Yourself Sanskrit", New Delhi Publication.
3. Suresh Soni, "India's Glorious Scientific Tradition", Ocean books (P) Ltd., New Delhi, 2017

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX04**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Value Education**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Knowledge of self-development.	**K2**
	CO2 Learn the importance of Human values.	**K1**
	CO3 Developing the overall personality.	**K3**
	CO4 Developing Character and Competence	**K3**

UNIT- I	**Values and Self Development**	**Periods: 6**	
Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.			**CO1**
UNIT- II	**Cultivation of Values**	**Periods: 6**	
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline			CO2
UNIT- III	**Personality Development**	**Periods: 6**	
Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.			**CO3**
UNIT- IV	**Character Development**	**Periods: 6**	
Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role.			**CO4**
Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Reference Books

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

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Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX05**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Constitution of India**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.	**K3**
	CO2 Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	**K3**
	CO3 Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections.	**K3**
	CO4 Discuss the passage of the Hindu Code Bill of 1956.	**K3**
	CO5 Discuss the administration and Election commission	**K3**

UNIT- I	**History of Making of The Indian Constitution**	**Periods: 6**	
History, Drafting Committee, (Composition & Working).			**CO1**
UNIT- II	**Philosophy of The Indian Constitution**	**Periods: 6**	
Preamble, Salient Features.			**CO2**
UNIT- III	**Contours of Constitutional Rights and Duties**	**Periods: 6**	
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.			**CO3**
UNIT- IV	**Organs of Governance**	**Periods: 6**	
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.			**CO4**
UNIT- V	**Local Administration and Election Commission**	**Periods: 6**	
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy. Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.			**CO5**

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

Reference Books

1. "The Constitution of India, 1950(Bare Act), Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1 st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
5. Suresh Soni, "India's Glorious Scientific Tradition" Ocean books (P) Ltd., New Delhi, 2017.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

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Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX06**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Pedagogy Studies**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?	**K2**
	CO2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?	**K2**
	CO3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?	**K2**
	CO4 Illustrate Professional development	**K3**
	CO5 Identify Research gaps and Future Directions	**K3**

UNIT- I	**Introduction and Methodology**	**Periods: 6**
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.		CO1
UNIT- II	**Thematic Overview**	**Periods: 6**
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.		**CO2**
UNIT- III	**Evidence on The Effectiveness of Pedagogical Practices**	**Periods: 6**
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies		**CO3**
UNIT- IV	**Professional Development**	**Periods: 6**
Professional development: alignment with classroom practices and follows up support – Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes		**CO4**
UNIT- V	**Research Gaps and Future Directions**	**Periods: 6**
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.		**CO5**

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

Reference Books

1. Ackers J, Hardman,F, "Classroom interaction in Kenyan primary schools, Compare", 31(2): 245- 261, 2001.
2. Agrawal M, "Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies", 36(3):361-379, 2004.
3. Akyeampong K, "Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report", London, DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count?", International Journal Educational Development, 33(3): 272–282, 2013.
5. Alexander RJ, "Culture and pedagogy: International comparisons in primary education", Oxford and Boston: Blackwell, 2001.
6. Chavan M, "Read India: Amass scale, rapid, 'learning to read' campaign", 2003.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX07**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Stress Management by Yoga**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop healthy mind in a healthy body thus improving social health also	**K2**
	CO2 Improve efficiency.	**K2**
	CO3 Understand Asan and Pranayam	**K2**
	CO4 Apply Asanas	**K4**
	CO5 Apply Pranayam	**K4**

UNIT- I	**Introduction**	**Periods: 6**	
Definitions of Eight parts of yoga. (Ashtanga).			**CO1**
UNIT- II	**Do`s and Don't's in Life**	**Periods: 6**	
Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.			**CO2**
UNIT- III	**Asan and Pranayam**	**Periods: 6**	
Asan and Pranayam - Various yoga poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam.			**CO3**
UNIT- IV	**Asan Practices**	**Periods: 6**	
Practice on Various yoga poses			**CO4**
UNIT- V	**Pranayam Practices**	**Periods: 6**	
Practice on various pranayam			**CO5**

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

Reference Books

1. Janardan Swami Yoga bhyasi Mandal, "Yogic Asanas for Group Tarining-Part-I", Nagpur.
2. Swami Vivekananda, "Rajayoga or conquering the Internal Nature", Advaita Ashrama Publication Department, Kolkata

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**					**End Semester Examination (ESE) Marks**	**Total Marks**
	Assignment 1	**Assignment 2**	**Test 1**	**Test 2**	**Attendance**		
Marks	20	20	25	25	10	-	100

Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category : **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX08**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Personality Development through Life Enlightenment Skills**	**2**	**-**	**-**	**-**	**100**	**-**	**100**
(Common to all M.Tech Programme)								
Prerequisite	No Prerequisite needed							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.	**K3**
	CO2	The person who has studied Geeta will lead the nation and mankind to peace and prosperity.	**K1**
	CO3	Study of Neet is hatakam will help in developing versatile personality of students.	**K3**

UNIT- I	**Periods: 6**	
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's) 4-Verses 18, 38,39 Chapter18 – Verses37,38,63.		**CO1**
UNIT- II	**Periods: 12**	
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3- Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.model – shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 – Chapter.		**CO2**
UNIT- III	**Periods: 12**	
Statements of basic knowledge – Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter12 -Verses 13, 14, 15, 16,17, 18 - Personality of role.		**CO3**

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

Reference Books

1. Gopinath, Rashtriya Sanskrit Sansthanam P, "Bhartrihari's Three Satakam, Niti-sringar- vairagya", New Delhi,2010.
2. Swami Swarupananda, Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100

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Department	**Computer Science Engineering (Big Data Analytics)**	Programme: **M.Tech.**						
Semester	**I/II**	Course Category: **AC**			*End Semester Exam Type: **TE**			
Course Code	**P23ACTX09**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Unnat Bharath Abhiyan**	**2**	**-**	**-**	**-**	**100**	**-**	**100**

(Common to all M.Tech Programme)

Prerequisite	No Prerequisite needed	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Gain an understanding of rural life, culture and social realities	**K3**
	CO2 Develop a sense of empathy and bonds of mutuality with local community	**K1**
	CO3 Appreciate significant contributions of local communities to Indian society and economy	**K3**
	CO4 Learn to value the local knowledge and wisdom of the community	**K3**
	CO5 Identify opportunities for contributing to community's socio-economic improvements.	**K3**

UNIT- I	**Appreciation of Rural Society**	**Periods: 6**	
Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.			**CO1**
UNIT- II	**Understanding Rural Economy and Livelihood**	**Periods: 6**	
Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.			**CO2**
UNIT- III	**Rural Institutions**	**Periods: 6**	
Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.			**CO3**
UNIT- IV	**Rural Development Programmes**	**Periods: 6**	
History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.			**CO4**
UNIT- V	**Field Based Practical Activities**	**Periods: 6**	
Visit MGNREGS project sites. Swachh Bharat project sites, Conduct Mission Antyodaya surveys, Interactive community exercise with local leaders, Panchayat functionaries, Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps, Participate in Gram Sabha meetings, Visit local Anganwadi Centre, Conduct soil health test, drinking water analysis.			**CO5**

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

Reference Books

1. Singh, Katar, "Rural Development : Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, "Sustainable Development Goals", 2015.
4. M.P.Boraian, "Best Practices in Rural Development", Shanlax Publishers, 2016

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Assignment 1	Assignment 2	Test 1	Test 2	Attendance		
Marks	20	20	25	25	10	-	100