



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to JNTUK, Kakinada)
(Accredited with A++ Grade by NAAC & Accredited by NBA(B.Tech-CSE, ECE & EEE))
BALUSUMUDI, BHIMAVARAM, W.G.Dist., A.P., PIN-534 202
Ph: 08816-221238, Email: dnrcet@gmail.com, Website: <https://dnrcet.org>

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

THIRD BOARD OF STUDIES (BOS) MEETING **(Held on 20-01-2026)**

Vision & Mission of the Institute

Vision of the Institution:

To evolve as a Quality Institution in Teaching, Innovative Research, Entrepreneurship and Consultation in Engineering & Technology, empower rural youth globally competent and self-disciplined technocrats.

Mission of the Institution:

- IM₁:** Inculcate technical knowledge, soft skills through student centric teaching & learning.
- IM₂:** Strengthen industry institute interaction, provide solutions to the ever-changing requirements.
- IM₃:** Implant entrepreneurial attitude and ethical values.
- IM₄:** Create work culture towards learning, Research & Development.
- IM₅:** Develop a unique practice that instills responsibility and accountability among the stakeholders

Vision & Mission of the Department

Vision of the Department:

To become an identified development center for high quality professionals in the area of Computer Science and Engineering serving the societal needs.

Mission of the Department:

DM₁: Train the stakeholders in the area of Computer Science and Engineering.

DM₂: Organize innovative technical training and leadership activities to groom professionals.

DM₃: Provide quality resources towards research and development on Artificial Intelligence.

Program Educational Objectives (PEOs)

Graduates of the Program will be

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
PEO-1	Apply engineering knowledge in the chosen fields with ethics and professional values.
PEO-2	Continue to learn and solve real life problems inculcate with interdisciplinary teams.
PEO-3	Face the challenges in industry and pursue higher studies.

Program Outcomes (POs)

After successful completion of the Program, the graduates will be able to

PROGRAM OUTCOMES (POs)	
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	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.
4	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.
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6	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.
7	Environment sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in

		multidisciplinary settings.
10	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.
11	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.
12	Lifelong 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.

Program Specific Outcomes (PSOs)

After successful completion of the Program, the graduates will be able to

PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO-1	Develop Computer Applications by applying Artificial Intelligence
PSO-2	Demonstrate the skills in the field of Networks, Web – Design, Cloud Computing and Data Analytics.

Mission of the Department – PEOs mapping

PEO Statements	DM1	DM2	DM3
PEO1: Apply engineering knowledge in the chosen fields with ethics and professional values.	3	3	3
PEO2: Continue to learn and solve real life problems inculcate with interdisciplinary teams.	3	3	2
PEO3: Face the challenges in industry and pursue higher studies.	2	3	3

Note:

Blooms Taxonomy Knowledge Level	Knowledge Level Representation
6 : Create	L6
5 : Evaluate	L5
4 : Analyze	L4
3 : Apply	L3
2 : Understand	L2
1 : Remember	L1

Mapping or Correlation Levels	
1:	Slight (Low)
2:	Moderate (Medium)
3:	Substantial (High)

Consistency or Justification of Co-relation parameters of the above matrix

Mapping Justification			
PEOs	Mission Element	Mapping Level	Justification
PEO1 (Core Skills)	DM1 (Engineering Knowledge)	3	PEO1 has high correlation with DM 1 as the Mission1 focuses on the quality teaching learning processes to acquire engineering Professional skills.
PEO1 (Core Skills)	DM2 (Technical Knowledge)	3	PEO1 has high correlation with DM 2 as the Mission 2 focuses on leadership capabilities of the graduates through various activities.
PEO1 (Core Skills)	DM3 (Professional Knowledge)	3	PEO1 has high correlation with DM 3 as the Mission 3 focuses on innovative research follows development on AI.
PEO2 (Ethical and Professional Skills)	DM1 (Engineering Knowledge)	3	PEO2 has high correlation with DM 1 as the Mission1 focuses on the application development in computer science & engineering.
PEO2 (Ethical and Professional Skills)	DM2 (Technical Knowledge)	3	PEO2 has high correlation with DM 2 as the Mission 2 focuses on seminars and workshops on practices /duties conducted for the students to train them about their duties and responsibilities.
PEO2 (Ethical and Professional Skills)	DM3 (Professional Knowledge)	2	PEO2 has moderate correlation with DM 3 as the Mission 3 focuses on the student participation for consultancy activities and real time projects are encouraged.

PEO3 (Problem Solving and Lifelong Learning)	DM1 (Engineering Knowledge)	2	PEO3 has moderate correlation with DM 1 as the Mission1 focuses on the quality education imparted through academically proficient teachers trained in institutes of repute would prepare graduates to evolve into professionally ethically sound engineers to meet the current technical challenges.
PEO3 (Problem Solving and Lifelong Learning)	DM2 (Technical Knowledge)	3	PEO3 has high correlation with DM 2 as the Mission 2 focuses on the Organize of activities to nurture graduates into ethically strong and responsible engineers capable of addressing global challenges in the area of Computer Science & engineering.
PEO3 (Problem Solving and Lifelong Learning)	DM3 (Professional Knowledge)	3	PEO3 has high correlation with DM 3 as the Mission3 focuses on the knowledge, practical skills and research aptitude sharpen at the institution would enable the graduates to have an urge for the lifelong learning.

PEOs mapping with department mission statements and justification of mapping

PEOs	DM1	Justification
PEO1	3	PEO1 has high correlation with DM1 as the Mission1 focuses on the quality teaching learning processes to acquire engineering professional skills.
PEO2	3	PEO1 has high correlation with DM1as the Mission 1 focuses on leadership capabilities of the graduates through various activities.
PEO3	2	PEO1 has moderate correlation with DM1 as the Mission 1 focuses on innovative research follows development on AI.
PEOs	DM2	Justification
PEO1	3	PEO2 has moderate correlation with DM2 as the Mission2 focuses on the application development in Computer Science & Engineering.
PEO2	3	PEO2 has high correlation with DM2 as the Mission2 focuses on seminars and workshops on practices /duties conducted for the students to train them about their duties and responsibilities.
PEO3	2	PEO2 has moderate correlation with DM2 as the Mission2 focuses on the student participation for consultancy activities and real time projects are encouraged.
PEOs	DM3	Justification
PEO1	3	PEO3 has high correlation with DM3 as the Mission3 focuses on the quality education imparted through academically proficient teachers trained in institutes of repute would prepare graduates to evolve into professionally ethically sound engineers to meet the current technical challenges.
PEO2	3	PEO3 has moderate correlation with DM3 as the Mission3 focuses on the Organize of activities to nurture graduates into ethically strong and responsible engineers capable of addressing global challenges in the area of Computer Science & Engineering.
PEO3	2	PEO3 has high correlation with DM3 as the Mission3 focuses on the knowledge, practical skills and research aptitude sharpen at the institution would enable the graduates to have an urge for the lifelong learning.

Graduate Accomplishments

Graduate Accomplishments:

- GA1.** Preparation – Employment/Higher studies
- GA2.** Core competence – Discipline knowledge
- GA3.** Core competence – 'T' shaped Engineer
- GA4.** Professionalism – 3 Ps – Professional value – knowledge – development
- GA5.** Lifelong learning - Environment

PEOs Mapping with Graduate Accomplishments:

	GA1	GA2	GA3	GA4	GA5
PEO1	3	3	2	3	3
PEO2	2	2	3	2	2
PEO3	3	3	2	2	3

Justification for Department PEOs with Graduate Accomplishments

Department PEOs	Graduate Accomplishments	Mapping level	JUSTIFICATION
PEO1	GA1	3	Apply engineering knowledge for improving placements and Higher studies
PEO1	GA2	3	Apply engineering knowledge for improving placements and Higher studies
PEO1	GA3	2	Apply engineering knowledge for improving placements and Higher studies
PEO1	GA4	3	Apply engineering knowledge for improving placements and Higher studies
PEO1	GA5	3	Apply engineering knowledge for improving placements and Higher studies
PEO2	GA1	2	Continue to learn Core & interdisciplinary knowledge
PEO2	GA2	2	Continue to learn Core & interdisciplinary knowledge
PEO2	GA3	3	Continue to learn Core & interdisciplinary knowledge
PEO2	GA4	2	Continue to learn Core & interdisciplinary knowledge
PEO2	GA5	2	Continue to learn Core & interdisciplinary knowledge
PEO3	GA1	3	Improve the Professional values and Face the challenges in industry
PEO3	GA2	3	Improve the Professional values and Face the challenges in industry
PEO3	GA3	2	Improve the Professional values and Face the challenges in industry
PEO3	GA4	2	Improve the Professional values and Face the challenges in industry
PEO3	GA5	3	Improve the Professional values and Face the challenges in industry

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Mr. B NANDANA KUMAR.
M. Tech (CSE), (PhD),
HoD, CSE



CIRCULAR

BHIMAVARAM
W. G. DIST (AP)
PIN: 534202

Ref: DNR CET/CSE/2026-27/BoS/C-3

Date: 09.01.2026

It is to inform all BoS members of the CSE department to attend the BoS meeting to be conducted **on 20th January, 2026** at **10:00 a.m.** The following agenda is being discussed.

Agenda:

1. Welcome Speech by the Chairperson.
2. Introducing the members of the Board of Studies.
3. To discuss and finalize the proposed III B. Tech. I & II Semester Course structure and Syllabus of DR24 Regulations.
4. To discuss and finalize the proposed M. Tech. Course structure and Syllabus of DR25 Regulations.
5. To discuss and finalize Syllabus for M. Tech I Sem (PG) course of AI &ML for Mechanical Engineering in Department of Mechanical Engineering.
6. Ratification of Course Objectives and Course Outcomes for the proposed Curriculum.
7. Finalization of Model Question Papers and List of Paper Setters.
8. Any other item with the permission of the chair.


Member Secretary


Nandan Kumar
Chairperson Board of Studies /
Head of the Department
Department of Computer Science &
Engineering

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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Mr. B Nandana Kumar

M. Tech (CSE), (PhD)

Assistant Professor & HoD, CSE

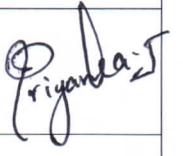
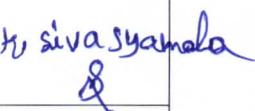
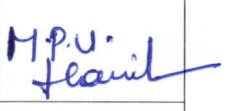
Department of Computer Science & Engineering

E-Mail: csehod@dnrcet.org

Mobile: +91-9550555254, Phone: 08816-221237

List of members of Board of Studies

S. No.	Category	Name	Position	Signature
1	Chairperson	Mr. B. Nandana Kumar	Assistant Professor & HoD Department of CSE DNR CET, Bhimavaram	
2	Expert Nominated by Vice-Chancellor	Dr. N. Ramakrishnaiah	Professor, CSE Department, UCEK, JNTUK Kakinada, Kakinada – 533003.	Attended ON-LINE
3	Subject Experts from outside Parent Universities	Dr. V. Chandrasekhar,	Professor & HoD, Department of CSE, S. R. K. R. Engineering College (A), BHIMAVARAM 534202.	Attended ON-LINE
4		Dr. P. Kiran Sree,	Professor & HoD, Department of CSE, Shri Vishnu Engineering College for Women (A), Bhimavaram, W.G. Dist., A.P.	Attended ON-LINE
5	Member (Industrial Expert)	Rajiv Chand Kakarla	CEO, Amaravathi Software Innovations, Rajahmundry, East Godavari District, A.P.,	Attended ON-LINE
6	Members Secretary	Mr. K. T. V. Subba Rao	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
	Faculty Members	Mrs. V. Navya Devi	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mrs. N. Bharathi	Assistant Professor, Department of CSE,	

		DNR CET, Bhimavaram.	
Mr. L. Dhanaratna Kishore	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. B. Supraja	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mr. G. V. Sriram	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. D Tejaswini	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. P. Lalitha Rajeswari	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. J. Priyanka	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Ms. K. Siva Syamala	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. M. V. S. K. Prabhavathi	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mr. Ch. Venkat Reddy	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. M. P. V. Harika	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. K. R. S. Spandana	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mrs. M. Bhargavi	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mr. B. Suryanarayana Murthy	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		
Mr. K. Rambabu	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.		

		Mr. P. Sirish Kumar	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr.  Ravi Kiran	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. B. Prasanna Kumar	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. K. Radha Krishna	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. K. Tulasiram	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. K Chanti Babu	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mrs. I. Ramadevi	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Ms. D. Phani Sri Lakshmi	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. T. Venkatesh	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
		Mr. Ch. Somesh Kumar	Assistant Professor, Department of CSE, DNR CET, Bhimavaram.	
8	Member (College Alumni)	K. S. Sai Kumar (219P1D5804)	Assistant Professor, Department of CE, VIT, Bhimavaram.	

21c Nandan Kumar

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Department of Computer Science & Engineering

Date: 9.01.2026

To

Dr. N. Ramakrishnaiah,
Professor,
CSE Department,
UCEK, JNTUK Kakinada,
Kakinada – 533003.

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

We take the privilege in inviting you for the Board of Studies Meeting of Department of Computer Science & Engineering, DNR College of Engineering & Technology as an Expert Nominated by Vice-Chancellor, JNTUK, Kakinada. It is proposed to discuss and finalize the course structure and syllabi for the 3rd year of DR24 B. Tech (CSE) course curriculum and the DR25 M. Tech (CSE) course curriculum.

In this regard, you are requested to attend the meeting scheduled to be held on **20.01.2026** at **10.00 AM** in online mode.

Kindly accept our invitation and make it convenient to attend the Board of Studies meeting.

Thanking You Sir

Yours Sincerely,

Nandankurorah

Chairperson Board of Studies /

Head of the Department

Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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Department of Computer Science & Engineering

Date: 9.01.2026

To

Dr. V. Chandrasekhar,
Professor & Dean,
Department of Computer Science & Engineering,
S. R. K. R. Engineering College (A),
BHIMAVARAM 534202.

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

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Yours Sincerely,

Nandankurral

**Chairperson Board of Studies /
Head of the Department**
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.

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Department of Computer Science & Engineering

Date: 09.01.2026

To

Dr. P. Kiran Sree,
Professor & HoD,
Department of Computer Science & Engineering,
Shri Vishnu Engineering College for Women (A),
Bhimavaram, W.G. Dist., A.P.

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

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Yours Sincerely,

Nandakumar

**Chairperson Board of Studies /
Head of the Department**
Head of the Department
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Department of Computer Science & Engineering

Date: 09.01.2026

To

Rajiv Chand Kakarla
CEO, Amaravathi Software Innovations
Rajahmundry,
East Godavari District, A.P.,

Dear Sir,

Sub: DNR College of Engineering & Technology – Department of Computer Science & Engineering – Board of Studies Meeting – Reg.

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Yours Sincerely,

Nandankurorah

**Chairperson Board of Studies /
Head of the Department**
Head of the Department
Department of Computer Science & Engineering
D.N.R. College of Engineering & Technology
BHIMAVARAM-534 202.



hodcse dnrct <hodcse@dnrcet.org>

BoS meeting regarding

1 message

hodcse dnrct <hodcse@dnrcet.org>
To: nrkrishna27@gmail.com

Tue, Jan 19, 2026 at 9:55 AM

Respected sir, we are from Dept. of CSE,DNRCET(9P) conducting 3rd BoS Meeting on behalf of this we are inviting to BoS meeting at 10.0AM on 20-1-2026

DNR CET1 is inviting you to a scheduled Zoom meeting.

Topic: 3rd Board of Studies(BoS) Meeting-CSE DEPT, DNRCET

Time: Jan 20, 2026 10:00 AM India

Join Zoom Meeting

<https://us05web.zoom.us/j/88487589518?pwd=DaFnxzXtq2y5YXUMgvb8Tc7VlwA3ew.1>

Meeting ID: 884 8758 9518

Passcode: 12345

Join instructions

<https://us05web.zoom.us/meetings/88487589518/invitations?signature=pH75yhBvEAwmpITZd7V BXwFzAG37o5RYq-jJKrVLzDA>



hodcse dnrcet <hodcse@dnrcet.org>

BoS meeting regarding

1 message

hodcse dnrcet <hodcse@dnrcet.org>
To: hodcse@svecw.edu.in

Tue, Jan 20, 2026 at 8:48 AM

Respected sir, we are from Dept. of CSE,DNRCET(9P) conducting 3rd BoS Meeting on behalf of this we are inviting to BoS meeting at 10.0AM on 20-1-2026

DNR CET1 is inviting you to a scheduled Zoom meeting.

Topic: 3rd Board of Studies(BoS) Meeting-CSE DEPT, DNRCET

Time: Jan 20, 2026 10:00 AM India

Join Zoom Meeting

<https://us05web.zoom.us/j/88487589518?pwd=DaFnxzXtq2y5YXUMgvb8Tc7VlwA3ew.1>

Meeting ID: 884 8758 9518

Passcode: 12345

Join instructions

<https://us05web.zoom.us/meetings/88487589518/invitations?signature=pH75yhBvEAwmplTzd7V BXwFzAG37o5RYq-jJKrVLzDA>



hodcse dnrcet <hodcse@dnrcet.org>

BoS meeting regarding

1 message

hodcse dnrcet <hodcse@dnrcet.org>
To: dr.vcs@srkrec.ac.in

Tue, Jan 20, 2026 at 8:50 AM

Respected sir, we are from Dept. of CSE,DNRCET(9P) conducting 3rd BoS Meeting on behalf of this we are inviting to BoS meeting at 10.0AM on 20-1-2026

DNR CET1 is inviting you to a scheduled Zoom meeting.

Topic: 3rd Board of Studies(BoS) Meeting-CSE DEPT, DNRCET

Time: Jan 20, 2026 10:00 AM India

Join Zoom Meeting

<https://us05web.zoom.us/j/88487589518?pwd=DaFnxzXtq2y5YXUMgvb8Tc7VlwA3ew.1>

Meeting ID: 884 8758 9518

Passcode: 12345

Join instructions

<https://us05web.zoom.us/meetings/88487589518/invitations?signature=pH75yhBvEAwmpITZd7VBXwFzAG37o5RYq-jJKrVLzDA>

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Ref: [DNRCET/CSE/2025-26/BoS/MoM-3](https://dnrcet/CSE/2025-26/BoS/MoM-3)

Date: 20.01.2026

Board of Studies (BoS) Minutes of Meeting

20th JANUARY, 2026 at 10:00 a.m.

Agenda:

1. Introducing the members of Board of Studies.
2. Discussion on III-year Semester I & II course structure for B. Tech (Computer Science & Engineering) Program for the academic year 2026-27.
3. Discussion on I Year Semester I & II for M. Tech (Computer Science & Engineering) Program for the academic year 2025-26.
4. Discussion on preparation of course syllabus in accordance to JNTUK course structure and syllabus.
5. To discuss and finalize Syllabus for M. Tech I Sem (PG) course of AI & ML for Mechanical Engineering in Department of Mechanical Engineering.
6. Discussion on Academic Regulations of PG Program.
7. Discussion and finalizing the model papers of both UG and PG.
8. Any other agenda with the permission of the chair.

The Board of Studies meeting held on 20th JANUARY, 2026 at 10:00 am through online & offline mode with the welcome speech by Mr. B NANDANA KUMAR, Assistant Professor & Head of department / Chairperson of BoS.

The points mentioned in the agenda were discussed, and the details are listed below:

Agenda No. 1: The Board of Studies (BoS) for Computer Science and Engineering department is constituted by the chairperson as per the guidelines of Academic Council. The Chairperson introduced all nominated Board of Studies members of department of Computer Science & Engineering to each other.

Agenda No. 2, 3, 4, 5, 6: The BoS members discussed on the agenda 2, 3, 4, 5 and made the following resolutions.

Resolution on Agenda 2, 3, 4, 5, 6 :

1. The members of the Board of Studies (BoS) and the chairperson made the decision to there are no changes in the B. Tech (DR24) III-year detailed syllabus, and it has been followed as prescribed by JNTUK, Kakinada, without any modifications and R-25 regulations for M. Tech Program for the academic year 2025-26 that were put into place for first year students. Syllabus for M. Tech I Sem (PG) course of AI & ML for Mechanical Engineering in Department of Mechanical Engineering. This included adhering the

academic regulations, syllabi, model papers, and the evaluation procedure for semester-end examinations (SEE) and continuous internal evaluation (CIE).

Agenda No.7: The BoS members discussed on the agenda 6 and made the following resolutions.

Resolution on Agenda 7:

As it is decided to adhere JNTUK, Kakinada R-23 model paper without any change in agenda 7. The chairperson of the BoS discussed with the members about the composition of the paper setters total 10 members for 3-Year UG Program for the academic year 2026-27 and 1st Year PG Program for the academic year 2025-26 i.e., one (2) from National Institute of Technology (NIT), one (2) from Government Universities, one (2) from Private / Deemed Universities, two (4) from Autonomous Colleges. All the members accepted unanimously and list is finalized and enclosed in Annexure G.

Agenda No.8: Hence there is no other agenda for discussion; hence the chairperson advised to conclude the meeting with the permission of all the BoS members.

The meeting concluded at 10:30 a.m. with a vote of thanks by Mr. B. NANDANA KUMAR, Chairperson of BoS / Professor & Head of the department.

University Nominee

Nandana Kumar

Chairperson Board of Studies /

Head of the Department

Head of the Department

Department of Computer Science & Engineering

D.N.R. College of Engineering & Technology

BHIMAVARAM-534 202.

Copy to:

1. Principal, DNRCET(A),
2. Dean, Academics, DNRCET(A),
3. Controller of Examinations, DNRCET(A),
4. Circulation among the faculty members, CSE Department, DNRCET(A),
5. File.

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE & SYLLABUS B. Tech CSE for COMPUTER SCIENCE & ENGINEERING PROGRAMME *(Applicable for batches admitted from 2026-2027)*



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

B.Tech. CSE (DR24 Regulation I Year COURSE STRUCTURE & SYLLABUS)

B.Tech. – I Year I Semester (for Group-A Branches)

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1		Communicative English	BS&H	2	0	0	2
2		Engineering Chemistry / Chemistry / Fundamental Chemistry	BS&H	3	0	0	3
3		Linear Algebra & Calculus	BS&H	3	0	0	3
4		Basic Civil & Mechanical Engineering	ES	3	0	0	3
5		Introduction to Programming	ES	3	0	0	3
6		Communicative English Lab	BS&H	0	0	2	1
7		Engineering Chemistry / Chemistry / Fundamental Chemistry Lab	BS&H	0	0	2	1
8		Engineering Workshop	ES	0	0	3	1.5
9		Computer Programming Lab	ES	0	0	3	1.5
10		Health and wellness, Yoga and Sports	BS&H	-	-	1	0.5
Total				14	00	11	19.5

B.Tech. – I Year I Semester (for Group-B Branches)

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1		Engineering Physics	BS&H	3	0	0	3
2		Linear Algebra & Calculus	BS&H	3	0	0	3
3		Basic Electrical & Electronics Engineering	ES	3	0	0	3
4		Engineering Graphics	ES	1	0	4	3
5		Introduction to Programming	ES	3	0	0	3
6		IT Workshop	ES	0	0	2	1
7		Engineering Physics Lab	BS&H	0	0	2	1
8		Electrical & Electronics Engineering Workshop	ES	0	0	3	1.5
9		Computer Programming Lab	ES	0	0	3	1.5
10		NSS / NCC / Scouts & Guides / Community Service	BS&H	-	-	1	0.5
Total				13	00	15	20.5

B. Tech. – I Year II Semester (for Group-A Branches)

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24BH1201	Engineering Physics	BS&H	3	0	0	3
2	BT24BH1202	Differential Equations & Vector Calculus	BS&H	3	0	0	3
3	BT24EC1201	Basic Electrical and Electronics Engineering	ES	3	0	0	3
4	BT24ME1201	Engineering Graphics	ES	1	0	4	3
5	BT24CS1201	IT Workshop	ES	0	0	2	1
6	BT24CS1202	Data Structures /	PC	3	0	0	3
	BT24EC1202	Electrical Circuit Analysis – I (Branch specific)					
7	BT24BH1203	Engineering Physics Lab	BS&H	0	0	2	1
8	BT24EC1202	Electrical and Electronics Engineering Workshop	ES	0	0	3	1.5
9	BT24CS1203	Data Structures Lab /	PC	0	0	3	1.5
	BT24EC1204	Electrical Circuit Analysis – I Lab					
10	BT24BH1204	NSS / NCC /Scouts & Guides / Community Service	BS&H	-	-	1	0.5
Total				13	00	15	20.5

B. Tech. – I Year II Semester (for Group-B Branches)

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24BH1201	Communicative English	BS&H	2	0	0	2
2	BT24BH12	Engineering Chemistry / Chemistry / Fundamental Chemistry	BS&H	3	0	0	3
3		Differential Equations & Vector Calculus	ES	3	0	0	3
4		Basic Civil & Mechanical Engineering	ES	3	0	0	3
5		Engineering Mechanics (Branch specific)	PC	3	0	0	3
		Network Analysis (Branch specific)					
		Data structures (Branch specific)					
6		Communicative English Lab	BS&H	0	0	2	1
7		Engineering Chemistry / Chemistry / Fundamental Chemistry Lab	BS&H	0	0	2	1
8		Engineering Workshop	ES	0	0	3	1.5
9		Engineering Mechanics & Building Practices Lab Engineering Mechanics Lab	PC	0	0	3	1.5
		Network Analysis Lab					
		Data structures Lab					
10		Health and wellness, Yoga and Sports		-	-	1	0.5
Total				14	00	11	19.5



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B.Tech. CSE (DR24 Regulation II Year COURSE STRUCTURE & SYLLABUS)

B. Tech.-II Year I Semester

S. No.	Course Code	Title	Category	L/D	T	P	Credits	
1	BT24BS2105	Discrete Mathematics & Graph Theory	BS&H	3	0	0	3	
2	BT24HS2101	Universal human values – understanding harmony and Ethical human conduct	BS&H	2	1	0	3	
3	BT24EC2107	Digital Logic & Computer Organization	ES	3	0	0	3	
4	BT24CS2101	Advanced Data Structures & Algorithm Analysis	PC	3	0	0	3	
5	BT24CS2102	Object Oriented Programming Through Java	PC	3	0	0	3	
6	BT24CS2103	Advanced Data Structures and Algorithm Analysis Lab	PC	0	0	3	1.5	
7	BT24CS2104	Object Oriented Programming Through Java Lab	PC	0	0	3	1.5	
8	BT24CS2105	Python Programming	PC	0	1	2	2	
9	BT24BS2106	Environmental Science	MC	2	0	0	-	
Total					16	2	8	20

B. Tech – II Year II Semester



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B.Tech. CSE (DR24 Regulation III Year COURSE STRUCTURE & SYLLABUS)

B. Tech.-III Year I Semester

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24CS3101	Data Warehousing and Data Mining	PC	3	0	0	3
2	BT24CS3102	Computer Networks	PC	2	1	0	3
3	BT24CS3103	Formal Languages and Automata Theory	PC	3	0	0	3
4	BT24CS31P1A	1. Object Oriented Analysis and Design	PE-1	3	0	0	3
	BT24CS31P1B	2. Artificial Intelligence					
	BT24CS31P1C	3. Microprocessors & Microcontrollers					
	BT24CS31P1D	4. Quantum Computing					
	BT24CS31P1E	5. 12 week MOOCsWwayam/ NPTEL course recommended by the BoS					
5		OR Entrepreneurship Development & Venture Creation	OE-1	3	0	0	3
6	BT24CS3105	Data Mining Lab	PC	0	0	3	1.5
7	BT24CS3106	Computer Networks Lab	PC	0	0	3	1.5
8	BT24CS3107	Full Stack development-2	SEC	0	1	2	2
9	BT24CS3108	User Interface Design using Flutter / SWAYAM Plus - Android Application Development (with Flutter)	ES	2	0	0	-
10	BT24BCS3109	Evaluation of Community Service Internship					
Total				16	2	8	20
MC	Minor Course (Student may select from the same specialized minors pool)			3	0	3	4.5
MC	Minor Course through SWAYAM/NPTEL (minimum 12 week, 3 credit course)			3	0	0	3
HC	Honors Course (Student may select from the same honors pool)			3	0	0	3
HC	Honors Course (Student may select from the same honors pool)			3	0	0	3



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B.Tech. CSE (DR24 Regulation III Year COURSE STRUCTURE & SYLLABUS)

B. Tech – III Year II Semester

S. No.	Course Code	Title	Category	L/D	T	P	Credits
1	BT24CS3201	Compiler Design	PC	3	0	0	3
2	BT24CS3202	Cloud Computing	PC	3	0	0	3
3	BT24CS3203	Cryptography & Network Security	PC	3	0	0	3
4	BT24CS32P2A	1. Software Testing Methodologies	PE-2	3	0	0	3
	BT24CS32P2B	2. Cyber Security					
	BT24CS32P2C	3. DevOps					
	BT24CS32P2D	4. Machine Learning					
	BT24EC32P2E	5. 12 week MOOC Swayam/NPTEL course					
5	BT24CS32P3A	1. Software Project Management	PE-3	3	0	0	3
	BT24CS32P3B	2. Mobile Adhoc Networks					
	BT24CS32P3C	3. Natural Language Processing					
	BT24CS32P3D	4. Big Data Analytics					
	BT24CS32P3E	5. Distributed Operating System					
	BT24CS32P3F	6. 12 week MOOC Swayam/NPTEL course recommended by the BoS					
6		Open Elective – II	PC	3	0	0	3
7	BT24CS3204	Cloud Computing Lab	PC	0	0	3	1.5
8	BT24CS3205	Cryptography & Network Security Lab	SEC	0	0	3	1.5
9		Soft skills // SWAYAM Plus - 21st Century Employability Skills	BS & H	0	1	2	2
10	BT24CS3206	Technical Paper Writing & IPR	BS & H	2	0	0	-
Total				20	1	08	23
11	Mandatory Industry Internship / Mini Project of 08 weeks duration during summer vacation						
MC	Minor Course (Student may select from the same specialized minors pool)			3	0	3	4.5
MC	Minor Course (Student may select from the same specialized minors pool)			3	0	0	3
HC	Honors Course (Student may select from the same honors pool)			3	0	0	3
HC	Honors Course (Student may select from the honors pool)			3	0	0	3

* Under Industry Internship interested students can pursue SWAYAM Plus courses viz., Hands-on Masterclass on Data Analytics OR Artificial Intelligence for Real-World Application



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OPEN ELECTIVES:

S.NO	Category	Titles
1	Open Elective -1	Principles of Operating Systems/ Computer Organization and Architecture
2	Open Elective-2	Principles of Database Management Systems
3	Open Elective-3	Object Oriented Programming Through Java
4	Open Elective-4	Principles of Software Engineering /Computer Networks

Minor Engineering

Note:

1. To obtain Minor Engineering, student needs to obtain 18 credits by successfully *completing any of the following courses in the concern stream.*
2. During Minor/Honors Course selection, there should not be any overlapping with *Regular/Major/OPEN Electives*

Minor in CSE

1. Principles of Database Management Systems 3-0-3-4.5 (II-II)
2. Principles of Software Engineering 3-0-0-3 (III-I)
3. Advanced Data Structures & Algorithm Analysis 3-0-3-4.5 (III-II)
4. Principles of Operating Systems 3-0-0-3 (IV-I)

Any of the following 12 Week 3 credit NPTEL MOOC Courses

1. Artificial Intelligence: Knowledge Representation and Reasoning
2. Computer Networks and Internet Protocol
3. Machine Learning and Deep Learning - Fundamentals and Applications
4. Fundamentals of Object Oriented Programming
5. Discrete Mathematics for CS
6. Software Engineering

COURSES OFFERED FOR HONORS DEGREE IN CSE

Note: To obtain Honor's degree, student needs to obtain 18 credits by successfully completing any of the following courses in the concern stream.

1. Social Network Analysis	12 Week 3 Credit Course, MOOCS
2. Applied Linear Algebra in AI & ML	12 Week 3 Credit Course, MOOCS
3. Design & Implementation of Human-Computer Interfaces – NPTEL MOOCS	
4. Cryptography and Network Security	12 Week 3 Credit Course, MOOCS
5. Privacy and Security in Online Social Media	12 Week 3 Credit Course, MOOCS
6. Deep Learning for Natural Language Processing -	12 Week 3 Credit Course, MOOCS
7. Computer Vision -	12 Week 3 Credit Course, MOOCS
8. Applied Time-Series Analysis	12 Week 3 Credit Course, MOOCS
9. Parallel Computer Architecture	12 Week 3 Credit Course, MOOCS
10. Reinforcement Learning	12 Week 3 Credit Course, MOOCS
11. GPU Architecture and Programming	12 Week 3 Credit Course, MOOCS
12. Computational Complexity	12 Week 3 Credit Course, MOOCS
13. Quantum Algorithms and Cryptography	12 Week 3 Credit Course, MOOCS
14. Unmanned Arial Systems & Robotics	12 Week 3 Credit Course, MOOCS
15. Prompt Engineering for Generative AI (III - II)	



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1. Computer Networks	3-0-0-3
2. Artificial Intelligence	3-0-0-3
3. Cyber Security	3-0-0-3
4. Introduction to Data Science	3-0-3-4.5
5. Data Warehousing and Data Mining	3-0-0-3
6. Object Oriented Programming Through Java	3-0-3-4.5
7. Cloud computing	3-0-0-3
8. Graph Theory	3-0-0-3
9. Data Analytics with Python	
10. Foundations of Cryptography	

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UG – Computer Science & Engineering

-Programme

III Year I Semester & Semester

Detailed Syllabus



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year – I Semester	Course Code: BT24CS3101	L	T	P	C
		3	0	0	3
DATAWARE HOUSING & DATA MINING					

Course Objectives:

- Introduce basic concepts and techniques of data warehousing and data mining
- Examine the types of the data to be mined and apply pre-processing methods on raw data
- Discover interesting patterns, analyze supervised and unsupervised models and estimate the accuracy of the algorithms.

CO1:	Explain the structure and phases of a compiler and design lexical analyzers using regular expressions, finite automata, and lexical analyzer generators.
CO2	Construct and analyze context-free grammars and perform syntax analysis by eliminating ambiguity, left recursion, and applying left factoring.
CO3:	Design and implement top-down and bottom-up parsing techniques , including LL(1), SLR, CLR, and LALR parsers with appropriate error recovery methods.
CO4:	Apply syntax-directed definitions and translation schemes to generate intermediate code , including type checking, control flow, and procedure handling.
CO5:	Analyze and apply code optimization techniques using basic blocks, flow graphs, loop optimization, data-flow analysis, and peephole optimization.
CO6:	Implement runtime storage management and code generation techniques , including register allocation and procedure calls.

•
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CO \ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	2	–	–	–	–	1	–	2	3	2
CO2	3	2	2	–	3	–	–	–	–	1	–	2	3	2
CO3	3	2	2	1	3	–	–	–	–	1	–	2	3	3
CO4	3	3	3	2	3	–	–	–	1	1	–	2	2	2
CO5	3	3	2	2	2	1	1	1	–	1	–	2	2	3
CO6	3	2	3	1	3	1	–	–	1	1	–	3	2	3

UNIT-I: Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse, Data Mining and Pattern Mining, Technologies, Applications, Major issues, Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. (Text Book- 1)

UNIT II: Data Preprocessing An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)

UNIT-III: Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)

UNIT-IV: Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm. (Text Book- 2)

UNIT-V: Cluster Analysis: Overview, Basics and Importance of Cluster Analysis, Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Text Book- 2)

TEXTBOOKS:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson, 2012.

Reference Books:

1. Data Mining: Vikram Pudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities Press, 2013.
3. (NPTEL course by Prof. Pabitra Mitra)
http://onlinecourses.nptel.ac.in/noc17_mg24/preview
4. http://www.saedsayad.com/data_mining_map.htm



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

IIIYear-ISemester	Course Code: BT24CS3102	L 2	T 1	P 0	C 3
COMPUTER NETWORKS					

Course Objectives:

- To provide insight about networks, topologies, and the key concepts.
- To gain comprehensive knowledge about the layered communication architectures (OSI and TCP/IP) and its functionalities.
- To understand the principles, key protocols, design issues, and significance of each layers in ISO and TCP/IP.
- To know the basic concepts of network services and various networks applications.

Course Outcomes:

At the end of the course students will be able to

CO1:	Explain the fundamentals of computer networks, including network types (LAN, MAN, WAN), topologies, reference models (OSI and TCP/IP), and physical layer transmission media.
CO2	Analyze data link layer design issues and protocols, including framing techniques, flow and error control mechanisms, sliding window protocols, HDLC, and Point-to-Point Protocol (PPP).
CO3:	Describe medium access control techniques and wired LAN technologies by evaluating random access, controlled access, channelization methods, and Ethernet standards.
CO4:	Apply network layer concepts to analyze packet switching, routing algorithms, congestion control mechanisms, traffic shaping algorithms, and internetworking principles.
CO5:	Interpret Internet Protocol operations by explaining IPv4 and IPv6 addressing schemes, header formats, subnetting, CIDR, fragmentation, tunneling, and transition mechanisms.
CO6:	Demonstrate understanding of transport and application layer protocols by explaining UDP and TCP operations, congestion control in TCP, and application services such as HTTP, email, DNS, and remote login.

UNIT I: Introduction: Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP.

Physical Layer – Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and introduction about unguided media.

UNIT II: Data link layer: Design issues, **Framing:** fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols:** simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.

Sliding window protocol: One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC, Point to point protocol (PPP)

UNIT – III: Media Access Control: **Random Access:** ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).

Wired LANs: Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet.

UNIT – IV: The Network Layer Design Issues – Store and Forward Packet Switching- Services Provided to the Transport layer- Implementation of Connectionless Service- Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks,

Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices, Approaches to Congestion Control-Traffic Aware Routing- Admission Control-Traffic Throttling-Load Shedding. Traffic Control Algorithm-Leaky bucket & Token bucket.

Internet Working: How networks differ- How networks can be connected- Tunneling, internetwork routing-, Fragmentation, network layer in the internet – IP protocols-IP Version 4 protocol-IPV4 Header Format, IP addresses, Class full Addressing, CIDR, Subnets-IP Version 6-The main IPV6 header, Transition from IPV4 to IPV6, Comparison of IPV4 & IPV6.

UNIT –V: The Transport Layer: Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications- Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.

Application Layer – World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System.

Text Books:

1. *Computer Networks*, Andrew S. Tanenbaum, Fifth Edition, Pearson Education / PHI.
2. *Data Communications and Networks*, Behrouz A. Forouzan, Fifth Edition, TMH.

Reference Books:

1. *Data Communications and Networks* – Achut S. Godbole, Atul Kahate.
2. *Computer Networks*, Mayank Dave, CENGAGE.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS3103	L	T	P	C
		3	0	0	3
FORMAL LANGUAGES AND AUTOMATA THEORY					

Course Objectives:

The main objectives of the course are to:

- To learn the fundamentals of **Regular and Context-Free Grammars and Languages**.
- To understand the relationship between **Regular Languages** and **Finite Automata and Machines**.
- To learn how to design **automata and machines** as **Acceptors, Verifiers, and Translators**.
- To understand the relationship between **Context-Free Languages**, **Pushdown Automata (PDA)**, and **Turing Machines (TM)**.
- To learn how to design **PDA** as acceptors and **TM** as calculators.

Course Outcomes:

At the end of the course students will be able to

CO1:	Explain the fundamental concepts of automata theory and design finite automata (DFA, NFA, ϵ -NFA), including minimization techniques and Mealy and Moore machines.
CO2	Analyze regular expressions and regular grammars, and demonstrate equivalence and inter-conversion among regular expressions, finite automata, and regular grammars using formal techniques.
CO3:	Apply context-free grammar concepts to generate and analyze formal languages, including derivations, parse trees, ambiguity removal, grammar simplification, and normal forms.
CO4:	Design and analyze pushdown automata and establish equivalence between pushdown automata and context-free grammars for language recognition.
CO5:	Explain the structure and functioning of Turing machines and design Turing machines to solve computational problems, including variants such as universal and restricted Turing machines.
CO6:	Analyze computability and complexity concepts by classifying problems as decidable or un decidable and distinguishing between complexity classes such as P, NP, NP-Hard, and NP-Complete.

CO \ PO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O1 0	P O1 1	P O1 2	PSO 1	PSO 2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	2
CO4	3	2	2	1	-	-	-	-	-	-	-	-	2	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	2	3
CO6	3	3	2	2								3	2	2

UNITI

Finite Automata: Need of Automata theory, Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with ϵ -Transitions, Minimization of Finite Automata, Finite Automata with output-Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNITII

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two RE, Manipulations of REs, Finite Automata and Regular Expressions, Inter Conversion, Equivalence between FA and RE, Pumping Lemma of Regular Sets, Closure Properties of Regular Sets, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Right and Left Linear Regular Grammars, Equivalence between RG and FA, Inter Conversion.

UNITIII

Formal Languages, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, ϵ -Productions and Unit Productions, Normal Forms-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNITIV

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description, Language Acceptance of Pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars, Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNITV

Turing Machine: Definition, Model, Representation of TMs-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a TM, Design of TMs, Types of TMs, Church's Thesis, Universal and Restricted TM, Decidable and Un-decidable Problems, Halting Problem of TMs, Post's Correspondence Problem, Modified PCP, Classes of P and NP, NP-Hard and NP-Complete Problems.

Text Books:

1. Introduction to Automata Theory, Languages and Computation, J.E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008
2. Theory of Computer Science-Automata, Languages and Computation, K. L. P. Mishra and N. Chandrasekharan, 3rd Edition, PHI, 2007

Reference Books:

1. Elements of Theory of Computation, Lewis H.P. & Papadimitriou C.H. Pearson/PHI
2. Theory of Computation, V.Kulkarni, Oxford University Press, 2013
3. Theory of Automata, Languages and Computation, Rajendrakumar, McGrawHill, 2014

e-Resources:

- 1) <https://nptel.ac.in/courses/106/104/106104028/>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS31P1A	L	T	P	C
		3	0	0	3
OBJECT ORIENTED ANALYSIS AND DESIGN					

Course Objectives:

The main objective is for the students to:

- Become familiar with all phases of **Object-Oriented Analysis and Design (OOAD)**.
- Master the main features of the **Unified Modeling Language (UML)**.
- Master the main concepts of **Object Technologies** and learn how to apply them in practice, developing the ability to analyze and solve challenging problems in various domains.
- Learn **Object Design Principles** and understand how to apply them toward implementation.

Course Outcomes: At the end of the course, students will be able to:

CO1:	Explain the nature of complex systems and software complexity, and apply system architecture concepts to analyze real-world case studies.
CO2	Describe UML fundamentals, object-oriented modeling principles, and software development life cycle concepts for effective system modeling.
CO3:	Develop class and object diagrams using basic and advanced structural modeling concepts such as relationships, interfaces, packages, and roles.
CO4:	Apply basic behavioral modeling techniques by creating use case, interaction, and activity diagrams for software systems.
CO5:	Analyze advanced behavioral modeling concepts including state machines, events, processes, and threads using state chart diagrams.
CO6:	Design architectural models using component and deployment diagrams to represent system structure and deployment for real-world applications.

CO \ PO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O1 0	P O1 1	P O1 2	PSO 1	PSO 2
CO1	3	2	2	1									3	2
CO2	3	2	2										3	2
CO3	3	3	3	1									2	3
CO4	3	3	3	1									2	3
CO5	3	3	2	2									2	3
CO6	3	2	3	2								2	2	3

UNIT I:

Introduction: The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation

UNIT II:

Introduction to UML: Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management.

UNIT III:

Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis.

UNIT IV:

Basic Behavioral Modeling-I: Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System

UNIT V:

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams. **Case Study:** Weather Forecasting

Text Books:

1. Grady BOOCHE, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , “Object- Oriented Analysis and Design with Applications”, 3rd edition, 2013, PEARSON.
2. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.

Reference Books:

1. MeilirPage-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech IndiaPvt. Ltd.
3. AtulKahate: Object Oriented Analysis & Design, TheMcGraw-Hill Companies.
4. Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS31P1B	L	T	P	C
		3	0	0	3
ARTIFICIAL INTELLIGENCE					

Pre-requisite:

- Knowledge in **Computer Programming**.
- A course on **Mathematical Foundations of Computer Science**.
- Background in **Linear Algebra, Data Structures and Algorithms, and Probability**.

Course Objectives:

- The students should be made to study the concepts of **Artificial Intelligence**.
- The students should be made to learn the methods of solving problems using **Artificial Intelligence**.
- The students should be made to understand the concepts of **Expert Systems**.
- To understand the applications of **Artificial Intelligence**, namely **game playing, theorem proving, and machine learning**.
- To learn different **knowledge representation techniques**.

Course Outcomes:

At the end of the course, students will be able to:

CO1:	Explain the foundations, history, and problem-solving aspects of Artificial Intelligence, including intelligent agents, environments, rationality, and problem formulation.
CO2	Apply uninformed and heuristic search techniques, game-playing strategies, and adversarial search algorithms to solve AI problems.
CO3:	Analyze knowledge representation techniques and reasoning methods using predicate logic, semantic networks, frames, rules, and probabilistic models.
CO4:	Apply logical inference techniques and learning methods such as inductive learning, decision trees, statistical learning, and reinforcement learning.
CO5:	Explain reasoning under uncertainty using probability theory, Bayesian inference, and Dempster-Shafer theory.
CO6:	Describe the architecture, components, and applications of expert systems and evaluate the role of expert systems in real-world problem domains.

CO \ PO	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	P O10	P O11	P O12	PSO 1	PSO 2
CO1	3	2	1										3	1
CO2	3	3	2	1									3	3
CO3	3	3	2	2									2	3
CO4	3	3	2	2									2	3
CO5	3	3	1	2									2	3
CO6	3	2	2	1								2	2	2

UNIT-I

Introduction: AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT-II

Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing-Adversarial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.

UNIT-III

Representation of Knowledge: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Bayes' probabilistic inferences and dempstershafer theory.

UNIT-IV

Logic concepts: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, Learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT-V

Expert Systems: Architecture of expert systems, Roles of expert systems – Knowledge Acquisition Meta knowledge Heuristics. Typical expert systems – MYCIN, DART, XCON: Expert systems shells.

Textbooks:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education.
1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill

Reference Books:

1. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence: a logical approach", Oxford University Press.
2. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problemsolving", Fourth Edition, Pearson Education.
3. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers.
4. Artificial Intelligence, SarojKaushik, CENGAGE Learning.

Online Learning Resources:

1. <https://ai.google/>
2. https://swayam.gov.in/nd1_noc19_me71/preview



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS31P1C	L	T	P	C
		0	0	3	1.5
MICRO PROCESSORS & MICRO CONTROLLERS					

Course Objectives:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers.
- To impart knowledge on addressing modes and instruction set of 8086 and 8051.
- To introduce assembly language programming concepts.
- To explain memory and I/O interfacing with 8086 and 8051. To introduce 16 bit and 32 bit microcontrollers.

Course Outcomes:

At the end of the course students will be able to

CO1:	Explain the structure and phases of a compiler and design lexical analyzers using regular expressions, finite automata, and lexical analyzer generators.
CO2	Develop assembly language programs for the 8086 microprocessor using various instruction sets, addressing modes, and assembler directives.
CO3:	Design and analyze interfacing of the 8086 microprocessor with memory and peripheral devices such as PPI, USART, DMA controller, displays, motors, and converters.
CO4:	Explain the architecture and instruction set of the 8051 microcontroller and develop assembly language programs for embedded control applications.
CO5:	Apply interfacing and programming techniques of the 8051 microcontroller for timers, serial communication, interrupts, LCD, keyboard, sensors, ADC/DAC, and external memory.
CO6:	Compare microprocessors and microcontrollers with modern processors such as PIC and ARM, and analyze their applications in real-time embedded systems.

CO \ PO	P O1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1										3	1
CO2	3	3	2	1	2								2	3
CO3	3	3	3	2	2								2	3
CO4	3	2	2	1	2								3	1
CO5	3	3	3	2	2								2	3
CO6	3	2	2	1								2	2	3

UNITI:

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNITII:

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNITIII:

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNITIV:

Microcontroller, Architecture of 8051, Special Function Registers(SFRs), I/O Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming.

UNITV:

Interfacing Microcontroller, Programming 8051 Timers, Serial Port Programming, Interrupts Programming, LCD & Keyboard Interfacing, ADC, DAC & Sensor Interfacing, External Memory Interface, Stepper Motor and Waveform generation, Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall,SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. RajKamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

Reference Books:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS31P1D	L	T	P	C
		0	0	3	1.5
QUANTUM COMPUTING					

Course Objectives:

To introduce the fundamentals of Quantum Computing and the problem-solving approach using finite-dimensional mathematics.

CO1:	Explain the historical evolution of quantum computing and differentiate between classical and quantum computation concepts such as bits, qubits, and logical operations.
CO2	Apply background mathematical, physical, and biological concepts including linear algebra, quantum mechanics principles, probability, and basic genomics relevant to quantum computing.
CO3:	Describe qubits as quantum information units and design quantum circuits using single-qubit and multi-qubit gates, Bloch sphere representation, and Bell states.
CO4:	Analyze and apply quantum algorithms such as Deutsch, Deutsch–Jozsa, Shor's, and Grover's algorithms and relate quantum and classical complexity classes.
CO5:	Explain the effects of noise in quantum systems and apply quantum error correction and fault-tolerant computation techniques.
CO6:	Analyze quantum information and cryptography concepts including quantum teleportation and compare classical and quantum information theories.

CO \ PO	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	P O1 0	P O1 1	P O1 2	PSO 1	PSO 2
CO1	3	1											3	1
CO2	3	2		1									3	2
CO3	3	3	2	1									2	3
CO4	3	3	2	2									2	3
CO5	3	3	2	2									2	2
CO6	3	2	1	1				1					3	2

UNIT-I

History of Quantum Computing: Importance of Mathematics, Physics and Biology.

Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT-II

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements.

Background Physics: Paul's exclusion Principle, Superposition, Entanglement and supersymmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT-III

Qubit: Physical implementations of qubits. Qubit as a quantum unit of information. The Bloch sphere.

Quantum Circuits: Single-qubit gates, multiple-qubit gates, designing quantum circuits. **Bell states**

UNIT-IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

UNIT-V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

Text Books:

1. Quantum Computation and Quantum Information, Nielsen M. A., Cambridge
2. Programming Quantum Computers, Essential Algorithms and Code Samples, Eric R Johnson, Nic Harrigan, Mercedes Ginemo, Segovia, Oreilly

Reference Books:

1. Quantum Computing for Computer Scientists, Noson S. Yanofsk, Mirco A. Mannucci
2. Principles of Quantum Computation and Information, Benenti G., Casati G. and Strini G., Vol.I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS3105	L	T	P	C
		0	1	2	2
DATA MINING LAB					

Pre-requisites: Data Base Management Systems, Python Programming

Course Objectives: The main objectives of the course are to:

- Inculcate **conceptual, logical, and physical design** of data warehouses, **OLAP applications**, and OLAP deployment.
- Design a **data warehouse or data mart** to present information needed by management in a usable form.
- Emphasize **hands-on experience** working with real datasets.
- Test real datasets using popular **data mining tools** such as **WEKA** and Python libraries.
- Develop the ability to design various **algorithms based on data mining tools**.

Software Requirements: WEKA Tool/Python/R-Tool/RapidTool/OracleData mining

List of Experiments:

1. Creation of a Data Warehouse

- Build **Data Warehouse/Data Mart** using open-source tools like **Pentaho Data Integration Tool**, **Pentaho Business Analytics**, or other tools like **Microsoft SSIS**, **Informatica**, **Business Objects**, etc.
- Design **multi-dimensional data models**, namely **Star, Snowflake, and Fact Constellation schemas**, for any one enterprise (e.g., Banking, Insurance, Finance, Healthcare, Manufacturing, Automobiles, Sales, etc.).
- Write **ETL scripts** and implement them using data warehouse tools.
- Perform various **OLAP operations** such as **slice, dice, rollup, drill-down, and pivot**.

2. Explore Machine Learning Tool “WEKA”

- Explore **WEKA Data Mining/Machine Learning Toolkit**.
- Download and/or install the **WEKA toolkit**.
- Understand the features of WEKA, such as **Explorer, Knowledge Flow interface, Experimenter, and command-line interface**.
- Navigate the options available in WEKA (e.g., **Select Attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel, Visualize panel**).
- Study the **ARFF file format**. Explore available datasets in WEKA and load a dataset (e.g., **Weather dataset, Iris dataset, etc.**).
- Load each dataset and observe the following:
 1. List the attribute names and their types.
 2. Number of records in each dataset.
 3. Identify the **class attribute** (if any).
 4. Plot histogram.
 5. Determine the number of records for each class.

6. Visualize the data in various dimensions.

3. Perform Data Preprocessing Tasks and Demonstrate Association Rule Mining

- Explore preprocessing options in WEKA and apply **unsupervised filters** like **Discretization, Resample, etc.** on each dataset.
- Load **weather, nominal, Iris, Glass datasets** into WEKA and run the **Apriori Algorithm** with different support and confidence values.
- Study the rules generated. Apply different **discretization filters** on numerical attributes and run Apriori association rule algorithm again. Study the rules generated.
- Derive **insights** and observe the effect of discretization on rule generation.

4. Demonstrate Classification on Datasets (WEKA/R)

- Load each dataset and run **ID3, J48 classification algorithms**. Study classifier output and compute **entropy values, Kappa statistic**.
- Extract **if-then rules** from the decision tree generated by the classifier. Observe the **confusion matrix**.
- Load each dataset into WEKA/R and perform **Naïve Bayes and k-Nearest Neighbor classification**. Interpret results.
- Plot **ROC curves**.
- Compare classification results of **ID3, J48, Naïve Bayes, and k-NN classifiers** for each dataset, and deduce which classifier performs best and worst, with justification.

5. Demonstrate Clustering of Datasets

- Load each dataset into WEKA/R and run **k-means clustering algorithm** with different values of **k**.
- Study clusters formed. Observe the **sum of squared errors** and **centroids**, and derive insights.
- Explore other clustering techniques available in WEKA/R.
- Explore visualization features to visualize clusters and derive insights.

6. Demonstrate Knowledge Flow Application on Datasets (WEKA/R)

- Develop a **Knowledge Flow layout** for finding strong association rules using **Apriori and FP-Growth algorithms**.
- Set up the knowledge flow to load an **ARFF file (batch mode)** and perform **cross-validation** using **J48 algorithm**.

7. Demonstrate plotting multiple ROC curves

- Plot multiple ROC curves in the same window using **J48** and **Random Forest tree**.

8. Demonstrate ZeroR technique on Iris dataset

- Apply necessary **preprocessing techniques** and share observations.

9. Write a Java program to prepare a simulated dataset with unique instances.

10. Write a Python program to generate frequent itemsets / association rules using Apriori algorithm.

11. Write a program to calculate chi-square value using Python/R and report observations.

12. Write a program of Naïve Bayesian classification using Python/R.

13. Implement a Java/R program to perform Apriori algorithm.

- 14. Write an R program to cluster your choice of data using simple k-means algorithm using JDK.**
- 15. Write a program of cluster analysis using simple k-means algorithm in Python/R.**
- 16. Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python.**
- 17. Visualize datasets using Matplotlib in Python/R (Histogram, Box plot, Bar chart, Pie chart, etc.).**



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS3106	L	T	P	C
		2	0	0	-
COMPUTER NETWORKS LAB					

Course Objectives:

To learn the basic concepts of **computer networking** and acquire practical knowledge of **network protocols**, with emphasis on **TCP/IP**.

The laboratory provides a practical approach to **Ethernet/Internet networking**, where networks are assembled and experiments are conducted to understand the **layered architecture** and the working of important protocols.

List of Experiments:

1. Study of **network devices** in detail and connect computers in a **Local Area Network (LAN)**.
2. Write a program to implement **data link layer framing methods** such as:
 - i) Character stuffing
 - ii) Bit stuffing
3. Write a program to implement **data link layer framing method – checksum**.
4. Write a program for **Hamming code generation** for error detection and correction.
5. Write a program to implement, on a dataset of characters, the three **CRC polynomials: CRC-12, CRC-16, and CRC-CCIP**.
6. Write a program to implement **Sliding Window Protocol** for **Go-Back-N**.
7. Write a program to implement **Sliding Window Protocol** for **Selective Repeat**.
8. Write a program to implement **Stop-and-Wait Protocol**.
9. Write a program for **congestion control** using the **Leaky Bucket algorithm**.
10. Write a program to implement **Dijkstra's algorithm** to compute the **shortest path** through a graph.
11. Write a program to implement **Distance Vector Routing Algorithm** by obtaining the routing table at each node (take an example subnet graph with weights indicating delay between nodes).
12. Write a program to implement a **Broadcast Tree** by taking a subnet of hosts.
13. **Wireshark**
 - i) Packet capture using Wireshark
 - ii) Starting Wireshark
 - iii) Viewing captured traffic
 - iv) Analysis, statistics, and filters
14. How to run an **Nmap scan**.
15. **Operating System Detection** using Nmap.
16. Do the following using **NS2 Simulator**:
 - i) NS2 Simulator – Introduction
 - ii) Simulation to find the number of packets dropped
 - iii) Simulation to find the number of packets dropped by **TCP/UDP**
 - iv) Simulation to find the number of packets dropped due to **congestion**
 - v) Simulation to compare **Data Rate and Throughput**



III Year-I Semester	Course Code: BT24CS3107	L	T	P	C
		0	1	2	2
FULLSTACKDEVELOPMENT -2					

Course Objectives:

The main objectives of the course are to:

- Make use of **router, template engine, and authentication using sessions** to develop applications in **Express JS**.
- Build a **single-page application (SPA)** using **RESTful APIs** in Express JS.
- Apply **router and hooks** in designing **React JS applications**.
- Make use of **MongoDB queries** to perform **CRUD operations** on document databases.

Experiments Covering the Topics:

- **Express JS:** Routing, HTTP Methods, Middleware, Templating, Form Data
- **Express JS:** Cookies, Sessions, Authentication, Database, RESTful APIs
- **React JS:** Render HTML, JSX, Components (Function & Class), Props and States, Styles, Respond to Events
- **React JS:** Conditional Rendering, Rendering Lists, React Forms, React Router, Updating the Screen
- **React JS:** Hooks, Sharing Data Between Components, Applications (To-do list and Quiz)
- **MongoDB:** Installation, Configuration, CRUD operations, Databases, Collections, and Records

Sample Experiments:

1. Express JS – Routing, HTTP Methods, Middleware

- a. Write a program to define a route, handling **routes, route parameters, query parameters**, and URL building.
- b. Write a program to **accept data, retrieve data, and delete a specified resource** using HTTP methods.
- c. Write a program to demonstrate the working of **middleware**.

2. Express JS – Templating, Form Data

- a. Write a program using a **templating engine**.
- b. Write a program to work with **form data**.

3. Express JS – Cookies, Sessions, Authentication

- a. Write a program for **session management** using cookies and sessions.
- b. Write a program for **user authentication**.

4. Express JS – Database, RESTful APIs

- a. Write a program to **connect MongoDB database** using **Mongoose** and perform CRUD operations.
- b. Write a program to develop a **single-page application** using **RESTful APIs**.

5. React JS – Render HTML, JSX, Components (Function & Class)

- a. Write a program to **render HTML** on a web page.
- b. Write a program for writing markup with **JSX**.
- c. Write a program for **creating and nesting components** (function and class).

6. React JS – Props and States, Styles, Respond to Events

- a. Write a program to work with **props and states**.
- b. Write a program to **add styles** (CSS & Sass) and display data.
- c. Write a program to **respond to events**.

7. React JS – Conditional Rendering, Rendering Lists, React Forms

- a. Write a program for **conditional rendering**.
- b. Write a program for **rendering lists**.
- c. Write a program for working with **different form fields using React Forms**.

8. React JS – React Router, Updating the Screen

- a. Write a program for **routing to different pages using React Router**.
- b. Write a program for **updating the screen** dynamically.

9. React JS – Hooks, Sharing Data Between Components

- a. Write a program to understand the importance of using **hooks**.
- b. Write a program for **sharing data between components**.

10. MongoDB – Installation, Configuration, CRUD Operations

- a. Install **MongoDB** and configure **Atlas**.
- b. Write **MongoDB queries** to perform CRUD operations on documents using `insert()`, `find()`, `update()`, `remove()`.

11. MongoDB – Databases, Collections, and Records

- a. Write MongoDB queries to **create and drop databases and collections**.
- b. Write MongoDB queries to work with **records** using `find()`, `limit()`, `sort()`, `createIndex()`, `aggregate()`.

12. Augmented Programs (Any 2 must be completed)

- a. Design a **To-do List application** using Node JS and Express JS.
- b. Design a **Quiz app** using React JS.
- c. Complete the **MongoDB certification** from the MongoDB University website.

Text Books:

1. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O'Reilly.
2. Node.js in Action, Mike Cantelon, Mark Harter, T.J. Holowaychuk, Nathan Rajlich, Manning Publications. (Chapters 1-11)
3. React Quickly, AzatMardan, Manning Publications (Chapters 1-8, 12-14)

Web Links:

1. ExpressJS - <https://www.tutorialspoint.com/expressjs>
2. ReactJS - <https://www.w3schools.com/REACT> (and) <https://react.dev/learn#>
3. MongoDB - <https://learn.mongodb.com/learning-paths/introduction-to-mongodb>



III Year-I Semester	Course Code: BT24CS3108	L	T	P	C
		0	1	2	2
USER INTERFACE DESIGN USING FLUTTER					

Course Objectives:

- Learn to implement **Flutter widgets and layouts**.
- Understand **responsive UI design** and **navigation** in Flutter.
- Gain knowledge of **widgets** and how to **customize widgets** for specific UI elements and themes.
- Understand how to include **animations**, apart from fetching and displaying data.

List of Experiments:

Students need to implement the following experiments:

1. Getting Started with Flutter and Dart

- Install **Flutter** and **Dart SDK**.
- Write a simple **Dart program** to understand the language basics.

2. Exploring Flutter Widgets and Layouts

- Explore various Flutter widgets (**Text, Image, Container, etc.**).
- Implement different layout structures using **Row, Column, and Stack widgets**.

3. Responsive UI Design

- Design a **responsive UI** that adapts to different screen sizes.
- Implement **media queries and breakpoints** for responsiveness.

4. Navigation in Flutter

- Set up **navigation between different screens** using **Navigator**.
- Implement **navigation with named routes**.

5. Stateful and Stateless Widgets

- Learn about **stateful and stateless widgets**.
- Implement **state management** using **setState** and **Provider**.

6. Custom Widgets and Theming

- Create **custom widgets** for specific UI elements.
- Apply **styling using themes and custom styles**.

7. Forms and Validation

- Design a **form with various input fields**.
- Implement **form validation and error handling**.

8. Animations in Flutter

- Add **animations** to UI elements using Flutter's animation framework.
- Experiment with different types of animations (**fade, slide, etc.**).

9. Working with REST APIs

- a) Fetch data from a **REST API**.
- b) Display the fetched data in a **meaningful way in the UI**.

10. Testing and Debugging

- a) Write **unit tests** for UI components.
- b) Use Flutter's **debugging tools** to identify and fix issues.

Text Books:

1. Marco L. Napoli, Beginning Flutter: A Hands-on Guide to App Development.
2. Rap Payne, Beginning App Development with Flutter: Create Cross-Platform Mobile Apps 1st Edition, Apres
3. Richard Rose, Flutter & Dart Cookbook, Developing Full stack Applications for the Cloud, Oreilly.



III Year-II Semester	Course Code: BT24CS3201	L	T	P	C
		0	1	2	2
COMPILER DESIGN					

Course Objectives:

Understand the basic concept of compiler design and its different phases, which will be helpful in constructing new tools like LEX, YACC, etc.

Course Outcomes (COs)

After completing this course, students will be able to:

CO1:	Explain the structure and phases of a compiler and design lexical analyzers using regular expressions, finite automata, and lexical analyzer generators.
CO2	Construct and analyze context-free grammars and perform syntax analysis by eliminating ambiguity, left recursion, and applying left factoring.
CO3:	Design and implement top-down and bottom-up parsing techniques , including LL(1), SLR, CLR, and LALR parsers with appropriate error recovery methods.
CO4:	Apply syntax-directed definitions and translation schemes to generate intermediate code , including type checking, control flow, and procedure handling.
CO5:	Analyze and apply code optimization techniques using basic blocks, flow graphs, loop optimization, data-flow analysis, and peephole optimization.
CO6:	Implement runtime storage management and code generation techniques , including register allocation and procedure calls.

CO \ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	—	2	—	—	—	—	1	—	2	3	2
CO2	3	2	2	—	3	—	—	—	—	1	—	2	3	2
CO3	3	2	2	1	3	—	—	—	—	1	—	2	3	3
CO4	3	3	3	2	3	—	—	—	1	1	—	2	2	2
CO5	3	3	2	2	2	1	1	1	—	1	—	2	2	3
CO6	3	2	3	1	3	1	—	—	1	1	—	3	2	3

UNITI:

Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.

Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring,

UNITII:

Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing. **Bottom Up Parsing:** Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers, Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers.

UNITIII:

Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. **Intermediate Code Generation:** Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Back patching, Intermediate Code for Procedures.

UNITIV:

Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization

UNITV:

Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays

Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson, 2007.

Reference Books:

1. Compiler Construction, Principles and Practice, Kenneth C Louden, Cengage Learning, 2006
2. Modern compiler implementation in C, Andrew W Appel, Revised edition, Cambridge University Press.
3. Optimizing Compilers for Modern Architectures, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, Lex and Yacc, edition, O'Reilly & Associates, 1990



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BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

III Year-II Semester	Course Code: BT24CS3202	L	T	P	C
		0	1	2	2

Course Objectives:

- To explain the evolving **utility computing model** called **cloud computing**.
- To introduce the various **levels of services** offered by the cloud.
- To discuss the fundamentals of **cloud-enabling technologies** such as **distributed computing, service-oriented architecture, and virtualization**.
- To emphasize **security** and other **challenges** in cloud computing.
- To introduce advanced concepts such as **containers, serverless computing, and cloud-centric Internet of Things (IoT)**

CO1:	Explain the fundamentals of cloud computing, including service models, deployment models, reference architecture, characteristics, benefits, and major cloud service providers.
CO2	Describe cloud-enabling technologies such as parallel and distributed computing, service-oriented architecture, web services, RPC, and virtualization.
CO3:	Analyze virtualization and containerization concepts and technologies, including hypervisors, containers, orchestration tools, and public cloud VM and container services.
CO4:	Evaluate cloud computing challenges related to scalability, fault tolerance, interoperability, economics, energy efficiency, and cloud security models.
CO5:	Apply advanced cloud computing concepts such as serverless computing, Function-as-a-Service, IoT integration, edge and fog computing.
CO6:	Analyze emerging trends and practices in cloud computing including DevOps, infrastructure-as-code, and quantum cloud computing for modern IT systems.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1										3	2
CO2	3	2	1	1									3	2
CO3	3	3	2	1	2								3	3
CO4	3	3	2	2				1					2	2
CO5	3	2	2	1	2								2	3
CO6	3	2	2	1	2							3	2	3

UNIT-I: Introduction to Cloud Computing Fundamentals

Cloud computing provides an overview of modern computing paradigms and introduces the concept of a cloud. The course covers the cloud computing reference model, including the various types of services such as IaaS, PaaS, and SaaS, and deployment models like public, private, and hybrid clouds. Students will learn about utility computing, the characteristics and benefits of cloud computing, and major cloud service providers such as Amazon Web Services, Microsoft Azure, and Google App Engine.

UNIT-II: Cloud Enabling Technologies

This unit explores the enabling technologies that support cloud computing. It discusses the ubiquitous Internet, parallel and distributed computing, and the essential elements of parallel computing, including hardware architectures like SISD, SIMD, MISD, and MIMD. Students will gain an understanding of distributed computing, inter-process communication, technologies for distributed systems, and remote procedure calls (RPC). Additionally, the unit introduces Service-Oriented Architecture (SOA), web services, and the role of virtualization in cloud environments.

UNIT-III: Virtualization and Containers

Students will study the characteristics of virtualized environments and a taxonomy of virtualization techniques. The unit explains the advantages and disadvantages of virtualization and its integration with cloud computing, with technology examples such as XEN and VMware. The course also covers containers, including their building blocks, container platforms like LXC and Docker, and orchestration tools such as Docker Swarm and Kubernetes. Public cloud offerings, including VMs (e.g., Amazon EC2) and container services (e.g., Amazon Elastic Container Service), are also examined.

UNIT-IV: Cloud Computing Challenges

This unit focuses on the challenges in cloud computing. Students will study the economics of the cloud, interoperability and standards, scalability, fault tolerance, and energy efficiency. The course explores federated cloud systems and the fundamentals of cloud computing security, including security architecture and the shared responsibility model. Security considerations across different cloud deployment models are also discussed.

UNIT-V: Advanced Concepts in Cloud Computing

The final unit introduces advanced cloud computing concepts such as serverless computing and Function-as-a-Service (FaaS). Students will learn about serverless architectures, public cloud platforms like AWS Lambda, and open-source alternatives such as OpenFaaS. The unit covers the Internet of Things (IoT), cloud-centric IoT layers, and applications. Students will also explore edge and fog computing, DevOps, infrastructure-as-code, and emerging areas such as quantum cloud computing.

Text Books:

1. MasteringCloudComputing,2ndedition,RajkumarBuyya,ChristianVecchiola,Thamarai Selvi, Shivananda Poojara, Satish N. Srirama, Mc Graw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang,Geoffery C. Fox, Jack J. Dongarra,Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. EssentialsofcloudComputing,K.Chandrasekhran,CRCpress,2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS3203	L	T	P	C
		0	1	2	2
CRYPTOGRAPHY & NETWORK SECURITY					

Course Objectives:

The main objectives of this course are to explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, public key algorithms, design issues and working principles of various authentication protocols and various secure communication standards including Kerberos, IPsec, and SSL/TLS.

CO1:	Explain the basic principles of information security, cryptographic services, attacks, and the mathematical foundations required for cryptography.
CO2	Analyze symmetric key cryptographic techniques, including DES and AES algorithms, their structure, security, and performance characteristics.
CO3:	Apply asymmetric key cryptographic algorithms such as RSA, ElGamal, Rabin, and Elliptic Curve Cryptography for secure communication.
CO4:	Explain data integrity mechanisms, cryptographic hash functions, digital signature schemes, and key management techniques including Kerberos.
CO5:	Analyze security mechanisms at application, transport, and network layers using protocols such as PGP, SSL/TLS, and IPsec.
CO6:	Evaluate system security threats and protection mechanisms including malware, buffer overflow attacks, intrusion detection systems, and firewalls.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1					1					3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	1									3	3
CO4	3	2	2	1				1					2	2
CO5	3	3	2	2				1					2	3
CO6	3	3	2	2				1				3	2	3

UNITI:

Basic Principles : Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography- integer arithmetic, modular arithmetic, matrices, linear congruence.

UNITII:

Symmetric Encryption: Mathematics of Symmetric Key Cryptography-algebraic structures, $GF(2^n)$ Fields, Introduction to Modern Symmetric Key Ciphers-modern block ciphers, modern stream ciphers, Data Encryption Standard- DES structure, DES analysis, Security of DES, Multiple DES, Advanced Encryption Standard-transformations, key expansions, AES ciphers, Analysis of AES.

UNITIII:

Asymmetric Encryption: Mathematics of Asymmetric Key Cryptography-primes, primarily testing, factorization, CRT, Asymmetric Key Cryptography- RSA crypto system, Rabin cryptosystem, Elgamal Crypto system, ECC

UNITIV:

Data Integrity, Digital Signature Schemes & Key Management : Message Integrity and Message Authentication-message integrity, Random Oracle model, Message authentication, Cryptographic Hash Functions-whirlpool, SHA-512, Digital Signature- process, services, attacks, schemes, applications, Key Management-symmetric key distribution, Kerberos.

UNITV:

Network Security-I: Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS, **Network Security-II :** Security at the Network Layer:IPSec-two modes, two security protocols, security association, IKE, ISAKMP, System Security-users, trust, trusted systems, buffer overflow, malicious software, worms, viruses, IDS, Firewalls.

Text Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Debdeep Mukhopadhyay, McGraw Hill, 2015
2. Cryptography and Network Security, 4th Edition, William Stallings, (6e) Pearson, 2006
3. Everyday Cryptography, 1st Edition, Keith M. Martin, Oxford, 2016

Reference Books:

1. Network Security and Cryptography, 1st Edition, Bernard Menezes, Cengage Learning, 2018



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P2A	L	T	P	C
		0	1	2	2
SOFTWARE TESTING METHODOLOGIES					

Course Objectives

- To provide knowledge of the concepts in **software testing**, such as the **testing process, criteria, strategies, and methodologies**.
- To develop skills in **software test automation** and **management using the latest tools**.

CO1:	Explain the purpose, principles, and models of software testing, including the impact of bugs and the taxonomy of software errors.
CO2	Apply path testing techniques, including flow graphs, path predicates, path sensitization, and instrumentation to identify test paths.
CO3:	Analyze data flow, transaction flow, and domain-based testing strategies and apply them for validating software correctness and interface behavior.
CO4:	Apply logic-based testing techniques such as decision tables, KV charts, and path expressions for systematic test case generation.
CO5:	Analyze state-based testing approaches including state graphs, transition testing, and testability considerations for software systems.
CO6:	Use graph matrices, node reduction algorithms, and software testing tools (e.g., JMeter, Selenium, SoapUI, Catalon) to design and execute practical test cases.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1										3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	1									3	3
CO4	3	3	2	2									2	2
CO5	3	3	2	2									2	3
CO6	3	2	3	2	2							3	2	3

UNIT-I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs Flow graphs and Path testing: Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT-II

Transaction Flow Testing: Transaction flows and **transaction flow testing techniques**.

Data Flow testing: Basics of data flow testing, strategies in data flow testing, application of data flow testing.

Domain Testing: domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT-III

Paths, Path products and Regular expressions: path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection.

Logic Based Testing: overview, decision tables, path expressions, kvcharts, specifications.

UNIT-IV

State, State Graphs and Transition testing: state graphs, good & bad state graphs, state testing, Testability tips.

UNIT-V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like Jmeter/selenium/soapUI/Catalon).

TextBooks:

1. Baris Beizer, *Software Testing Techniques*, Dreamtech, Second Edition.
2. Dr. K.V.K.K. Prasad, *Software Testing Tools*, Dreamtech.

Reference Books:

1. Brian Marick, *The Craft of Software Testing*, Pearson Education.
2. *Software Testing Techniques*, SPD (O'Reilly).
3. Edward Kit, *Software Testing in the Real World*, Pearson.
4. Perry, *Effective Methods of Software Testing*, John Wiley.
5. Meyers, *The Art of Software Testing*, John Wiley.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P2B	L	T	P	C
		0	1	2	2
CYBER SECURITY					

Course Objectives:

The aim of the course is to

- Identify security risks and take preventive steps
- Understand the forensics fundamentals
- Understand the evidence capturing process
- Understand the preservation of digital evidence

CO1:	Explain the fundamentals of cybercrime, including its origins, types, attack vectors, and security challenges posed by mobile and networked devices.
CO2	Analyze common cybercrime tools and attack methods, including phishing, malware, buffer overflows, DoS/DDoS attacks, SQL injection, spoofing, and social engineering.
CO3:	Apply techniques for cybercrime investigation including digital evidence collection, e-discovery, email/IP tracking, password recovery, and case-based forensic analysis.
CO4:	Demonstrate knowledge of computer forensics, including software and hardware tools, system forensics (Windows/Linux), multimedia forensics, biometrics, and mobile device investigations.
CO5:	Evaluate cybercrime legal frameworks, including global cyber laws, the Indian IT Act, amendments, digital signatures, and challenges in legal enforcement.
CO6:	Develop awareness of ethical, legal, and technological implications of cybercrime and apply best practices for prevention, detection, and mitigation of cyber threats.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1										3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	2									3	3
CO4	3	3	2	2	2			1					2	2
CO5	3	2	1	1				1				2	2	3
CO6	3	2	2	1		1		2				3	2	3

UNIT I: Introduction to Cybercrime: Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Cyber criminals, Classifications of Cybercrime, Cyberstalking, Cybercafe and Cybercrimes, Botnets. Attack Vector, Proliferation of Mobile and Wireless Devices, Security Challenges Posed by Mobile Devices, Attacks on Mobile/Cell Phones, Network and Computer Attacks.

UNIT II: Tools and Methods : Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, Sniffers, Spoofing, Session Hijacking Buffer over flow, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, Identity Theft (ID Theft), Foot Printing and Social Engineering, Port Scanning, Enumeration.

UNIT III: Cyber Crime Investigation: Introduction, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV: Computer Forensics and Investigations: Understanding Computer Forensics, Preparing for Computer Investigations. Current Computer Forensics Tools: Evaluating Computer Forensics Tools, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Graphics and Network Forensics, E-mail Investigations, Cell Phone and Mobile Device Forensics.

UNIT V: Cyber Crime Legal Perspectives: Introduction: Cybercrime and the legal landscape around the world; the Indian IT Act; challenges to Indian law and the cybercrime scenario in India; consequences of not addressing the weaknesses in the Information Technology Act; digital signatures and the Indian IT Act; amendments to the Indian IT Act; cybercrime and punishment; cyberlaw, technology, and students – Indian scenario.

Text Books:

1. Sunit Belapure and Nina Godbole, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, WILEY, 2011.
2. Nelson Phillips and Enfinger Steuart, *Computer Forensics and Investigations*, Cengage Learning, New Delhi, 2009.

Reference Books:

1. Michael T. Simpson, Kent Backman, and James E. Corley, *Hands-on Ethical Hacking and Network Defence*, Cengage, 2019.
2. John R. Vacca, *Computer Forensics: Computer Crime Investigation*, Firewall Media, New Delhi.

3. Alfred Basta, Nadine Basta, Mary Brown, and Ravinder Kumar, *Cyber Security and Cyber Laws*, Cengage, 2018.

E-Resources:

1. CERT-In Guidelines-<http://www.cert-in.org.in/>
2. <https://www.coursera.org/learn/introduction-cybersecurity-cyber-attacks>[Online Course]
3. <https://computersecurity.stanford.edu/free-online-videos>[FreeOnline Videos]
4. Nickolai Zeldovich. 6.858 Computer Systems Security. Fall 2014. Massachusetts Institute of Technology: MIT OpenCourseWare, <https://ocw.mit.edu> License: Creative Commons BY-NC-SA.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P2C	L	T	P	C
		0	1	2	2
DEVOPS					

Course Objectives:

The main objectives of this course are to:

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
- Implement automated system update and DevOps lifecycle.

CO1:	Explain the fundamentals of DevOps, including SDLC, Agile model, DevOps principles, architecture, lifecycle, CI/CD concepts, workflow, and release management practices.
CO2	Demonstrate version control and source code management using Git, including workflows, branching, staging, collaboration, and code quality analysis with tools like SonarQube.
CO3:	Apply build automation and Continuous Integration (CI) concepts using Jenkins, including pipeline creation, master-slave architecture, user management, and automated build execution.
CO4:	Implement Continuous Delivery (CD) processes, containerization using Docker, and testing automation with tools like Selenium and JavaScript testing frameworks.
CO5:	Analyze configuration management using Ansible, Puppet, and Chef, including deployment tasks, roles, templating, and automation for infrastructure management.
CO6:	Deploy, manage, and orchestrate containerized applications on Kubernetes/OpenShift, understanding namespaces, resources, deployment strategies, and CI/CD integration in cloud environments.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1	1									3	2
CO2	3	3	2	1	2								3	2
CO3	3	3	3	1	2								3	3
CO4	3	3	3	2	2								2	2
CO5	3	2	2	1	2								2	3
CO6	3	2	2	2	2							3	2	3

UNIT-I

Introduction to DevOps: Introduction to SDLC, Agile Model. Introduction to Devops. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation, Understanding Code Quality, Automation of CI/ CD. Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT-II

Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. **UNIT TESTING - CODE COVERAGE:** Junit, nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.

UNIT-III

Build Automation-Continuous Integration(CI): Build Automation, What is CI Why Clis Required, CI tools, Introduction to Jenkins (With Architecture), Jenkins workflow, Jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects & Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.

UNIT-IV

Continuous Delivery (CD): Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, DockerFile, Running containers, Working with containers and publish to Docker Hub.

Testing Tools: Introduction to Selenium and its features, JavaScript testing.

UNIT-V

Configuration Management-ANSIBLE: Introduction to Ansible, Ansible tasks, Roles, Jinja templating, Vaults, Deployments using Ansible.

CONTAINERIZATION USING KUBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC & ConfigMaps, Deploying Apps on OpenShift Container Pods. Introduction to Puppet master and Chef.

Text Books:

1. Joyner, Joseph., *Devops for Beginners: Devops Software Development Method Guide for Software Developers and It Professionals*, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., *Hands-on DevOps with Linux*, 1st Edition, BPB Publications, India, 2021.

Reference Books:

1. Len Bass, Ingo Weber, Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison Wesley; ISBN-10.
2. Gene Kim, Jez Humble, Patrick Debois, John Willis, *The DevOps Handbook*, 1st Edition, IT Revolution Press, 2016.
3. Joakim Verona, *Practical DevOps*, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona, *Practical DevOps*, Ingram Shorttitle, 2nd Edition, 2018; ISBN-10: 1788392574.
5. Deepak Gaikwad, Viral Thakkar, *DevOps Tools from Practitioner's Viewpoint*, Wiley Publications; ISBN: 9788126579952.



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY(Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P2D	L	T	P	C
0	1	2	2		
MACHINE LEARNING					

Course Objectives:

The objectives of the course are to:

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbors (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering.

CO1:	Explain the fundamentals of Machine Learning, including paradigms, data types, stages of ML, feature engineering, model selection, learning, evaluation, and prediction.
CO2	Apply nearest neighbor-based models, including K-Nearest Neighbor, radius-based methods, and regression techniques, to solve classification and regression problems.
CO3:	Analyze decision tree-based models, random forests, and Bayes classifiers for classification and regression, and understand bias-variance trade-offs.
CO4:	Apply linear discriminant techniques, perceptrons, support vector machines (SVM), logistic regression, and multilayer perceptrons (MLPs) for supervised learning tasks.
CO5:	Demonstrate clustering techniques including partitional, hierarchical, fuzzy, rough, and expectation-maximization-based clustering methods for unsupervised learning.
CO6:	Evaluate the performance of different machine learning models using appropriate metrics and select suitable models for real-world datasets.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1	1									3	2
CO2	3	3	2	1									3	2
CO3	3	3	2	2									3	3
CO4	3	3	3	2									2	2
CO5	3	3	2	1									2	3
CO6	3	3	2	2								3	2	3

UNIT-I: Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets.

UNIT-II: Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression Algorithms.

UNIT-III: Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression. The Bayes Classifier: Introduction to the Bayes Classifier, Bayes’ Rule and Inference, The Bayes Classifier and its Optimality, Multi- Class Classification, Class Conditional Independence and Naive Bayes Classifier (NBC)

UNIT-IV: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptrons (MLPs), Backpropagation for Training an MLP.

UNIT-V: Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization, Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-Based Clustering, Spectral Clustering.

Text Books: “Machine Learning Theory and Practice”, MNMurthy, VSAnanthanarayana, Universities Press(India), 2024

Reference Books:

1. “Machine Learning”, Tom M. Mitchell, McGraw-Hill Publication, 2017
2. “Machine Learning in Action”, Peter Harrington, DreamTech
3. “Introduction to Data Mining”, Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P3A	L	T	P	C
		0	1	2	2
SOFTWARE PROJECT MANAGEMENT					

Course Objectives:

At the end of the course, the student shall be able to:

- Describe and determine the purpose and importance of project management from the perspectives of planning, tracking, and completion of a project.
- Compare and differentiate organization structures and project structures.
- Implement a project to manage project schedule, expenses, and resources using appropriate project management tools.

CO1:	Explain conventional and modern software management principles, including the software lifecycle, software economics, and iterative process adoption.
CO2	Analyze software lifecycle phases and artifacts, including engineering, management, and programmatic artifacts, to support effective project planning.
CO3:	Apply model-based software architectures, process workflows, iterative process planning, milestones, and checkpoint assessment for project execution.
CO4:	Demonstrate project organization structures, process automation techniques, and software metrics for project control, monitoring, and quality assurance.
CO5:	Explain Agile methodology, Scrum adoption patterns, and iterating towards agility for software development projects.
CO6:	Analyze DevOps principles, architecture, delivery pipeline, tool stack, and adoption strategies for continuous integration, delivery, and deployment in projects.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1	1									3	2
CO2	3	3	2	1									3	2
CO3	3	3	3	2									3	3
CO4	3	2	2	2	2								2	2
CO5	3	2	1	1								2	2	3
CO6	3	3	2	2	2							3	2	3

UNIT-I:

Conventional Software Management: The waterfall model, conventional software Management performance.

Evolution of Software Economics: Software Economics, pragmatic software costestimation.

Improving Software Economics: Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

UNIT-II:

Life cycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts.

UNIT-III:

Model based software architectures: A Management perspective and technical perspective.

Work Flows of the process: Software process workflows, Iteration

workflows. **Checkpoints of the process:** Major milestones, Minor Milestones, Periodic status assessments.

Iterative Process Planning: Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning.

UNIT-IV:

Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, evolution of organizations.

Process Automation: Automation building blocks, the project environment.

Project Control and Process Instrumentation: The seven core metrics, management indicators, quality indicators, life cycle expectations, pragmatic software metrics, metrics automation.

UNIT-V:

Agile Methodology, ADAPTING to Scrum, Patterns for Adopting Scrum, Iterating towards Agility. **Fundamentals of DevOps:** Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

Text Books:

1. Software Project Management, Walker Royce, PEA, 2005.
2. Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.
3. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humble, 1st

Edition, O'Reilly publications, 2016.

Reference Books:

1. Bob Hughes, Mike Cotterell, *Software Project Management*, 3rd Edition, TMH.
2. Joel Henry, *Software Project Management*, PEA.
3. Pankaj Jalote, *Software Project Management in Practice*, PEA, 2005.
4. Robert K. Wysocki, *Effective Software Project Management*, Wiley, 2006.
5. Kathy Schwalbe, *Project Management in IT*, Cengage



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P3B	L	T	P	C
		0	1	2	2
MOBILE ADHOC NETWORKS					

Course Objectives:

From the course, the student will learn:

- Architect sensor networks for various application setups.
- Devise appropriate data dissemination protocols and model link cost.
- Understand the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at different layers.
- Evaluate the performance of sensor networks and identify bottlenecks.

CO1:	Explain the fundamentals of Ad Hoc Wireless Networks, including characteristics, applications, challenges, and MAC protocol classifications.
CO2	Analyze routing protocols for MANETs, including topology-based, position-based approaches, and transport layer solutions for TCP and other protocols.
CO3:	Evaluate security requirements and protocols in Ad Hoc Wireless Networks, including key management, secure routing, cooperation, and intrusion detection systems.
CO4:	Explain the architecture, design issues, communication, and energy considerations in Wireless Sensor Networks (WSNs), including sensor clustering and data retrieval mechanisms.
CO5:	Apply network layer, transport layer, MAC layer, and application layer protocols to design efficient WSN communication and data aggregation systems.
CO6:	Analyze security mechanisms, key management, secure data aggregation, sensor network operating systems, programming languages (nesC, TinyGALS), and simulation tools (NS-2, TOSSIM) for WSNs.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1	1									3	2
CO2	3	3	2	2									3	2
CO3	3	3	2	2				1				3	3	3
CO4	3	2	1	1									2	2
CO5	3	3	2	2	2								2	3
CO6	3	3	2	2	2			1				3	2	3

UNIT I: Introduction to Ad Hoc Wireless Networks- Cellular and Ad Hoc Wireless Networks, Characteristics of MANETs, Applications of MANETs, Issues and Challenges of MANETs, Ad Hoc Wireless Internet, MAC protocols for Ad hoc Wireless Networks-Issues, Design Goals and Classifications of the MAC Protocols.

UNIT II: Routing Protocols for Ad Hoc Wireless Networks- Issues in Designing a Routing Protocol, Classifications of Routing Protocols, Topology-based versus Position- based Approaches, Issues and design goals of a Transport layer protocol, Classification of Transport layer solutions, TCP over Ad hoc Wireless Networks, Solutions for TCP over Ad Hoc Wireless Networks, Other Transport layer protocols.

UNIT III: Security protocols for Ad hoc Wireless Networks- Security in Ad hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad hoc Wireless Networks, Cooperation in MANETs, Intrusion Detection Systems.

UNIT IV: Basics of Wireless Sensors and Applications- The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications, Data Retrieval in Sensor Networks-Classification of WSNs, MAC layer, Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT V: Security in WSNs- Security in WSNs, Key Management in WSNs, Secure Data Aggregation in WSNs, Sensor Network Hardware-Components of Sensor Mote, Sensor Network Operating Systems-TinyOS, LA-TinyOS, SOS, RETOS, Imperative Language- nesC, **Dataflow Style Language**-TinyGALS, Node-Level Simulators, NS-2 and its sensor network extension, TOSSIM.

Text Books:

1. AdHocWirelessNetworks—ArchitecturesandProtocols,1stedition,C.SivaRam Murthy, B. S. Murthy, Pearson Education, 2004
2. Ad Hoc and Sensor Networks – Theory and Applications, 2nd edition *Carlos Corderio Dharma P. Aggarwal*, World Scientific Publications / Cambridge University Press, March 2006

Reference Books:

1. Wireless Sensor Networks: An Information Processing Approach, 1st edition, *Feng Zhao, Leonidas Guibas*, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2. Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, 1st edition, *Subir Kumar Sarkar*, et al., Auerbach Publications, Taylor & Francis Group, 2008
3. AdhocNetworking, 1st edition, *Charles E. Perkins*, Pearson Education, 2001
4. Wireless Ad hoc Networking, 1st edition, *Shih-Lin Wu, Yu-Chee Tseng*, Auerbach Publications, Taylor & Francis Group, 2007
5. Wireless Sensor Networks – Principles and Practice, 1st edition, *Fei Hu, Xiaojun Cao*, An Auerbach book, CRC Press, Taylor & Francis Group, 2010



 III Year-II Semester	Course Code: BT24CS32P3C	L	T	P	C
		0	1	2	2

Course Objectives:

This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

CO1:	Explain the fundamentals of Natural Language Processing (NLP), including language modeling, regular expressions, finite-state automata, morphology, tokenization, and spelling correction.
CO2	Apply word-level analysis techniques, including N-gram models, smoothing methods, Part-of-Speech tagging, and statistical tagging approaches like Hidden Markov Models and Maximum Entropy models.
CO3:	Analyze syntactic structures using Context-Free Grammars, dependency grammars, parsing techniques, probabilistic CFGs, and feature-based unification approaches.
CO4:	Demonstrate semantic and pragmatic analysis, including first-order logic, description logics, word sense disambiguation, thematic roles, and selectional restrictions.
CO5: .	Apply discourse analysis methods, including discourse segmentation, coherence, anaphora resolution, coreference resolution, and use of lexical resources such as WordNet, PropBank, and FrameNet.
CO6:	Evaluate NLP models and techniques using real-world datasets and resources, integrating multiple levels of language analysis for practical NLP applications.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	2
CO2	3	3	2	1									3	2
CO3	3	3	3	2									3	3
CO4	3	3	2	2									2	2
CO5	3	3	2	2									2	3
CO6	3	3	2	2								3	2	3

UNITI:

INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNITII:

WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part- of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNITIII:

SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures

UNITIV:

SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNITV:

DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm–Coreference Resolution–Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin - Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.

Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M. Reese, O'Reilly Media, 2015.

3. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010. Edition
4. Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS32P3D	L	T	P	C
		0	1	2	2

BIGDATA ANALYTICS

Course Objectives: This course is aimed at enabling the students to:

- To provide an overview of an exciting and growing field of Big Data analytics.
- To introduce the tools required to manage and analyze Big Data, such as Hadoop, NoSQL, MapReduce, HIVE, Cassandra, and Spark.
- To teach the fundamental techniques and principles in achieving Big Data analytics with scalability and streaming capability.
- To optimize business decisions and create competitive advantage with Big Data analytics.

CO1:	Explain the fundamentals of big data, key trends, applications across industries, analytics techniques, and associated technologies including Hadoop, cloud, and mobile business intelligence.
CO2	Apply NoSQL database concepts, including aggregate data models, key-value, document, graph databases, sharding, replication, and consistency models, with practical experience in Cassandra.
CO3:	Analyze Hadoop architecture, including HDFS, MapReduce, fault tolerance, high availability, data locality, data integrity, and Hive for data processing, querying, and optimization.
CO4:	Demonstrate Apache Spark concepts, including in-memory processing, RDDs, DataFrames, transformations, actions, Spark SQL, Catalyst optimizer, and cluster deployment strategies.
CO5:	Implement performance tuning in Spark and utilize Spark features for large-scale data processing, debugging, and cluster management.
CO6:	Apply stream processing techniques using Spark Structured Streaming, including event-time processing, stateful operations, windowing, handling late data, and transformations on streams for real-time analytics.

C O \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	1	1									3	2
CO2	3	3	2	1	2								3	2
CO3	3	3	3	2	2								3	3
CO4	3	3	3	2	2								2	2
CO5	3	3	2	2	3								2	3
CO6	3	3	2	2	3							3	2	3

UNIT I: big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT II: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT III: Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT IV: Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Dataframes, RDDtoDataframes, Catalyst optimizer, DataFrame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- StandaloneMode, Spark on YARN, SparkLogs, TheSparkUI-SparkUIHistory Server, Debugging and Spark First Aid

UNIT V: Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing -EventTime, State full Processing, Window on EventTime-Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, *Big Data, Big Analytics: Emerging*, 1st Edition, 2013.
2. Bill Chambers and Matei Zaharia, *SPARK: The Definitive Guide*, O'Reilly, First Edition, 2018.
3. *Business Intelligence and Analytic Trends for Today's Businesses*, Wiley, First Edition, 2013.
4. P. J. Sadalage and M. Fowler, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Addison-Wesley Professional, 2012.

5. Tom White, *Hadoop: The Definitive Guide*, Third Edition, O'Reilly, 2012.

Reference Books:

1. Eric Sammer, *Hadoop Operations*, O'Reilly, First Edition, 2012.
2. E. Capriolo, D. Wampler, and J. Rutherford, *Programming Hive*, O'Reilly, 2012.
3. Lars George, *HBase: The Definitive Guide*, O'Reilly, First Edition, September 2011.
4. Eben Hewitt, *Cassandra: The Definitive Guide*, O'Reilly, 2010.
5. Alan Gates, *Programming Pig*, O'Reilly, First Edition, October 2011.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING**

III Year-II Semester	Course Code: BT24CS32P3E	L	T	P	C
		0	1	2	2

Course Objectives:

The main objective of the course is to introduce design issues and different message passing techniques in DOS, distributed systems, RPC implementation and its performance in DOS, distributed shared memory and resource management, distributed file systems and evaluate the performance in terms of fault tolerance, file replication as major factors

CO1:	Explain the fundamentals of distributed computing systems, including system models, distributed operating systems, design issues, and Distributed Computing Environment (DCE).
CO2	Apply message passing concepts, including synchronization, buffering, process addressing, failure handling, group communication, and IPC mechanisms in distributed systems.
CO3:	Demonstrate Remote Procedure Calls (RPCs), including RPC models, transparency, stub generation, parameter passing, client-server binding, exception handling, security, and performance optimization.
CO4:	Analyze Distributed Shared Memory (DSM) systems, including architecture, consistency models, synchronization mechanisms, clock/event ordering, mutual exclusion, and election algorithms.
CO5:	Evaluate resource management techniques in distributed systems, including global scheduling, task assignment, load balancing, load sharing, process migration, and threads management.
CO6:	Explain distributed file systems, including file models, access models, file-sharing semantics, caching, replication, fault tolerance, and atomic transactions.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	2
CO2	3	3	2	2									3	2
CO3	3	3	3	2	2								3	3
CO4	3	3	2	2									2	2
CO5	3	3	2	2	2								2	3
CO6	3	2	2	2	2							3	2	3

Unit I: Fundamentals:

What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment(DCE).

Message Passing:

Introduction, Desirable features of a Good Message Passing System, Issues in PC by Message Passing, Synchronization, Buffering, Multi-datatype Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication, Case Study: 4.3 BSD UNIX IPC Mechanism.

Unit II: Remote Procedure Calls:

Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding, Exception Handling, Security, Some Special Types of RPCs, RPC in Heterogeneous Environments, Lightweight RPC, Optimization for Better Performance, Case Studies: Sun RPC

Unit III: Distributed Shared Memory:

Introduction, General Architecture of DSM systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. Synchronization: Introduction, Clock Synchronization, Event Ordering, Mutual Exclusion, Dead Lock, Election Algorithms

Unit IV: Resource Management:

Introduction, Desirable Features of a Good Global Scheduling Algorithm, Task Assignment Approach, Load – Balancing Approach, Load – Sharing Approach Process Management: Introduction, Process Migration, Threads.

Unit V: Distributed File Systems:

Introduction, Desirable Features of a Good Distributed File System, File models, File-Accessing Models, File-Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions and Design Principles.

Textbooks

1. Pradeep.K.Sinha:DistributedOperatingSystems:ConceptsandDesign,PHI,2007.

Reference Books:

1. Andrew S. Tanenbaum, *Distributed Operating Systems*, Pearson Education, 2013.

2. Ajay D. Kshemkalyani and Mukesh Singhal, *Distributed Computing: Principles, Algorithms and Systems*, Cambridge University Press, 2008.
3. Sunita Mahajan and Seema Shan, *Distributed Computing*, Oxford University Press, 2015.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS3204	L	T	P	C
		0	1	2	2
CLOUD COMPUTING LAB					

Course Objectives:

- Introduce the various levels of services offered by cloud.
- To give practical knowledge about working with virtualization and containers.
- To introduce the advanced concepts such as serverless computing and cloud simulation.

Course Outcomes : At the end of the course, the student should be able to

- Demonstrate various service types, delivery models, and technologies of a cloud computing environment.
- Distinguish the services based on virtual machines and containers in the cloud offerings.
- Assess the challenges associated with cloud-based applications.
- Discuss advanced cloud concepts such as serverless computing and cloud simulation.
- Examine various programming paradigms suitable to solve real-world and scientific problems using cloud services.

List of Experiments:

1. Lab on web services
2. Lab on IPC,messaging, publish/subscribe
3. Install Virtual Box/VMwareWorkstation with different flavours of Linux or windows OS on top of windows8 or above.
4. Install a C compiler in the virtual machine created using Virtual Box and execute Simple Programs.
5. Create an Amazon EC2 instance and set up a web-server on the instance and associate an IP address with the instance. In the process, create a security group allowing access to port 80 on the instance.

OR

6. Do the same with OpenStack
7. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
8. Start a Docker container and set up a web-server (e.g. apache2 or Python based Flask micro web framework) on the instance. Map the host directory as a data volume for the container.
9. Find a procedure to transfer the files from one virtual machine to another virtual machine. Similarly, from one container to another container.
10. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)

11. Install Hadoop on a single node cluster and run simple applications like wordcount.
12. Utilize OpenFaaS – Serverless computing framework and demonstrate basic event driven function invocation.
13. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

TextBooks:

1. Mastering Cloud Computing, 2nd edition, Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, Shivananda Poojara, Satish N. Srivastava, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Elsevier, 2012.

ReferenceBooks:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
3. Online documentation and tutorials from cloud service providers (e.g. AWS, Google App Engine)
4. Docker, Reference documentation, <https://docs.docker.com/reference/>
5. OpenFaaS, Serverless Functions Made Simple, <https://docs.openfaas.com/>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS3205	L	T	P	C
		0	1	2	2
CRYPTOGRAPHY & NETWORK SECURITY LAB					

Course Objectives:

- To learn basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.
- To understand and implement encryption and decryption using Ceaser Cipher, Substitution Cipher, Hill Cipher.

List of Experiments:

1. Write a C program that contains a string(char pointer) with a value 'HelloWorld'. The Program should XOR each character in this string with 0 and display the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello World'. The program should AND or and XOR each character in this string with 127 and display the result
3. Write a Java program to perform encryption and decryption using the following algorithms:
 - a) Ceaser Cipher
 - b) Substitution Cipher
 - c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic.
5. Write a C/Java program to implement the Blowfish algorithm logic.
6. Write a C/Java program to implement the Rijndael algorithm logic.
7. Using Java Cryptography, encrypt the text "Hello world" using Blowfish. Create your own key using Java keytool.
8. Write a Java program to implement the RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as the other party (Bob).
10. Calculate the message digest of a text using the SHA-1 algorithm in Java



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code:	L	T	P	C
		0	1	2	2
SOFT SKILLS					

Course Objectives:

- To equip the students with the skills to effectively communicate in English.
- To train the students in interview skills, group discussions, and presentation skills.
- To motivate the students to develop confidence.
- To enhance the students' interpersonal skills.
- To improve the students' writing skills.

UNIT-I

Analytical Thinking & Listening Skills: Self-Introduction, Shaping Young Minds -ATalk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception.

Communication Skills: Verbal Communication; Non Verbal Communication (Body Language)

UNIT-II

Self-Management Skills: Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities

Etiquette: Social Etiquette,Business Etiquette,TelephoneEtiquette,DiningEtiquette

UNIT-III

Standard Operation Methods : Basic Grammars, Tenses, Prepositions, Pronunciation, Letter Writing; Note Making, Note Taking,Minutes Preparation, Email & Letter Writing

UNIT-IV

Job-Oriented Skills:Group Discussion, Mock Group Discussions, Resume Preparation, Interview Skills, Mock Interviews

UNIT-V

Interpersonal relationships: Introduction, Importance, Types, Uses,Factors affecting interpersonal relationships, Accommodating different styles, Consequences of interpersonal relationships

Text books:

1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press,2011.
2. S.P.Dhanavel,English and SoftSkills,OrientBlackswan,2010.

Reference books:

1. R. S. Aggarwal, *A Modern Approach to Verbal & Non-Verbal Reasoning*, S. Chand & Company Ltd., 2018.
2. Meenakshi Raman and Sangeeta Sharma, *Technical Communication: Principles and Practice*, Oxford University Press, 2011.

E-resources:

1. https://swayam-plus.swayam2.ac.in/courses/course-details?id=P_CAMBR_01



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS3206	L	T	P	C
		0	1	2	2

TECHNICAL PAPER WRITING & IPR

Course Objective : The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Unit I:

Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.

Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II:

Drafting report and design issues: The use of drafts, Illustrations and graphics.

Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III:

Proofreading and summaries: Proofreading, summaries, Activities on summaries.

Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV: Using word processor:

Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V:

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

Text Books:

1. Kompal Bansal & Parshit Bansal, “Fundamentals of IPR for Beginner’s”, 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, “Technical Communication: A Practical Approach”, Pearson.
3. Ramappa, T., “Intellectual Property Rights Under WTO”, 2nd Ed., SChand, 2015.

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.

E-resources:

1. <https://www.udemy.com/course/reportwriting/>
2. <https://www.udemy.com/course/professional-business-english-and-technical-report-writing/>
3. <https://www.udemy.com/course/betterbusinesswriting/>

Open Electives, offered to other department students:

Open Elective I: Principles of Operating Systems/ Computer Organization and Architecture

Open Elective II: Principles of Database Management Systems

Open Elective III: Object Oriented Programming Through Java

Open Elective IV: Principles of Software Engineering /Computer Networks



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS3109	L	T	P	C
		3	0	0	3
	Principles of Operating Systems				

Course Objectives:

The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

CO1:	Understand the basic concepts, principles, functions, and structure of operating systems.
CO2	Explain process management concepts and apply CPU scheduling algorithms for effective resource utilization.
CO3:	Apply inter-process communication and synchronization techniques to handle concurrent processes efficiently.
CO4:	Analyze deadlock conditions and apply appropriate deadlock prevention, avoidance, and recovery techniques.
CO5:	Analyze memory management techniques and file system structures used in operating systems.
CO6:	Understand and apply protection and security mechanisms in operating systems.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	2	-	-	-	-	-	-	-	-	2
CO3	3	3	3	2	2	-	-	-	2	-	-	2
CO4	3	3	2	3	-	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2
CO6	3	2	2	-	-	2	-	2	-	-	-	3

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication.

Threads and Concurrency: Multithreading models, Thread libraries, Threading issues.

CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT - III

Synchronization Tools: The Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization.

Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks.

UNIT - IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping.

Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing

Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File-System Mounting, Partitions and Mounting, File Sharing.

Text Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems: A Concept Based Approach, D.M Dhamdhere, 3rd Edition, McGraw-Hill, 2013

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-I Semester	Course Code: BT24CS3110	L	T	P	C
		3	0	0	3
Computer Organization and Architecture					

Course Objectives:

The purpose of the course is to introduce principles of computer organization and the basic architectural concepts. It provides an in depth understanding of basic organization, design, programming of a simple digital computer, computer arithmetic, instruction set design, micro programmed control unit, pipelining and vector processing, memory organization and I/O systems

CO1:	Understand the basic principles of computer organization and architectural concepts of a digital computer.
CO2	Explain the organization and functioning of computer arithmetic operations and instruction set design.
CO3:	Analyze the design and operation of control units, including hardwired and micro programmed control.
CO4:	Apply concepts of pipelining and vector processing to improve system performance.
CO5:	Analyze memory organization techniques and input/output system architectures.
CO6:	Apply computer organization concepts to analyze performance and support continuous learning in advanced computer architectures.

UNIT I:

Basic Structure Of Computers: Computer Types, Functional unit, Basic Operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers.

Logic gates: Digital Logic gates, Two-level realizations using gates - AND-OR, OR-AND, NAND-NAND and NOR-NOR

UNIT II:

Sequential circuits I: Classification of sequential circuits (synchronous and asynchronous): basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion of flip-flop to flip-flop, Race around condition, Master J-K flipflop

Register Transfer Language And Micro-operations: Register Transfer language. Register Transfer Bus and memory transfers, Arithmetic Micro-operations, Logic micro operations, shift micro operations, Arithmetic logic shift unit. Instruction codes. Computer Registers, Computer instructions, Instruction cycle.

UNIT III:

Micro Programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT IV:

Microprocessors: Evaluation of Microprocessors, CISC and RISC, Characteristics of Microprocessors

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Cache memories performance considerations, Virtual memories
Introduction to Shift registers and RAID

UNIT V:

Input – Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, DMA, Input Output Processor, Serial Communication.

Text Books:

1. Digital Logic and Computer Design, Moriss Mano, 11th Edition, Pearson Education.
2. Computer Organization, 5th ed., Hamacher, Vranesic and Zaky, TMH, 2002
3. Computer System Architecture, 3/e, Moris Mano, Pearson/PHI.

Reference Books:

1. Computer System Organization & Architecture, John D. Carpinelli, Pearson, 2008
2. Computer System Organization, Naresh Jotwani, TMH, 2009
3. Computer Organization & Architecture: Designing for Performance, 7th ed., William Stallings, PHI, 2006
4. Structured Computer Organization, Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

III Year-II Semester	Course Code: BT24CS3207	L	T	P	C
		3	0	0	3
Principles of Database Management Systems					

Course Objectives:

The main objectives of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data
- Introduce the concepts of SQL
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing database storage techniques

CO1:	Understand the fundamental concepts of database management systems and the relational data model.
CO2	Use SQL to define, manipulate, and query data in relational databases.
CO3:	Apply conceptual database design techniques using ER models.
CO4:	Apply normalization techniques to achieve efficient logical database design.
CO5:	Analyze physical database design concepts including storage structures and file organization.
CO6:	Apply database design and query optimization concepts to solve real-world data management problems.

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	3	2	-	3	-	-	-	-	-	-	2
CO3	3	3	3	2	-	-	-	-	2	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2
CO6	3	3	3	2	3	-	-	2	-	-	-	3

UNIT I:

Introduction: Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

UNIT II:

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance.

UNIT III:

BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV:

Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF).

UNIT V:

Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Text Books:

- 1) Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
- 2) Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

- 1) Introduction to Database Systems, 8th edition, C J Date, Pearson.
- 2) Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
- 3) Database Principles Fundamentals of Design Implementation and Management, 10th edition, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning, 2022

Web-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105175/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview



DR 25 REGULATIONS

M. Tech CURRICULUM

(Applicable for batches admitted from 2025-2026)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

**D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY
AUTONOMOUS**

Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada
Accredited with A⁺⁺ Grade by NAAC & Accredited by NBA (B. TECH – CSE, ECE & EEE)



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY AUTONOMOUS

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ACADEMIC REGULATIONS - DR25 FORM. Tech (REGULAR) DEGREE COURSE

Applicable for the students admitted to M. Tech (Regular) Course from the Academic Year 2025-26 and onwards. The M. Tech Degree of Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfil all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates (i) in national level qualifying Entrance Test (GATE), (ii) AP PGECET conducted by State Government and (iii) Few Sponsored seats notified by university on the basis of any order of merit as approved by the State Government /University, subject to reservations as laid down by the Government from time to time.

2.0 AWARD OF M. Tech DEGREE

- 2.1 A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years. Under any circumstances, permission shall not be given to complete the course work beyond four years.
- 2.2 **The student shall register for all 80 credits and secure all the 80 credits.**
- 2.3 The minimum instruction period in each semester is 16 weeks.

3.0 PROGRAMME OF STUDY

The following specializations are offered at present for the M. Tech Programme of study.

M.Tech in

1. Computer Science & Engineering
2. Digital Electronics and Communication Systems
3. Structural Engineering
4. Machine Design

and any other course as approved by AICTE/ University from time to time.



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4.0 ATTENDANCE

4.1 Attendance is calculated separately for each course. Attendance in all classes (Lectures/Laboratories) is compulsory. The minimum required attendance in each course is 75%. A student shall not be permitted to appear for the Semester End Examinations (SEE), if his/her attendance is less than 75%.

4.2 Condoning of shortage of attendance (between 65% and 75%) up to a maximum of 10% (*considering the days of attendance in sports, games, NSS activities and medical exigencies*) in each course (Theory/Lab/Seminar) is condoned on production of valid Certificates/documents in the stipulated time mentioned here with:

4.2.1 Students who are admitted as in patients for treatment are only eligible to claim condonation of attendance. Such students under medical exigencies need to Produce (a) Doctor Medical Prescription, (ii) Medical bills duly signed by Doctor/Hospital authorities, (c) Diagnosis reports, if any, (d) Discharge summary issued at the time of discharge and any other supporting documents within two week(s) from the date of discharge to the respective institution.

Note: University at any point of time can inform the institution(s) to submit such list/proofs. *Hence, respective institution shall verify and accord condonation privilege scrupulously.*

4.2.2 Students' participation in Sports/Games and NSS activities shall also be permitted for condonation of attendance. In such cases, they need to produce (a) invitation letter from the organizing institute/agency, (ii) participation certificate and any supporting documents within two week(s) from the date of participation to the respective institution

4.3 A prescribed fee per course shall be payable for condoning shortage of attendance after getting the approval of College Academic Committee for the same. The College Academic Committee shall maintain all the relevant documents along with the request from the students, whose attendance is condoned.

4.4 Shortage of Attendance below 65% in any course shall in no case be condoned.

4.5 A Student, whose shortage of attendance is not condoned in any course(s) (Theory/Lab/Seminar) in any Semester, is considered as '**Detained in that course(s)**', and is not eligible to write Semester End Examination(s) of such Course(s), (in case of Seminar, his/her Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek re-registration for those course(s) in subsequent Semesters, and attend the same as and when offered.

4.6 A student shall put in a minimum required attendance in at least FOUR courses in I semester for promotion to II Semester; and at least FOUR courses in II semester for promotion to III Semester.



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Re-admission / re-registration

4.7 A student shall not be permitted to appear for the Semester End Examinations (SEE) in a course unless they meet the prescribed attendance requirements for that course. Such students may take readmission for the course in the subsequent semester when it is offered by paying the prescribed fee, *at least 30 days before the commencement of classwork*. The college must obtain permission from the University by submitting the list of students eligible/applied for readmission before the commencement of classwork

4.8 Students who fail due to **less internal marks (less than 50%)** may register for the course within the maximum permissible duration of the Program.

4.9 In such a case, the candidate must re-register for the course(s) and secure the required minimum attendance. The candidate's attendance in the re-registered course(s) shall be calculated separately to decide upon eligibility for writing the end examination in those course(s).

4.10 In a semester, students are permitted to re-register maximum of THREE courses.

4.11 Upon re-registration, the student's previous performance in the respective course(s) will be nullified. Re-registration must be completed by paying the prescribed fee at least 30 days prior to the commencement of classwork. The college is required to obtain approval from the University by submitting a list of eligible and interested students before the start of commencement of classwork.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated course-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the theory courses 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The continuous / internal evaluation shall be made based on the **average** of the marks secured in the two CIE/Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each CIE/midterm examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks. End semester examination is conducted for 60 marks for all **FIVE (5)** questions (one question from one unit) to be answered (either or).

5.2 For practical courses, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day-to-day work-10 marks, record- 10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with breakup marks of Procedure-15, Experimentation- 25, Results- 10, Viva-voce-10.



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- 5.3 For Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor/mentor and two other senior faculty members of the department. For Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 5.4 A candidate shall be deemed to have secured the minimum academic requirement in a course if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.
- 5.5 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the second examiner shall be appointed by the University from the panel of examiners submitted by the respective college.
- 5.6 Students shall undergo mandatory summer internship / industrial training (3 credits) for a minimum of **eight weeks duration** at the end of second semester of the Programme /Summer Break. A student will be required to submit a summer internship/industrial training report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of a HoD / Professor of the department and two faculty. The report and the oral presentation shall carry 40% and 60% weightages respectively. For summer internship / industrial training, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 5.7 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. The examination committee will be constituted by the HoD and Professor of the department and two faculty. For comprehensive viva-voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.0 EVALUATION OF SEMINAR/INTERNSHIP/DISSERTATION WORK

All the students admitted under these regulations have to mandatorily comply the requirements of (i) Seminar-I, (ii) Seminar-II, (iii) Comprehensive Viva, (iv) Dissertation Part-A and (v) Dissertation Part-B. Out of these, (i) to (iv) are evaluated by internally by Project Review Committee (PRC) and (v) External Evaluation.

- 6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and Two other senior faculty members in the department.
- 6.2 Students are required to appear for Seminar-I and Seminar-II in First and Second semester respectively. They shall present before PRC on the topic of their choice/interest preferably on the courses listed in respective semesters. PRC shall advise the students in advance to select topics which strengthen their Dissertation Part-A and Dissertation Part-B.



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- 6.3 Students shall undergo mandatory summer internship / industrial training (2 credits) for a minimum of eight weeks duration at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship/industrial training report to the concerned department and appear for an oral presentation before PRC. The report and the oral presentation shall carry 40% and 60% weightages respectively. For summer internship / industrial training, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.4 The objective of comprehensive viva-voce is to assess the overall knowledge of the student in the relevant field of Engineering/Specialization in the PG program. Viva will be conducted in 3rd semester. For comprehensive viva-voce, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.5 Registration of Dissertation/Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses, both theory and practical and duly approved by PRC.
- 6.6 After satisfying 6.5, student has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval
- 6.7 If a candidate wishes to change his/her supervisor or topic of the project, he/she can do so with the approval of PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- 6.8 Continuous assessment of Dissertation-Part A and Dissertation-Part B during the Semester(s) will be monitored by PRC. *Dissertation-Part A* will be only internal evaluation by PRC for 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.
- 6.9 The candidate shall submit a status report to the PRC in two stages, each accompanied by an oral presentation, with a minimum interval of three months between the two.
- 6.10 The work on the project shall be initiated at the beginning of the III Sem and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis (*Dissertation – Part A & Part B*) only with the approval of PRC not earlier than 40 weeks from the date of registration of the project work.
- 6.11 Three copies of the project thesis, printed on both sides of the page and certified by the supervisor, shall be submitted to the College/Institute along with the plagiarism report.
- 6.10 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.
- 6.11 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is not favourable again, the thesis shall be summarily rejected. The



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candidate has to reregister for the project and complete the project within the stipulated time after taking the approval from the University.

6.12 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination. The Board shall jointly report the candidate's work for a maximum of 100 marks. Corresponding grade will be awarded by the University.

6.13 If the report of the Viva-Voce is unsatisfactory (i.e., < 50 marks), the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the University.

7.0 Cumulative Grade Point Average (CGPA)

Marks Range (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	S	Outstanding	10
≥80 to <90	A	Excellent	9
≥70 to <80	B	Very Good	8
≥60 to <70	C	Good	7
≥50 to <60	D	Fair	6
<50	F	Fail	3
		Absent	0

Computation of SGPA

- The following procedure is to be adopted to compute the Semester Grade Point Average(SGPA) and Cumulative Grade Point Average (CGPA):
- The **SGPA** is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e
$$\text{SGPA (Si)} = \sum (\text{Ci} \times \text{Gi}) / \sum \text{Ci}$$
- Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Computation of CGPA

- The **CGPA** is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a Programme, i.e.
$$\text{CGPA} = \sum (\text{Ci} \times \text{Si}) / \sum \text{Ci}$$
- Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.
- The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
- Equivalent Percentage = (CGPA- 0.5) x 10



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8.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Division with Distinction	≥ 7.5 (without supplementary History)	From the CGPA secured from 80 credits
First Class	≥ 6.5	
Second Class	≥ 6.0 to < 6.5	

The secured grade, grade points, status and credits obtained will be shown separately in the memorandum of marks. If a student wants to leave the program / exit after successful completion of first two semesters, he/she will be awarded Post Graduate Diploma in the specialization concerned.

9.0 WITHHOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

10.0 GENERAL

- 10.1 Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.
- 10.2 The academic regulation should be read as a whole for the purpose of any interpretation.
- 10.3 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- 10.4 The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.



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MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	Both the candidates involved in the malpractice will forfeit their seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.



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4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.



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7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.



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12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.
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Malpractices identified by squad or special invigilators:

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.



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Programme Structure

R25 M.Tech Course Structure

M.Tech (XXXX) I – Semester

S. No.	Course Code	Course Title	L	T	P	C
1		Program Core – 1	3	1	0	4
2		Program Core – 2	3	1	0	4
3		Program Core – 3	3	1	0	4
4		Program Elective – I	3	0	0	3
5		Program Elective – II	3	0	0	3
6		Laboratory – 1	0	1	2	2
7		Laboratory – 2	0	1	2	2
8		Seminar-I	0	0	2	1
TOTAL			15	5	6	23

List of Professional Elective Courses in I Semester (Electives – I & II)

S.No.	Course Code	Course Title
1		
2		
3		
4		
5		
6		
7		
8		

@ Minimum 2/3 themes per elective



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M.Tech (XXXX) II – Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1		Program Core – 4	3	1	0	4
2		Program Core – 5	3	1	0	4
3		Program Core – 6	3	1	0	4
4		Program Elective – III	3	0	0	3
5		Program Elective - IV	3	0	0	3
6		Laboratory – 3	0	1	2	2
7		Laboratory – 4	0	1	2	2
8		Seminar – II	0	0	2	1
		TOTAL	15	5	6	23

List of Professional Elective Courses in II Semester (Electives III & IV)

S.No.	Course Code	Course Title
1		
2		
3		
4		
5		
6		
7		
8		

@ Minimum 2/3 themes per elective



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M.Tech (XXXX) - III Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1		Research Methodology and IPR / <i>Swayam 12 week MOOC course – RM&IPR</i>	3	0	0	3
2		Summer Internship/ Industrial Training (8-10 weeks)*	-	-	-	3
3		Comprehensive Viva [#]	-	-	-	2
4		Dissertation Part – A ^{\$}	-	-	20	10
TOTAL			3	-	20	18

* Student attended during summer / year break and assessment will be done in 3rd Sem.

Comprehensive viva can be conducted courses completed upto second sem.

\$ Dissertation – Part A, internal assessment

M.Tech (XXXX) – IV Semester

Sl. No.	Course Code	Course Title	L	T	P	C
1		Dissertation Part – B [%]	-	-	32	16
		TOTAL	-	-	32	16

% External Assessment



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Revised Bloom's Taxonomy Action Verbs

Definitions	I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Bloom's Definition	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.
Verbs	<ul style="list-style-type: none"> • Choose • Define • Find • How • Label • List • Match • Name • Omit • Recall • Relate • Select • Show • Spell • Tell • What • When • Where • Which • Who • Why 	<ul style="list-style-type: none"> • Classify • Compare • Contrast • Demonstrate • Explain • Extend • Illustrate • Infer • Interpret • Outline • Relate • Rephrase • Show • Summarize • Translate 	<ul style="list-style-type: none"> • Apply • Build • Choose • Construct • Develop • Experiment with • Identify • Interview • Make use of • Model • Organize • Plan • Select • Solve • Utilize 	<ul style="list-style-type: none"> • Analyze • Assume • Categorize • Classify • Compare • Conclusion • Contrast • Discover • Dissect • Distinguish • Divide • Examine • Function • Inference • Inspect • List • Motive • Relationships • Simplify • Survey • Take part in • Test for • Theme 	<ul style="list-style-type: none"> • Agree • Appraise • Assess • Award • Choose • Compare • Conclude • Criteria • Criticize • Decide • Deduct • Defend • Determine • Disprove • Estimate • Evaluate • Explain • Importance • Influence • Interpret • Judge • Justify • Mark • Measure • Opinion • Perceive • Prioritize • Prove • Rate • Recommend • Rule on • Select • Support • Value 	<ul style="list-style-type: none"> • Adapt • Build • Change • Choose • Combine • Compile • Compose • Construct • Create • Delete • Design • Develop • Discuss • Elaborate • Estimate • Formulate • Happen • Imagine • Improve • Invent • Make up • Maximize • Minimize • Modify • Original • Originate • Plan • Predict • Propose • Solution • Solve • Suppose • Test • Theory

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

COURSE STRUCTURE & SYLLABUS M. Tech CSE for COMPUTER SCIENCE & ENGINEERING PROGRAMME

(Applicable for batches admitted from 2025-2026)



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I-SEMESTER

S. No	Course Code	Course Title	Teaching Scheme			C			
			L	T	P				
1	D2515800	ProgramCore-1 : Data Structures and Algorithm Analysis	3	1	0	4			
2	D2515801	ProgramCore-2 : Advanced Data warehousing and Data Mining	3	1	0	4			
3	D2515802	ProgramCore-3 : Mathematical foundations of computer science	3	1	0	4			
4	Program Elective-I			3	0	3			
	1. Image Processing								
	2. Soft computing								
	3. Advanced Computer Networks								
	4. Advanced Software Engineering								
5	Program Elective-II			3	0	3			
	1. Time Series Analysis								
	2. High Performance Computing								
	3. Agile Methodologies								
	4. Advanced Compiler Design								
	5. Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS								
6	D2515803	Laboratory-1: Data Structures and Algorithm Analysis lab	0	1	2	2			
7	D2515804	Laboratory-2: Advanced Data warehousing and Data Mining lab	0	1	2	2			
8	D2515805	Seminar-I	0	0	2	1			
Total Credits			15	5	6	23			

List of Professional Elective Courses in I Semester (Electives – I & II)

S. No	Course Title	Course Code
1	Image Processing	D25158A0
2	Soft computing	D25158A1
3	Advanced Computer Networks	D25158A2
4	Advanced Software Engineering	D25158A3
5	Time Series Analysis	D25158B0
6	High Performance Computing	D25158B1
7	Agile Methodologies	D25158B2
8	Advanced Compiler Design	D25158B3
9	Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS	D25158B4

II-SEMESTER

S. No	Course Code	Course Title	Teaching Scheme			C			
			L	T	P				
1	D2525800	ProgramCore-4 : Machine Learning	3	1	0	4			
2	D2525801	ProgramCore-5 : Natural Language Processing	3	1	0	4			
3	D2525802	ProgramCore-6 : Introduction to Quantum computing	3	1	0	4			
4	Program Elective-III			3	0	3			
	1. Feature Engineering								
	2. Generative AI								
	3. Adhoc Sensor Networks								
	4. Principles of Network Security								
5	Program Elective-IV			3	0	3			
	1. Block Chain Technologies								
	2. DevOps								
	3. Secure Coding								
	4. Design Patterns								
	5. Any minimum12 weeks MOOCS/NPTEL courses suggested by BOS								
6	D2525803	Laboratory-3: Machine Learning Lab	0	1	2	2			
7	D2525804	Laboartory-4: Natural Language Processing Lab	0	1	2	2			
8	D2525805	Seminar-II	0	0	2	1			
Total Credits			15	5	6	23			

List of Professional Elective Courses in II Semester (Electives – III & IV)

S. No	Course Title	Course Code
1	Feature Engineering	D25258A0
2	Generative AI	D25258A1
3	Adhoc Sensor Networks	D25258A2
4	Principles of Network Security	D25258A3
5	Block Chain Technologies	D25258B0
6	DevOps	D25258B1
7	Secure Coding	D25258B2
8	Design Patterns	D25258B3
9	Any minimum12 weeks MOOCS/NPTEL courses suggested by BOS	D25258B4

III-SEMESTER

S. No	Course Code	Course Title	Teaching Scheme			C
			L	T	P	
1	D2535800	Research Methodology and IPR / Swayam 12 week MOOC course – RM&IPR	3	0	0	3
2	D2535801	Summer Internship/ Industrial Training (8-10 weeks)*	-	-	-	3
3	D2535802	Comprehensive Viva [#]	-	-	-	2
4	D2535803	Dissertation Part – A ^{\$}	-	-	20	10
Total Credits			3	-	20	18

* Student attended during summer / year break and assessment will be done in 3rd Sem.

Comprehensive viva can be conducted courses completed upto second sem.

\$ Dissertation – Part A, internal assessment

IVSEMESTER

S. No	Course Code	Course Title	Teaching Scheme			C
			L	T	P	
1	D2545800	Dissertation Part – B [%]	--	--	32	16
Total Credits					32	16

% External Assessment



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

M. Tech Programme
CSE COURSE STRUCTURE & SYLLABUS

(Common to M. Tech Computer Science & Engineering)



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515800	L	T	P	C
		3	1	0	4
DATA STRUCTURES & ALGORITHMS ANALYSIS					

		Knowledge Level (K) #
CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency	K2
CO2	Master a variety of advanced abstract data type (ADT) and data structures and their implementation.	K4
CO3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	K4
CO4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	K3
CO5	Ability to compare various search trees and find solutions for IT related problems	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction to Data Structures- Singly Linked Lists, Doubly Linked Lists, Circular Lists-Algorithms, Stacks and Queues- Algorithm Implementation using Linked Lists.	10Hrs
UNIT – 2	Searching- Linear and Binary, Search Methods, Sorting- Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Trees- Binary trees, Operations- Insertion, Deletion, Properties, Representation and Traversals (DFT, BFT), Expression Trees (Infix, prefix, postfix), Graphs- Basic Concepts, Storage structures and Traversals	12Hrs
UNIT – 3	Dictionaries, ADT, The List ADT, Stack ADT, Queue ADT, Hash Table Representation, Hash Functions, Collision Resolution-Separate Chaining, Open Addressing- Linear Probing, Double Hashing	12Hrs
UNIT – 4	Priority queues- Definition, ADT, Realising a Priority Queue Using Heaps, Definition, Insertion, Deletion, Search Trees- Binary Search Trees, Definition, ADT, Implementation, Operations- Searching, Insertion, Deletion	12Hrs
UNIT – 5	Search Trees- AVL Trees, Definition, Height of AVL Tree, Operations- Insertion, Deletion and Searching. Introduction to Red-Black and Splay Trees, B-Trees, Height of B-Tree, Insertion, Deletion and Searching, Comparison of Search Trees	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, Richard F.Gilberg, Behrouz A. Forouzon, Cengage Learning, 2004
2. Data Structures, Algorithms and Applications in java, 2 nd Edition, Sartaj Sahni, University Press/Orient BlackSwan, 2005

Reference Books:

1. Data Structures And Algorithm Analysis, 2 nd Edition, Mark Allen Weiss, Pearson, 2002
2. Data Structures And Algorithms in C++, 3 rd Edition, Adam Drozdek, Cengage Learning, 2005
3. C and Data Structures: A Snap Shot Oriented Treatise Using Live Engineering Examples, 1 st Edition, N.B.Venkateswarlu, E.V. Prasad, S Chand & Co, 2009
4. Classic Data Structures, 2 nd Edition, Debasis Samantha, PHI Learning, 2009



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515801	L	T	P	C
		3	1	0	4
ADVANCED DATA WAREHOUSING AND DATA MINING					

Pre-requisites: Data Structures, Algorithms, Probability & Statistics, Data Base Management Systems

Course Objectives: The main objective of the course is to

- ⊕ Understand Data Warehousing and OLA
- ⊕ Master Data Preprocessing and Statistical Techniques
- ⊕ Apply Classification Techniques and Model Evaluation
- ⊕ Perform Association and Sequential Pattern Mining
- ⊕ Explore Clustering and Advanced Data Mining

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Describe the architecture, modeling techniques, and implementation strategies of data warehouses and OLAP systems, including modern cloud-based approaches (K2).	K2
CO2	Apply statistical and visualization techniques to describe datasets and perform data preprocessing tasks such as cleaning, integration, reduction, and transformation. (K3)	K3
CO3	Develop and evaluate classification models using decision trees, Bayesian classifiers, and rule-based methods for solving predictive analytics problems.(K4)	K4
CO4	Discover meaningful associations and sequential patterns in data using algorithms like Apriori, FP-Growth, and sequential pattern mining techniques. (K3)	K3
CO5	Implement clustering techniques such as K-means, hierarchical clustering, and DBSCAN, and analyze advanced data mining for text, spatial, and graph data.(K4)	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Data Warehousing and Online Analytical Processing: Basic concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Cloud Data Warehouse; Data Mining Methodologies: CRISP-DM and SEMMA, Comparison of Data Mining Methodologies. Statistical Limits on Data Mining, Introduction to Predictive Analytics, Technologies, Applications, Major issues (Text Book- 1)	10Hrs
UNIT – 2	Data Objects & Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Preprocessing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. (Text Book- 1)	10Hrs
UNIT – 3	Classification: Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Attribute Selection Measures, Tree Pruning, Scalability and Decision Tree Induction, Visual Mining for Decision Tree Induction, Bayesian Classification Methods: Bayes Theorem, Naïve Bayes Classification, Rule-Based Classification, Model Evaluation and Selection. (Text Book- 2)	12Hrs
UNIT – 4	Association Analysis: Problem Definition, Frequent Itemset Generation, Rule Generation: Confident Based Pruning, Rule Generation in Apriori Algorithm, Compact Representation of frequent item sets, FP-Growth Algorithm, <i>Sequential Patterns</i> : Preliminaries, Sequential Pattern Discovery (Text Book- 2)	12Hrs
UNIT – 5	Cluster Analysis: Clustering techniques, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bi-secting K Means, <i>Agglomerative Hierarchical Clustering</i> : Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. <i>Mining rich data types</i> : Mining text data, Spatial-temporal data, Graph and networks. (Text Book- 2)	12Hrs
	Total	56Hrs

*Note:

Text Books:

1. Data Mining concepts and Techniques, 3rd edition, Jiawei Han, Michel Kamber, Elsevier, 2011.
2. Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar,

Reference Books:

3. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
4. Data Mining Techniques, Arun K Pujari, 3rd edition, Universities

Online Resources: (NPTEL course by Prof.PabitraMitra)

1. http://onlinecourses.nptel.ac.in/noc17_mg24/preview
2. http://www.saedsayad.com/data_mining_map.htm



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515803	L	T	P	C
		3	1	0	4
MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE					

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	To apply the basic rules and theorems of probability theory such as Baye's Theorem, to determine probabilities that help to solve engineering problems and to determine the expectation and variance of a random variable from its distribution	K3
CO2	Able to perform and analyze of sampling, means, proportions, variances and estimates the maximum likelihood based on population parameters	K5
CO3	To learn how to formulate and test hypotheses about sample means, variances and proportions and to draw conclusions based on the results of statistical tests	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		2	3		2
CO2	2		2	3		2
CO3	3	2	3	3		2

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Basic Probability and Random Variables: Random Experiments, Sample Spaces Events, the Concept of Probability the Axioms of Probability, Some Important Theorems on Probability Assignment of Probabilities, Conditional Probability Theorems on Conditional Probability, Independent Events, Bayes Theorem or Rule. Random Variables, Discrete Probability Distributions, Distribution Functions for Random Variables, Distribution Functions for Discrete Random Variables, Continuous Random Variables	10Hrs
UNIT – 2	Sampling and Estimation Theory: Population and Sample, Statistical Inference Sampling With and Without Replacement Random Samples, Random Numbers Population Parameters Sample Statistics Sampling Distributions, Frequency Distributions, Relative Frequency Distributions, Computation of Mean, Variance, and Moments for Grouped Data. Unbiased Estimates and Efficient Estimates Point Estimates and Interval Estimates. Reliability Confidence Interval Estimates of Population Parameters, Maximum Likelihood Estimates	10Hrs

UNIT – 3	Tests of Hypothesis and Significance: Statistical Decisions Statistical Hypotheses. Null Hypotheses Tests of Hypotheses and Significance Type I and Type II Errors Level of Significance Tests Involving the Normal Distribution One-Tailed and Two- Tailed Tests P Value Special Tests of Significance for Large Samples Special Tests of Significance for Small Samples Relationship between Estimation Theory and Hypothesis Testing Operating Characteristic Curves. Power of a Test Quality Control Charts Fitting Theoretical Distributions to Sample Frequency Distributions, The Chi-Square Test for Goodness of Fit Contingency Tables Yates' Correction for Continuity Coefficient of Contingency.)	12Hrs
UNIT – 4	Algebraic Structures and Number Theory: Algebraic Systems, Examples, General Properties, Semi Groups and Monoids, Homomorphism of Semi Groups and Monoids, Group, Subgroup, Abelian Group, Homomorphism, Isomorphism. Properties of Integers, Division Theorem, The Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic (Fermat's Theorem and Euler's Theorem)	12Hrs
UNIT – 5	Graph Theory: Basic Concepts of Graphs, Sub graphs, Matrix Representation of Graphs: Adjacency Matrices, Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Planar Graphs, Euler's Formula, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Algorithms for Spanning Trees (Problems Only and Theorems without Proofs).	12Hrs
		Total 56Hrs

*Note:

Text Books:

1. Foundation Mathematics for Computer Science, 1st edition, John Vince, Springer, 2015
2. Probability & Statistics, 3rd Edition, Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, Schaum's Outline Series, Tata McGraw-Hill Publishers, 2018
3. Probability and Statistics with Reliability, 2nd edition, K. Trivedi, Wiley, 2011
4. Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, H. Rosen, Tata McGraw Hill, 2003

Reference Books:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, 1st edition, M. Mitzenmacher and E. Upfal, 2005
2. Applied Combinatorics, 6th edition, Alan Tucker, Wiley, 2012



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158A0	L	T	P	C
		3	0	0	3
IMAGE PROCESSING (PROGRAM ELECTIVE-I)					

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Describe and explain basic principles of digital image processing.	K3
CO2	Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).	K3
CO3	Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).	K4
CO4	CO4 Assess the performance of image processing algorithms and systems	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction: Fundamental steps in Image Processing System, Components of Image Processing System, Elements of Visual Perception, Image Sensing and acquisition, Image sampling & Quantization, Basic Relationship between pixels. Image Enhancement Techniques: Spatial Domain Methods: Basic grey level transformation, Histogram equalization, Image subtraction, image averaging	10Hrs

UNIT – 2	Spatial filtering: Smoothing, sharpening filters, Laplacian filters, Frequency domain filters, Smoothing and sharpening filters, Homomorphism is filtering. Image Restoration & Reconstruction: Model of Image Degradation/restoration process, Noise models, Spatial filtering, Inverse filtering, Minimum mean square Error filtering, constrained least square filtering, Geometric mean filter, Image reconstruction from projections. Color Fundamentals, Color Models, Color Transformations.	10Hrs
UNIT – 3	Image Compression: Redundancies- Coding, Interpixel, Psycho visual; Fidelity, Source and Channel Encoding, Elements of Information Theory; Loss Less and Lossy Compression; Run length coding, Differential encoding, DCT, Vector quantization, Entropy coding, LZW coding; Image Compression Standards-JPEG, JPEG 2000, MPEG; Video compression.	12Hrs
UNIT – 4	Wavelet Based Image Compression: Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous, Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding	12Hrs
UNIT – 5	Image Segmentation: Discontinuities, Edge Linking and boundary detection, Thresholding, Region Based Segmentation, Watersheds; Introduction to morphological operations; binary morphology- erosion, dilation, opening and closing operations, applications; basic gray-scale morphology operations; Feature extraction; Classification; Object recognition. Digital Image Watermarking: Introduction, need of Digital Image Watermarking, applications of watermarking in copyright protection and Image quality analysis.	12Hrs
Total		56Hrs

*Note:

Text Books:

1. Digital Image Processing. 2nd ed. Gonzalez, R.C. and Woods, R.E. India: Person Education, 2009

Reference Books:

1. Digital Image Processing. John Wiley, Pratt, W. K, Fourth Edition-2001
2. Digital Image Processing, Jayaraman, S., Veerakumar, T. and Esakkiranjan, S., Tata McGraw-Hill, Edition



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158A1	L	T	P	C
		3	0	0	3
SOFT COMPUTING (Program Elective-I)					

Course Objectives:

1. To introduce the concepts in Soft Computing such as Artificial Neural Networks, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrids.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K#)
CO1	CO1 Learn soft computing techniques and their applications.	K2
CO2	CO2 Analyze various neural network architectures.	K3
CO3	CO3 Define the fuzzy systems	K2
CO4	CO4 Understand the genetic algorithm concepts and their applications.	K2
CO5	CO5 Identify and select a suitable Soft Computing technology to solve the problem; construct a solution and implement a Soft Computing solution	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction to Soft Computing, Artificial neural networks, biological neurons, Basic models of artificial neural networks, Connections, Learning, Activation Functions, McCulloch and Pitts Neuron, Hebb network.	10Hrs
UNIT – 2	Perceptron networks, Learning rule, Training and testing algorithm, Adaptive Linear Neuron, Back propagation Network, Architecture, Training algorithm	10Hrs
UNIT – 3	Fuzzy logic, fuzzy sets, properties, operations on fuzzy sets, fuzzy relations, operations on fuzzy relations, Fuzzy membership functions, fuzzification, Methods of membership, value assignments, intuition, inference, rank ordering, Lambda –Cuts for fuzzy sets , Defuzzification methods	12Hrs
UNIT – 4	Truth values and Tables in Fuzzy Logic, Fuzzy propositions, Formation of fuzzy rules, Decomposition of rules, Aggregation of rules, Fuzzy Inference Systems, Mamdani and Sugeno types, Neuro-fuzzy hybrid systems, characteristics, classification	12Hrs
UNIT – 5	Introduction to genetic algorithm, operators in genetic algorithm, coding, selection, crossover, mutation, stopping condition for genetic algorithm flow, Genetic-neuro hybrid systems, Genetic Fuzzy rule based system	12Hrs
	Total	56Hrs

Text Books:

1. S. N. Sivanandam and S. N. Deepa, Principles of soft computing–John Wiley & Sons,2007.
2. Timothy J. Ross, Fuzzy Logic with engineering applications, John Wiley & Sons, 2016.

Reference Books:

1. N.K. Sinha and M.M. Gupta, Soft Computing & Intelligent Systems: Theory & Applications–Academic Press /Elsevier. 2009.
2. Simon Haykin, Neural Network–A Comprehensive Foundation–Prentice Hall International, Inc.1998
- 3.R. Eberhart and Y. Shi, Computational Intelligence: Concepts to Implementation, Morgan Kaufman/Elsevier, 2007.
4. Driankov D., Hellendoorn H. and Reinfrank M., An Introduction to Fuzzy Control Narosa Pub., 2001.

5. BartKosko, Neural Network and Fuzzy Systems-Prentice Hall,Inc.,Englewood Cliffs, 1992
6. Goldberg D.E, Genetic Algorithms in Search , Optimization , and Machine Learning
Addison Wesley, 1989



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158A2	L	T	P	C
		3	0	0	3

ADVANCED COMPUTER NETWORKS
(Program Elective-I)

Course Objectives: This course is aimed at enabling the students to

1. The course is aimed at providing basic understanding of Computer networks starting with OSI Reference Model, Protocols at different layers with special emphasis on IP, TCP & UDP and Routing algorithms.
2. Some of the major topics which are included in this course are CSMA/CD, TCP/IP implementation, LANs/WANs, internetworking technologies, Routing and Addressing.
3. Provide the mathematical background of routing protocols.
4. Aim of this course is to develop some familiarity with current research problems and research methods in advance computer networks

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Illustrate reference models with layers, protocols, and interfaces.	K4
CO2	Describe routing algorithms, subnetting, and addressing in IPv4 and IPv6.	K3
CO3	CO3 Analyze basic network protocols and their use in network design and implementation.	K3
CO4	Describe concepts related to wireless networks such as WLANs, WiMAX, IEEE 802.11, cellular and satellite systems.	K4
CO5	Describe emerging network trends such as MANETs and Wireless Sensor Networks (WSNs).	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Network layer: Network Layer design issues: store-and forward packet switching, services provided transport layers, implementation connection less services, implementation connection oriented services, comparison of virtual – circuit and datagram subnets, Routing Algorithms-shortest path routing, flooding, distance vector routing, link state routing, Hierarchical routing, congestion control algorithms : Approaches to congestion control, Traffic aware routing, Admission control, Traffic throttling, choke Packets, Load shedding, Random early detection, Quality of Service, Application requirements, Traffic shaping, Leaky and Token buckets.	12Hrs
UNIT – 2	Internetworking and IP protocols: How networks differ, How networks can be connected, internetworking, tunneling, The network layer in the internet, IPV4 Protocol, IP addresses, Subnets, CIDR, classful and Special addressing, network address translation (NAT),IPV6 Address structure address space, IPV6 Advantages, packet format, extension Headers, Transition from IPV4 to IPV6 , Internet Control Protocols-IMCP, ARP, DHCP.	12Hrs
UNIT – 3	Transport Layer Protocols: Introduction, Services, Port numbers, User Datagram Protocol: User datagram, UDP services, UDP Applications, Transmission control Protocol: TCP services, TCP features, Segment, A TCP connection, State transition diagram, Windows in TCP, Flow control and error control, TCP Congestion control, TCP Timers, SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control	12Hrs
UNIT – 4	Wireless LANS: Introduction, Architectural comparison, Access control, The IEEE 802.11 Project: Architecture, MAC sub layer, Addressing Mechanism, Physical Layer, Bluetooth: Architecture, Bluetooth Layers Other Wireless Networks: WIMAX: Services, IEEE project 802.16, Layers in project 802.16, Cellular Telephony: Operations, First Generation (1G), Second Generation (2G), Third Generation (3G), Fourth Generation (4G), Satellite Networks: Operation, GEO Satellites, MEO satellites, LEO satellites	12Hrs
UNIT – 5	Emerging trends in Computer networks:Mobile computing: Motivation for mobile computing, Protocol stack issues in mobile computing environment, mobility issues in mobile computing, security issues in mobile networks, MOBILE Ad Hoc Networks: Applications of Ad Hoc Networks, Challenges and Issues in MANETS, MAC Layer Issues Routing Protocols in MANET, Transport Layer Issues, Ad hoc Network Security Wireless Sensor Networks: WSN functioning, Operating system support in sensor devices, WSN characteristics, sensor network operation, Sensor Architecture: Cluster management, Wireless Mesh Networks: WMN design, Issues in WMNs, Computational Grids, Grid Features, Issues in Grid construction design, Grid design features,P2P Networks:	12Hrs
		Total 60Hrs

Text Books:

1. Data communications and networking 4th edition Behrouz A Fourzan,TMH-2007
2. Computer networks 4th edition Andrew S Tanenbaum, Pearson,2012
3. Computer networks, Mayank Dave,CENGAGE, First edition.2012

Reference Books:

- 1.Computer networks, A system Approach, 5th ed, Larry L Peterson and Bruce S Davie, Elsevier-2012.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158A3	L	T	P	C
		3	0	0	3
ADVANCED SOFTWARE ENGINEERING (PROGRAM ELECTIVE-I)					

Course Objectives: This course is aimed at enabling the students to

1. This course is designed to provide an in depth understanding of phases of Software Development, common process models including Waterfall, the Unified Process, hands-on experience with elements of the agile process, a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, and Software Design techniques.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Demonstrate software process, various models and Agile methodologies	K4
CO2	Analyze and Specify software requirements through a SRS documents	K5
CO3	Design and Plan software solutions to problems	K3
CO4	Analyze the importance of Quality assurance and design, implement, and execute test cases at the Unit level.	K5
CO5	Design, implement, and execute test cases at Integration level and analyze the role of various metrics	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Software and Software Engineering: Nature of software, Software Process, Software Engineering Practice. Process Models: Generic process model, defining a framework activity, identifying task set, process assessment and improvement, perspective process models Agility and process: Agility, Agile process, Scrum, other Agile frameworks, recommended process model	10Hrs
UNIT – 2	Human aspects of Software Engineering: characteristics and psychology of Software Engineer, software team, team structure. Principles that guide practice: core principles, principles that guide each framework activity. Understanding Requirements: Requirements engineering, establishing groundwork, requirements gathering, developing use cases, building analysis model, negotiating requirements, requirements monitoring, validating Requirements Requirements modeling: requirements analysis, class-based modeling, functional modeling, behavioral modeling.	12Hrs
UNIT – 3	Design: Design process, design concepts, design model Architectural design: software architecture, architectural styles, architectural design, assessing alternative architectural designs. User experience design: elements, golden rules, User interface analysis and design, user experience analysis, user interface design, design evaluation, usability and accessibility Design for mobility: mobile development life cycle, mobile architecture, web design pyramid, , mobility and design quality, best practices.	12Hrs
UNIT – 4	Quality: software quality, quality dilemma, achieving software quality Reviews: review metrics, Informal reviews, Formal technical reviews. Software Quality Assurance: elements, SQA process, Product characteristics, SQA tasks, goals and metrics, statistical software quality assurance, software reliability, ISO 9000 quality standards, SQA plan. Software testing: strategic approach to software testing, planning and recordkeeping, test case design, white box testing, black box testing, object oriented testing.	12Hrs
UNIT – 5	Software testing- integration level: Software testing fundamentals, integration testing, regression testing, integration testing in OO context, validation testing. Software testing- testing for mobility: mobile testing guidelines, testing strategies, User experience testing issues, web application testing, Web testing strategies, security testing, performance testing. Software metrics and analytics: software measurement, software analytics, product metrics, metrics for testing, metrics for maintenance, process and project metrics, software measurement, metrics for software quality	12Hrs
	Total	58Hrs

Text Books:

1. "Software Engineering, A practitioner's Approach", Roger S. Pressman, Bruce R. Maxim, 9th Edition, Tata McGraw-Hill.
2. "Software Engineering", Ian Sommerville, 9th edition, Pearson education

Reference Books:

1. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158B0	L	T	P	C
		3	0	0	3
TIME SERIES ANALYSIS (PROGRAM ELECTIVE-II)					

Course Objectives: This course is aimed at enabling the students to

1. The main objective of the course is to introduce a variety of statistical models for time series and cover the main methods for analyzing these models

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K#)
CO1	CO1 formulate real life problems using time series models	K1
CO2	Describe the statistical software to estimate the models from real data, and draw conclusions and develop solutions from the	K3
CO3	Explain the visual and numerical diagnostics to assess the soundness of their models	K2
CO4	Develop to communicate the statistical analyses of substantial data sets through explanatory text, tables and graphs	K5
CO5	combine and adapt different statistical models to analyse larger and more complex data	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	INTRODUCTION OF TIMESERIES ANALYSIS: Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series. Models for time series analysis, Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting, Forecasting Process, Data for forecasting, Resources for forecasting	10Hrs

UNIT – 2	STATISTICS BACKGROUND FOR FORECASTING: Graphical Displays, Time Series Plots, Plotting Smoothed Data, Numerical Description of Time Series Data, Use of Data Transformations and Adjustments, General Approach to Time Series Modeling and Forecasting, Evaluating and Monitoring Forecasting Model Performance	12Hrs
UNIT – 3	TIME SERIES REGRESSION MODEL: Introduction Least Squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Prediction of New Observations, Model Adequacy Checking, Variable Selection Methods in Regression, Generalized and Weighted Least Squares, Regression Models for General Time Series Data, Exponential Smoothing, First order and Second order	12Hrs
UNIT – 4	AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS: Autoregressive Moving Average (ARMA) Models, Stationarity and Invertibility of ARMA Models, Checking for Stationarity using Variogram, Detecting Nonstationarity, Autoregressive Integrated Moving Average (ARIMA) Models, Forecasting using ARIMA, Seasonal Data, Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction, Finding the "BEST" Model. Example: Internet Users Data Model Selection Criteria, Impulse Response Function to Study the Differences in Models Comparing Impulse Response Functions for Competing Models.	12Hrs
UNIT – 5	MULTIVARIATE TIME SERIES MODELS AND FORECASTING: Multivariate Time Series Models and Forecasting, Multivariate Stationary Process, Vector ARIMA Models, Vector AR (VAR) Models, Neural Networks and Forecasting Spectral Analysis, Bayesian Methods in Forecasting.	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)
2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek PalDr. PksPrakash (2017)



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY(Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158B1	L	T	P	C
		3	0	0	3
HIGH PERFORMANCE COMPUTING (PROGRAM ELECTIVE-II)					

Course Objectives: This course is aimed at enabling the students to

1. The main objective of the course is to introduce a variety of statistical models for time series and cover the main methods for analyzing these models

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Describe different parallel architectures, inter-connect networks programming models	K3
CO2	CO2 Develop an efficient parallel algorithm to solve given problem	K4
CO3	Analyze and measure performance of modern parallel computing systems	K5
CO4	CO4 Build the logic to parallelize the programming task	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction: Motivating Parallelism, Scope of Parallel Computing, Parallel Programming Platforms: Implicit Parallelism, Trends in Microprocessor and Architectures, Limitations of Memory, System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Scalable design principles, Architectures: N-wide superscalar architectures, Multi-core architecture.	10Hrs
UNIT – 2	Parallel Programming: Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing,	12Hrs

	Containing Interaction Overheads, Parallel Algorithm Models, The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU.	
UNIT – 3	Basic Communication: Operations- One-to-All Broadcast and All-to-One Reduction, All-to-All Broadcast and Reduction, All-Reduce and Prefix-Sum Operations, Scatter and Gather, All-to-All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations. Programming shared address space platforms: threads- basics, synchronization, OpenMP programming	12Hrs
UNIT – 4	Analytical Models: Sources of overhead in Parallel Programs, Performance Metrics for Parallel Systems, and The effect of Granularity on Performance, Scalability of Parallel Systems, Minimum execution time and minimum cost, optimal execution time. Dense Matrix Algorithms: Matrix Vector Multiplication, Matrix-Matrix	12Hrs
UNIT – 5	Parallel Algorithms- Sorting and Graph : Issues in Sorting on Parallel Computers, Bubble Sort and its Variants, Parallelizing Quick sort, All-Pairs Shortest Paths, Algorithm for sparse graph, Parallel Depth-First Search, Parallel Best First Search. CUDA Architecture: CUDA Architecture, Using the CUDA Architecture, Applications of CUDA Introduction to CUDA C-Write and launch CUDA C kernels, Manage GPU memory, Manage communication and synchronization, Parallel programming in CUDA- C.	12Hrs
	Total	58Hrs

*Note:

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason Sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3

Reference Books

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publishers Inc. San Francisco, CA, USA 2013 ISBN: 780124159884
3. David Culler Jaswinder Pal Singh, "Parallel Computer Architecture: A Hardware/ Software Approach", Morgan Kaufmann, 1999, ISBN 978-1-55860-343-1
4. Rod Stephens, "Essential Algorithms", Wiley, ISBN: ISBN: 978-1-118-61210-1



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158B2	L	T	P	C
		3	0	0	3
AGILE METHODOLOGIES (PROGRAM ELECTIVE-II)					

Course Objectives: This course is aimed at enabling the students to

1. The main objectives of this course are to introduce the important concepts of Agile software development Process, emphasize the role of stand-up meetings in software collaboration, impart the knowledge on values and principles in understanding agility

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Understand the core values and mindset of Agile Methodology for effective project development	K1
CO2	Explain Agile Principles and apply them in Agile Project management practices	K3
CO3	CO3 Describe Key concepts of XP, Simplicity, and Incremental Design	K2
CO4	Apply Lean Principles to identify and Eliminating Waste in software processes	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Learning Agile: Getting Agile into your brain, Understanding Agile values, No Silver Bullet, Agile to the Rescue, adding Agile makes a difference. A fractured perspective, How a fractured perspective causes project problems. The Agile Manifesto, Purpose behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software over Comprehensive Documentation, Customer Collaboration over Contract Negotiation, Responding to Change over Following a Plan,	10Hrs

	Methodologies Help You Get It All in Place at Once, Where to Start with a New Methodology	
UNIT – 2	The Agile Principles: The 12 Principles of Agile Software, The Customer Is Always Right, "Do As I Say, Not As I Said". Delivering the Project, Better Project Delivery for the Ebook Reader Project. Communicating and Working Together, Better Communication for the Ebook Reader Project. Project Execution—Moving the Project Along, A Better Working Environment for the Ebook Reader Project Team. Constantly Improving the Project and the Team. The Agile Project: Bringing All the Principles Together	12Hrs
UNIT – 3	SCRUM and Self-Organizing Teams: The Rules of Scrum, Act I: I Can Haz Scrum?, Everyone on a Scrum Team owns the Project, The Scrum Master Guides the Team's Decisions, The Product Owner Helps the Team Understand the Value of the Software, Everyone Owns the Project, Scrum Has Its Own Set of Values ,Status Updates Are for Social Networks!, The Whole Team Uses the Daily Scrum, Feedback and the Visibility-Inspection- Adaptation Cycle, The Last Responsible Moment, How to Hold an Effective Daily Scrum. Sprinting into a Wall, Sprints, Planning, and Retrospectives, Iterative or Incremental?, The Product Owner Makes or Breaks the Sprint, Visibility and Value, How to Plan and Run an Effective Scrum Sprint Scrum Planning And Collective Commitment: Not Quite Expecting the Unexpected, User Stories, Velocity, and Generally Accepted Scrum Practices, Make Your Software Useful, User Stories Help Build Features Your Users Will Use, Conditions of Satisfaction, Story Points and Velocity, Burndown Charts, Planning and Running a Sprint Using Stories, Points, Tasks, and a Task Board. Victory Lap, Scrum Values Revisited, Practices Do Work Without the Values (Just Don't Call It Scrum), Is Your Company's Culture Compatible with Scrum Values.	12Hrs
UNIT – 4	XP And Embracing Change: Going into Overtime, The Primary Practices of XP, Programming Practices, Integration Practices, Planning Practices, Team Practices, Why Teams Resist Changes, and How the Practices Help. The Game Plan Changed, but We're Still Losing, The XP Values Help the Team Change Their Mindset, XP Helps Developers Learn to Work with Users, Practices Only "Stick" When the Team Truly Believes in Them, An Effective Mindset Starts with the XP Values, The XP Values, Paved with Good Intentions. The Momentum Shifts, Understanding the XP Principles Helps You Embrace Change, The Principles of XP, XP Principles Help You Understand Planning, XP Principles Help You Understand Practices—and Vice Versa, Feedback Loops. XP , Simplicity, and Incremental Design: Code and Design, Code Smells and Antipatterns (or, How to Tell If You're Being Too Clever), XP Teams Look for Code Smells and Fix Them, Hooks, Edge Cases, and Code That Does Too Much. Make Code and Design Decisions at the Last Responsible Moment, Fix Technical Debt by Refactoring Mercilessly, Use Continuous Integration to Find Design Problems, Avoid Monolithic Design, Incremental Design and the Holistic XP Practices. Teams Work Best When They Feel Like They Have Time to	12Hrs

	Planning, Team, and Holistic Practices Form an Ecosystem Incremental Design Versus Designing for Reuse, When Units Interact in a Simple Way, the System Can Grow Incrementally, Great Design Emerges from Simple Interactions, Final Score.	
UNIT – 5	Lean, Eliminating Waste, and Seeing the whole: Lean Thinking, Commitment, Options Thinking, and Set-Based Development, Creating Heroes and Magical Thinking. Eliminate Waste, Use a Value Stream Map to Help See Waste Clearly, Gain a Deeper Understanding of the Product, See the Whole, Find the Root Cause of Problems That You Discover. Deliver As Fast As Possible, Use an Area Chart to Visualize Work in Progress, Control Bottlenecks by Limiting Work in Progress. Kanban, Flow, and Constantly Improving: The Principles of Kanban, Find a Starting Point and Evolve Experimentally from There. Stories Go into the System; Code Comes Out, Improving Your Process with Kanban, Visualize the Workflow, Limit Work in Progress. Measure and Manage Flow, Managing Flow with WIP Limits Naturally Creates Slack. Make Process Policies Explicit So Everyone Is on the Same Page. Emergent Behavior with Kanban. The Agile Coach: Coaches Understand Why People Don't Always Want to	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.

Reference Books:

1. Andrew stellman, Jennifer Green, Head first Agile, O'Reilly, 2017.
2. Rubin K , Essential Scrum : A practical guide to the most popular Agile process, Addison- Wesley, 2013



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158B3	L	T	P	C
		3	0	0	3
ADVANCED COMPILER DESIGN (PROGRAM ELECTIVE-II)					

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Demonstrate various phases involved in the design of compiler	K4
CO2	Organize and apply Syntax Analysis Techniques such as Top Down Parsing and LL(1) grammars	K3
CO3	CO3 Design Bottom Up Parsing and Construct LR parsers	K4
CO4	Analyse synthesized, inherited attributes and syntax directed translation schemes	K5
CO5	CO5 Determine appropriate algorithms for a target code generation	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Lexical Analysis: Language Processors, Structure of a Compiler, Lexical Analysis, The Role of the Lexical Analyzer, Bootstrapping, Input Buffering, Specification of Tokens, Recognition of Tokens, Lexical Analyzer Generator-LEX, Finite Automata, Regular Expressions and Finite Automata, Design of a Lexical Analyzer Generator.	10Hrs
UNIT – 2	Syntax Analysis: The Role of the Parser, Context-Free Grammars, Derivations, Parse Trees, Ambiguity, Left Recursion, Left Factoring, Top Down Parsing: Pre Processing Steps of Top Down Parsing, Backtracking, Recursive Descent Parsing, LL (1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing	12Hrs
UNIT – 3	Bottom Up Parsing: Introduction, Difference between LR and LL Parsers, Types of LR Parsers, Shift Reduce Parsing, SLR Parsers,	12Hrs

	Construction of SLR Parsing Tables, More Powerful LR Parses, Construction of CLR (1) and LALR Parsing Tables, Dangling Else Ambiguity, Error Recovery in LR Parsing, Handling Ambiguity Grammar with LR Parsers	
UNIT – 4	Syntax Directed Translation: Syntax-Directed Definitions, Evaluation Orders for SDD's, Applications of Syntax Directed Translation, Syntax-Directed Translation Schemes, Implementing L-Attributed SDD's. Intermediate Code Generation: Variants of Syntax Trees, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking, Control Flow, Backpatching, Intermediate Code for Procedures.	12Hrs
UNIT – 5	Run Time Environments: Storage Organization, Run Time Storage Allocation, Activation Records, Procedure Calls, Displays, Code Optimization: The Principle Sources of Optimization, Basic Blocks, Optimization of Basic Blocks, Structure Preserving Transformations, Flow Graphs, Loop Optimization, Data-Flow Analysis, Peephole Optimization, Code Generation: Issues in the Design of a Code Generator, Object Code Forms, Code Generation Algorithm, Register Allocation and Assignment.	12Hrs
	Total	58Hrs

*Note:

Text Books:

1. Compilers: Principles, Techniques and Tools, Second Edition, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffry D. Ullman, Pearson Publishers, 2007

Reference Books:

1. *Compiler Construction, Principles and Practice*, Kenneth C. Louden, Cengage Learning, 2006
2. *Modern compiler implementation in C*, Andrew W Appel, Revised edition, Cambridge University Press.
3. *Optimizing Compilers for Modern Architectures*, Randy Allen, Ken Kennedy, Morgan Kauffmann, 2001.
4. Levine, J.R., T. Mason and D. Brown, *Lex and Yacc*, edition, O'Reilly & Associates, 1990



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D25158B4	L	T	P	C
		3	0	0	3

Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS
(PROGRAM ELECTIVE-II)



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515803	L	T	P	C
		0	1	2	2
DATA STRUCTURES ALGORITHM & ANALYSIS LAB (Laboratory-1)					

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Ability to write and analyze algorithms for algorithm correctness and efficiency	K2
CO2	Master a variety of advanced abstract data type (ADT) and data structures and their Implementation.	K4
CO3	Demonstrate various searching, sorting and hash techniques and be able to apply and solve problems of real life	K4
CO4	Design and implement variety of data structures including linked lists, binary trees, heaps, graphs and search trees	K3
CO5	Ability to compare various search trees and find solutions for IT related problems	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
Experiment- 1	Write a java program to perform various operations on single linked list	10Hrs
Experiment- 2	Write a java program for the following a) Reverse a linked list b) Sort the data in a linked list c) Remove duplicates d) Merge two linked lists	12Hrs
Experiment- 3	Write a java program to perform various operations on doubly linked list	12Hrs
Experiment- 4	Write a java program to perform various operations on circular linked list	

Experiment- 5	Write a java program for performing various operations on stack using linked list	12Hrs
Experiment- 6	Write a java program for performing various operations on queue using linked list	12Hrs
Experiment- 7	Experiment- 7 Write a java program for the following using stack <ul style="list-style-type: none"> a) Infix to postfix conversion. b) Expression evaluation. 	
Experiment- 8	Write a java program to implement various operations on Binary Search Tree Using Recursive and Non-Recursive methods.	
Experiment- 9	Write a java program to implement the following for a graph. a) BFS b) DFS	
Experiment- 10	Write a java program to implement Merge & Heap Sort of given elements	
Experiment- 11	Write a java program to implement Quick Sort of given elements	
Experiment- 12	Write a java program to implement various operations on AVL trees	
Experiment- 13	Write a java program to perform the following operations: a) Insertion into a B-tree b) Searching in a B-tree	
Experiment- 14	Write a java program to implementation of recursive and non-recursive functions to Binary tree Traversals	
Experiment- 15	Write a java program to implement all the functions of Dictionary (ADT) using Hashing	
	Total	58Hrs



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515804	L	T	P	C
		0	1	2	2
ADVANCED DATA WAREHOUSING AND DATA MINING LAB (Laboratory-2)					

Pre-requisites: Data Base Management Systems, Python Programming

COURSE OBJECTIVES: The main objective of the course is to

- ✚ Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment
- ✚ Design a data warehouse or data mart to present information needed by management in a form that is usable
- ✚ Emphasize hands-on experience working with all real data sets.
- ✚ Test real data sets using popular data mining tools such as WEKA, Python Libraries
- ✚ Develop ability to design various algorithms based on data mining tools

Software Requirements: WEKA Tool/Python/R-Tool/Rapid Tool/Oracle Data mining

UNIT	CONTENTS	Contact Hours
Experiment- 1	<p>Creation of a Data Warehouse.</p> <p>1. Build Data Warehouse/Data Mart (using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects,etc.,)</p> <p>2. Design multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc).</p> <p>3. Write ETL scripts and implement using data warehouse tools. •Perform Various OLAP operations such slice, dice, roll up, drill up and pivot</p>	10Hrs

Experiment- 2	<ul style="list-style-type: none"> ➤ Explore machine learning tool "WEKA" ➤ Explore WEKA Data Mining/Machine Learning Toolkit. ➤ Downloading and/or installation of WEKA data mining toolkit. ➤ Understand the features of WEKA toolkit such as Explorer, Knowledge Flow interface, Experimenter, command-line interface. ➤ Navigate the options available in the WEKA (ex. Select attributes panel, Preprocess panel, Classify panel, Cluster panel, Associate panel and Visualize panel) ➤ Study the arff file format Explore the available data sets in WEKA. Load a data set (ex. Weather dataset, Iris dataset, etc.) <ul style="list-style-type: none"> ➤ Load each dataset and observe the following: 1. List the attribute names and they types 2. Number of records in each dataset 3. Identify the class attribute (if any) 4. Plot Histogram 5. Determine the number of records for each class. 6. Visualize the data in various dimensions 	12Hrs
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Experiment- 3	<p>Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets</p> <ol style="list-style-type: none"> 1.Explore various options available in Weka for preprocessing data and apply Unsupervised filters like Discretization, Resample filter, etc. on each dataset 2 Load weather, nominal, Iris, Glass datasets into Weka and run Apriori Algorithm with different support and confidence values. 3. Study the rules generated. Apply different discretization filters on numerical attributes and run the Apriori association rule algorithm. Study the rules generated. 4. Derive interesting insights and observe the effect of discretization in the rule generation process. 	12Hrs
Experiment- 4	<p>Demonstrate performing classification on data sets Weka/R</p> <ol style="list-style-type: none"> 1.Load each dataset and run 1d3, J48 classification algorithm. Study the classifier output. Compute entropy values, Kappa statistic. 2.Extract if-then rules from the decision tree generated by the classifier, Observe the confusion matrix. 3. Load each dataset into Weka/R and perform Naïve-bayes classification and k-Nearest Neighbour classification. Interpret the results obtained. 4. Plot RoC Curves 5. Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and deduce which classifier is performing best and poor for each dataset and justify. 	
Experiment- 5	<p>Demonstrate performing clustering of data sets</p> <ol style="list-style-type: none"> 1.Load each dataset into Weka/R and run simple k-means clustering algorithm with different values of k (number of desired clusters). 2. Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights. 3. Explore other clustering techniques available in Weka/R. Explore visualization features of Weka/R to visualize the clusters. Derive interesting insights and explain 	12Hrs

Experiment- 6	Demonstrate knowledge flow application on data sets into Weka/R 1.Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms 2.Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm Demonstrate plotting multiple ROC curves in the same plot window by using j48 and Random forest tree	12Hrs
Experiment- 7	Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations	
Experiment- 8	Write a java program to prepare a simulated data set with unique instances	
Experiment- 9	Write a Python program to generate frequent item sets / association rules using Apriori algorithm	
Experiment- 10	Write a program to calculate chi-square value using Python/R. Report your observation.	
Experiment- 11	Implement a Java/R program to perform Apriori algorithm	
Experiment- 12	Write a R program to cluster your choice of data using simple k-means algorithm using JDK	
Experiment- 13	Write a program of cluster analysis using simple k-means algorithm Python/R programming language	
Experiment- 14	Write a program to compute/display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python	
Experiment- 15	Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)	
		Total 58Hrs



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - I Semester	Course Code: D2515805	L	T	P	C
		0	0	2	1
Seminar-1					



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D2525800	L	T	P	C
		3	1	0	4
MACHINE LEARNING					

Course Objectives: The objectives of the course are to

1. Define machine learning and its different types (supervised and unsupervised) and understand their applications.
2. Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
3. Implement unsupervised learning techniques, such as K-means clustering.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Enumerate the Fundamentals of Machine Learning	K2
CO2	CO2 Build Nearest Neighbour based models	K2
CO3	CO3 Apply Models based on decision trees and Bayes rule	K4
CO4	CO4 Choose appropriate clustering technique	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction to Machine Learning: Evolution of Machine Learning, Paradigms for ML, Learning by Rote, Learning by Induction, Reinforcement Learning, Types of Data, Matching, Stages in Machine Learning, Data Acquisition, Feature Engineering, Data Representation, Model Selection, Model Learning, Model Evaluation, Model Prediction, Search and Learning, Data Sets	10Hrs

UNIT – 2	Nearest Neighbor-Based Models: Introduction to Proximity Measures, Distance Measures, Non-Metric Similarity Functions, Proximity Between Binary Patterns, Different Classification Algorithms Based on the Distance Measures ,K-Nearest Neighbor Classifier, Radius Distance Nearest Neighbor Algorithm, KNN Regression, Performance of Classifiers, Performance of Regression	12Hrs
UNIT – 3	Models Based on Decision Trees: Decision Trees for Classification, Impurity Measures, Properties, Regression Based on Decision Trees, Bias–Variance Trade-off, Random Forests for Classification and Regression The Bayes Classifier: Introduction to the Bayes Classifier, Bayes' Rule and Inference, The Bayes Classifier and its Optimality, Multi-Class Classification Class Conditional Independence and Naive Bayes Classifier (NBC)	12Hrs
UNIT – 4	: Linear Discriminants for Machine Learning: Introduction to Linear Discriminants, Linear Discriminants for Classification, Perceptron Classifier, Perceptron Learning Algorithm, Support Vector Machines, Linearly Non-Separable Case, Non-linear SVM, Kernel Trick, Logistic Regression, Linear Regression, Multi-Layer Perceptron's (MLPs), Backpropagation for Training an MLP	12Hrs
UNIT – 5	Clustering : Introduction to Clustering, Partitioning of Data, Matrix Factorization Clustering of Patterns, Divisive Clustering, Agglomerative Clustering, Partitional Clustering, K-Means Clustering, Soft Partitioning, Soft Clustering, Fuzzy C-Means Clustering, Rough Clustering, Rough K-Means Clustering Algorithm, Expectation Maximization-	12Hrs
		Total 58Hrs

*Note:

Text Books:

- 1."Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

- 1.Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
- 2."Machine Learning in Action",Peter Harrington, DreamTech
- 3."Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D2525801	L	T	P	C
		3	1	0	4
NATURAL LANGUAGE PROCESSING					

Course Objectives: This course introduces the fundamental concepts and techniques of natural language processing (NLP).

- Students will gain an in-depth understanding of the computational properties of natural languages and the commonly used algorithms for processing linguistic information.
- The course examines NLP models and algorithms using both the traditional symbolic and the more recent statistical approaches.
- Enable students to be capable to describe the application based on natural language processing and to show the points of syntactic, semantic and pragmatic processing.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Demonstrate a given text with basic Language features	K5
CO2	CO2 Design an innovative application using NLP components	K3
CO3	Explain a rule based system to tackle morphology/syntax of a language	K3
CO4	CO4 Design a tag set to be used for statistical processing for real-time applications	K3
CO5	compare and contrast the use of different statistical approaches for different types of NLP applications	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	INTRODUCTION: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology,	10Hrs

	rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance	
UNIT – 2	WORD LEVEL ANALYSIS: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models	12Hrs
UNIT – 3	SYNTACTIC ANALYSIS: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures	12Hrs
UNIT – 4	SEMANTICS AND PRAGMATICS: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.	12Hrs
UNIT – 5	DISCOURSE ANALYSIS AND LEXICAL RESOURCES: Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)	12Hrs
	Total	58Hrs

*Note:

Text Books:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, 2nd Edition, Daniel Jurafsky, James H. Martin – Pearson Publication, 2014.
2. Natural Language Processing with Python, First Edition, Steven Bird, Ewan Klein and Edward Loper, O'Reilly Media, 2009.

Reference Books:

1. Language Processing with Java and Ling Pipe Cookbook, 1st Edition, Breck Baldwin, Atlantic Publisher, 2015.
2. Natural Language Processing with Java, 2nd Edition, Richard M Reese, O'Reilly Media, 2015.
3. Handbook of Natural Language Processing, Second, Nitin Indurkha and Fred J. Damerau, Chapman and Hall/CRC Press, 2010. Edition Natural Language Processing and Information Retrieval, 3rd Edition, Tanveer Siddiqui, U.S. Tiwary, Oxford University Press, 2008.



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY (Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year – II Semester	Course Code: D2525802	L	T	P	C
		3	1	0	4
INTRODUCTION TO QUANTUM COMPUTING					

Course Objectives: The main objectives of the course are to

1. Introduce fundamental concepts of quantum mechanics and its mathematical formalism. Explore quantum computing and communication principles and technologies.
2. Understand the physical implementation and limitations of quantum systems.
3. Enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
4. Familiarize students with the emerging trends in quantum technologies

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Describe the Historical development of quantum theory and its relevance to modern computing	K2
CO2	CO2 Define Qubits and Compare the Classical vs. quantum information	K4
CO3	CO3 Explain the Classical computing review and limitations	K3
CO4	Demonstrate the principles and techniques of Quantum error correction	K4
CO5	Discuss the working, applications and potential of Quantum sensors in real-world scenarios	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations	10Hrs
UNIT – 2	Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)	12Hrs
UNIT – 3	Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.	12Hrs
UNIT – 4	Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm	12Hrs
UNIT – 5	Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation	12Hrs
		Total 58Hrs

*Note:

Text Books:

- 1.Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

Reference Books:

- 1.Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
- 2.Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol.I: Basic Concepts, Vol II
- 3.Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258A0	L	T	P	C
		3	0	0	3
FEATURE ENGINEERING (PROGRAM ELECTIVE-III)					

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Describe the Basic concepts of Data, Tasks, Models, Features and Model building	K2
CO2	Explain the concept of converting Text into Flat Vectors using Bag- of- Words, and Bag-of-n-Grams	K3
CO3	CO3 Demonstrate techniques for Dimensionality Reduction	K4
CO4	CO4 Discuss non linear Featurization	K4
CO5	Explain the concept of Item-Based Collaborative Filtering	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	The Machine Learning Pipeline: Data, Tasks, Models, Features, Model Evaluation Fancy Tricks with Simple Numbers: Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Log Transform in Action, Power Transforms: Generalization of the Log Transform, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling), ℓ_2 Normalization, Interaction Features, Feature Selection	10Hrs
UNIT – 2	Text Data: Flattening, Filtering, and Chunking: Bag-of-X: Turning Natural Text into Flat Vectors, Bag- of-Words, Bag-of-n-Grams, Filtering for Cleaner Features: Stopwords, Frequency-Based Filtering, Stemming; Atoms of Meaning: From Words to n-Grams to Phrases: Parsing and Tokenization, Collocation Extraction for Phrase Detection The Effects of Feature Scaling: From Bag-of-Words to Tf-Idf : Tf-Idf : A Simple Twist on Bag-of- Words, Putting It to the Test : Creating a Classification Dataset,	12Hrs

	Scaling Bag-of-Words with Tf-Idf Transformation, Classification with Logistic Regression, Tuning Logistic Regression with Regularization	
UNIT – 3	Categorical Variables: Counting Eggs in the Age of Robotic Chickens; Encoding Categorical Variables: One-Hot Encoding, Dummy Coding, Effect Coding, Pros and Cons of Categorical Variable Encodings; Dealing with Large Categorical Variables: Feature Hashing, Bin Counting. Dimensionality Reduction: Squashing the Data Pancake with PCA: Intuition, Derivation: Linear Projection, Variance and Empirical Variance, Principal Components: First Formulation, Principal Components: Matrix-Vector Formulation, General Solution of the Principal Components; Transforming Features, Implementing PCA: PCA in Action, Whitening and ZCA, Considerations and Limitations of PCA	12Hrs
UNIT – 4	Nonlinear Featurization via K-Means Model Stacking: k-Means Clustering, Clustering as Surface Tiling, k-Means Featurization for Classification: Alternative Dense Featurization, Pros, Cons, and Gotchas	12Hrs
UNIT – 5	Item-Based Collaborative Filtering, First Pass: Data Import, Cleaning, and Feature Parsing, Academic Paper Recommender: Naive Approach, Second Pass: More Engineering and a Smarter Model, Academic Paper Recommender: Take 2, Third Pass: More Features is More Information, Academic Paper Recommender: Take 3	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. "Feature Engineering for Machine Learning Principles and Techniques for Data Scientists", Alice Zheng& Amanda Casari, O'REILLY, 2018
2. "Feature Engineering and Selection: A Practical Approach for Predictive Models", Max Kuhn, Kjell Johnson, CRC Press, 2019



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258A1	L	T	P	C
		3	0	0	3
GENERATIVE AI (PROGRAM ELECTIVE-III)					

Course Objectives:

1. To learn Python and TensorFlow skills for Generative AI.
2. To study techniques for cleaning and preparing data for Generative AI tasks.
3. To implement generative AI models
4. To develop innovative applications using generative AI tools and techniques.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Implement Python and TensorFlow basics, including data handling and preprocessing techniques	K5
CO2	Implement Generative AI models such as GANs, VAEs, LSTM networks, and Transformer models for image text, and music	K4
CO3	Evaluate model performance and experiment with hyper parameters and optimization techniques to enhance Generative AI outcomes.	K6
CO4	Develop innovative applications in image, text, and music generation, showcasing practical skills	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction To Gen Ai: Historical Overview of Generative modelling, Difference between Gen AI and Discriminative Modeling, Importance of generative models in AI and Machine Learning, Types of Generative models, GANs, VAEs, autoregressive models and Vector quantized Diffusion models, Understanding if probabilistic modeling and generative process, Challenges of Generative Modeling, Future of Gen AI, Ethical Aspects of AI, Responsible AI, Use Cases	10Hrs

UNIT – 2	Generative Models For Text: Language Models Basics, Building blocks of Language models, Transformer Architecture, Encoder and Decoder, Attention mechanisms, Generation of Text, Models like BERT and GPT models, Generation of Text, Autoencoding, Regression Models, Exploring ChatGPT, Prompt Engineering: Designing Prompts, Revising Prompts using Reinforcement Learning from Human Feedback (RLHF), Retrieval Augmented Generation, Multimodal LLM, Issues of LLM like hallucination	12Hrs
UNIT – 3	Generation of Images: Introduction to Generative Adversarial Networks, Adversarial Training Process, Nash Equilibrium, Variational Autoencoders, Encoder-Decoder Architectures, Stable Diffusion Models, Introduction to Transformer-based Image Generation, CLIP, Visual Transformers ViT- Dall-E2 and Dall-E3, GPT-4V, Issues of Image Generation models like Mode Collapse and Stability.	12Hrs
UNIT – 4	Generation of Painting, Music, and Play: Variants of GAN, Types of GAN, Cyclic GAN, Using Cyclic GAN to Generate Paintings, Neural Style Transfer, Style Transfer, Music Generating RNN, MuseGAN, Autonomous agents, Deep Q Algorithm, Actor-critic Network.	12Hrs
UNIT – 5	Open Source Models And Programming Frameworks: Training and Fine tuning of Generative models, GPT 4 All, Transfer learning and Pretrained models, Training vision models, Google Copilot, Programming LLM, LangChain, Open Source Models, Llama, Programming for TimeSformer, Deployment, Hugging Face.	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. Denis Rothman, "Transformers for Natural Language Processing and Computer Vision", Third Edition , Packt Books, 2024

Reference Books:

1. David Foster, "Generative Deep Learning", O'Reily Books, 2024.
2. Altaf Rehmani, "Generative AI for Everyone", BlueRose One, 2024.



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258A2	L	T	P	C
		3	0	0	3
ADHOC SENSOR NETWORKS (PROGRAM ELECTIVE-III)					

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Describe fundamentals of wireless communication, wireless propagation, and challenges in adhoc and sensor networks	K2
CO2	Analyze MAC layer issues and protocols in adhoc networks including IEEE 802.11	K4
CO3	Evaluate routing and transport layer protocols in adhoc wireless networks and explain their security considerations	K5
CO4	Explain WSN architecture ,sensor node components and MAC protocols including IEEE 802.15.4	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction: Fundamentals of Wireless Communication Technology, The Electromagnetic Spectrum, Radio propagation Mechanisms, Characteristics of the Wireless channel mobile ad hoc networks (MANETs), Wireless Sensor Networks (WSNs): concepts and architectures, Applications of Ad Hoc and Sensor Networks, Design Challenges in Ad hoc and Sensor Networks	10Hrs

UNIT – 2	MAC Protocols for Ad Hoc Wireless Networks: Issues in designing a MAC Protocol, Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention based protocols, Contention based protocols with Reservation Mechanisms, Contention based protocols with Scheduling Mechanisms, Multi-channel MAC – IEEE 802.11.	12Hrs
UNIT – 3	Routing Protocols and Transport Layer In Ad Hoc Wireless Networks: Routing Protocol: Issues in designing a routing protocol for Ad hoc networks, Classification, proactive routing, reactive routing (on-demand), hybrid routing, Transport Layer protocol for Ad hoc networks, Design Goals of a Transport Layer Protocol for AdHoc Wireless Networks, Classification of Transport Layer solutions-TCP over Ad hoc wireless, Network Security, Security in Ad Hoc Wireless Networks, Network Security Requirements.	12Hrs
UNIT – 4	Wireless Sensor Networks (WSNS) And Mac Protocols: 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.	12Hrs
UNIT – 5	: WSN Routing, Localization & Qos: Issues in WSN routing, OLSR, Localization, Indoor and Sensor Network Localization, absolute and relative localization, triangulation, QOS in WSN, Energy Efficient Design, Synchronization.	12Hrs
		Total 58Hrs

*Note:

Text Books:

1. Ad Hoc Wireless Networks: Architectures and Protocols "C. Siva Ram Murthy, and B. S. Manoj, Pearson Education, 2008
2. "Wireless Adhoc and Sensor Networks", Labiod. H, Wiley, 1 st edition-2008
3. "Wireless ad -hoc and sensor Networks: theory and applications", Li, X, Cambridge University Press, fifth edition-2008.

Reference Books:

1. "Ad Hoc & Sensor Networks: Theory and Applications", 2nd edition, Carlos De MoraisCordeiro, Dharma Prakash Agrawal ,World Scientific Publishing Company, 2011
2. Wireless Sensor Networks Feng Zhao and LeonidesGuibas,Elsevier Publication 2nd edition-2004
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig,Wiley, 2005 (soft copy available)
4. "Wireless Sensor Networks Technology, Protocols, and Applications", KazemSohraby, Daniel Minoli, & TaiebZnati, John Wiley, 2007. (soft copy available)



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258A3	L	T	P	C
		3	0	0	3
PRINCIPLES OF NETWORK SECURITY (PROGRAM ELECTIVE-III)					

COURSE OBJECTIVES:

1. Explain the objectives of information security
2. Explain the importance and application of each of confidentiality, integrity, authentication and availability
3. Understand the basic categories of threats to computers and networks
4. Discusses the Mathematics of Cryptography
5. Discuss the fundamental ideas of Symmetric and Asymmetric Cryptographic Algorithms
6. Discusses the Network layer, Transport Layer and Application Layer Protocols Enhanced security mechanisms

Course Outcomes: At the end of the course, student will be able to

CO	Course Outcomes	Knowledge Level (K)#
CO1	Understand security issues related to computer networks and learn different symmetric key techniques	K2
CO2	Apply mathematic of cryptography for symmetric and Asymmetric algorithms and apply this knowledge to understand the Cryptographic algorithms	K3
CO3	CO3 Understand and Compare different types of symmetric and	K2
CO4	Explain Hash functions, message authentication and digital signature and their importance to the security	K2
CO5	CO5 Analyze enhanced security protocols at various network layer,	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L-1, M-2, H-3)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Security Concepts: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography. Classical Encryption Techniques-symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines,	10Hrs
UNIT – 2	Introduction to Symmetric Cryptography: Algebraic Structures- Groups, Rings, Fields, GF(2) fields, Polynomials. Mathematics of Asymmetric cryptography: Primes, Checking For Primeness, Eulers phi-functions, Fermat's Little Theorem, Euler's Theorem, Generating Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence Exponentiation And Logarithm.	12Hrs
UNIT – 3	Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, IDEA, Block cipher operation, Stream ciphers: RC4, RC5 Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elgamal Cryptographic system, Elliptic Curve Arithmetic, Elliptic Curve Cryptography.	12Hrs
UNIT – 4	Cryptographic Hash Functions: Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithms (SHA) Message Authentication Codes: Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MAC'S, MAC'S Based On Hash Functions: HMAC, MAC'S Based On Block Ciphers: DAA And CMAC Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, RSA-PSS Digital Signature Algorithm.	12Hrs
UNIT – 5	Network and Internet Security: Transport-Level Security: Web Security Considerations, Transport Level Security, HTTPS, SSH. IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Authentication Header Protocol. Electronic-Mail Security: Internet-mail Security, Email Format, Email Threats and Comprehensive Email Security, S/MIME, PGP.	12Hrs
		Total 58Hrs

*Note:

TEXT BOOKS:

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 7th Edition, 2017
2. Cryptography and Network Security: Behrouz A. Forouzan Debdeep, Mc Graw Hill, 3rd Edition, 2015

REFERENCE BOOKS:

1. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
2. Introduction to Cryptography with Coding Theory: Wade Trappe, Lawrence C. Washington, Pearson.
3. Modern Cryptography: Theory and Practice By Wenbo Mao. Pearson



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258B0	L	T	P	C
		3	0	0	3

BLOCK CHAIN TECHNOLOGIES

(PROGRAM ELECTIVE-IV)

Course Objectives:

1. Architect sensor networks for various application setups.
2. Devise appropriate data dissemination protocols and model links cost.
3. Understandings of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
4. Evaluate the performance of sensor networks and identify bottlenecks

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Discuss the Cryptographic primitives used in Blockchain (K2)	K2
CO2	CO2 Discuss about various technologies borrowed in blockchain (K2)	K2
CO3	CO3 Illustrate various models for blockchain (K2)	K2
CO4	CO4 Discuss about Ethereum (K2)	K2
CO5	CO5 Discuss about Hyperledger Fabric (K2)	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	INTRODUCTION TO BLOCKCHAIN: Introduction, history of Bitcoin and origins of Blockchain, Fundamentals of Blockchain and key components (Chapter 1-book1), Permission and Permissionless platforms(Chapter 1-book2), Introduction to Cryptography, SHA256 and ECDSA, Hashing and Encryption, Symmetric/Asymmetric keys, Private and Public Keys(Chapter 3-book2).	10Hrs

UNIT – 2	TECHNOLOGIES BORROWED IN BLOCKCHAIN: Technologies Borrowed in Blockchain –hash pointers- - Digital cash etc.- Bitcoin blockchain - Wallet – Blocks Merkley Tree - hardness of mining - Transaction verifiability - Anonymity - forks - Double spending - Mathematical analysis of properties of Bitcoin - Bitcoin- the challenges and solutions. (Chapter 3-book2).	12Hrs
UNIT – 3	CONSENSUS MECHANISMS : Consensus Algorithms: Proof of Work (PoW) as random oracle - Formal treatment of consistency- Liveness and Fairness - Proof of Stake (PoS) based Chains -Hybrid models (PoW + PoS), Byzantine Models of fault	12Hrs
UNIT – 4	ETHEREUM: Ethereum -Ethereum Virtual Machine (EVM) -Wallets for Ethereum -Solidity - Smart Contracts (Chapter 5-book1), - The Turing Completeness of Smart Contract Languages and verification challenges- Using smart contracts to enforce legal contracts- Comparing Bitcoin scripting vs. Ethereum Smart Contracts-Some attacks on smart contracts (Chapter 6 and	12Hrs
UNIT – 5	HYPERLEDGER FABRIC: Hyperledger fabric- the plug and play platform and mechanisms in permissioned blockchain - Beyond Cryptocurrency – applications of blockchain in cyber security- integrity of information- E-Governance and other contract enforcement mechanisms - Limitations of blockchain as a technology and myths vs reality of blockchain technology (Chapter 16-book1), (Chapter 9 -book2)	12Hrs
	Total	58Hrs

*Note:

Text Books:

1. Blockchain Technology Chandramouli Subramanian, Asha A George, Abhilash K A and Meena Karthikeyan, University Press, 2020.
2. Mastering Blockchain - Distributed ledger technology, decentralization, and smart contracts explained, Imran Bashir,2nd ed. Edition,2018, pakct publication

Reference Books:

1. .Shukla, M.Dhawan, S.Sharma,S. Venkatesan "Blockchain Technology: Cryptocurrency and Applications" ,Oxford University Press 2019 .
2. Cryptography and network security principles and practice, William Stallings, Pearson, 8th edition,

WEB REFERENCES:

1. <https://drive.google.com/file/d/1PtYaDmWYaqPVGjKDnMYGWO5eoI5wMPtJ/view>
2. <https://archive.nptel.ac.in/courses/106/104/106104220/>
3. <https://www.tutorialspoint.com/blockchain/index.htm>



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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258B1	L	T	P	C
		3	0	0	3
DEVOPS (PROGRAM ELECTIVE-IV)					

Course Objectives: The main objectives of this course are to:

1. Describe the agile relationship between development and IT operations.
2. Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability.
3. Implement automated system update and DevOps lifecycle.

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	CO1 Explain DevOps Life cycle process	K2
CO2	CO2 Demonstrate the concept of Code coverage	K3
CO3	Explain Jenkins , jenkins workflow, jenkins master slave architecture, Jenkins Pipelines	K2
CO4	CO4 Discuss the concept of Dockers Command and running containers	K2

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction to Dev Ops: Introduction to SDLC, Agile Model. Introduction to DevOps. DevOps Features, DevOps Architecture, DevOps Lifecycle, Understanding Workflow and principles, Introduction to DevOps tools, Build Automation, Delivery Automation. Understanding Code Quality, Automation of CI/CD. Release	10Hrs

UNIT – 2	Source Code Management (GIT): The need for source code control, The history of source code management, Roles and code, source code management system and migrations. What is Version Control and GIT, GIT Installation, GIT features, GIT workflow, working with remote repository, GIT commands, GIT branching, GIT staging and collaboration. UNIT TESTING-CODECOVERAGE: Junit ,nUnit & Code Coverage with Sonar Qube, SonarQube - Code Quality Analysis.	12Hrs
UNIT – 3	Build Automation - Continuous Integration (CI): Build Automation, What is CI Why CI is Required, CI tools, Introduction to Jenkins (With Architecture), Jenkins workflow, Jenkins master slave architecture, Jenkins Pipelines, PIPELINE BASICS - Jenkins Master, Node, Agent, and Executor Freestyle Projects& Pipelines, Jenkins for Continuous Integration, Create and Manage Builds, User Management in Jenkins Schedule Builds, Launch Builds on Slave Nodes.	12Hrs
UNIT – 4	Continuous Delivery: Importance of Continuous Delivery, CONTINUOUS DEPLOYMENT CD Flow, Containerization with Docker: Introduction to Docker, Docker installation, Docker commands, Images & Containers, Docker File, running containers, working with containers and publish to Docker Hub. Testing Tools: Introduction to Selenium and its features, Java Script testing	12Hrs
UNIT – 5	Configuration Management - ANSIBLE: Introduction to Ansible, Ansible tasks Roles, Jinja2 templating, Vaults, Deployments using Ansible. CONTAINERIZATION USING UBERNETES(OPENSHIFT): Introduction to Kubernetes Namespace & Resources, CI/CD - On OCP, BC, DC& Config Maps, Deploying Apps on Open shift Container Pods. Introduction to Puppet master and Chef	12Hrs
Total		58Hrs

*Note:

List of Experiments:

1. Write code for a simple user registration form for an event.
2. Explore Git and GitHub commands.
3. Practice Source code management on GitHub. Experiment with the source code written in exercise 1.
4. Jenkins installation and setup, explore the environment.
5. Demonstrate continuous integration and development using Jenkins.
6. Explore Docker commands for content management.
7. Develop a simple containerized application using Docker.

8. Integrate Kubernetes and Docker
9. Automate the process of running containerized application developed in exercise 7 using Kubernetes.
10. Install and Explore Selenium for automated testing.
11. Write a simple program in Java Script and perform testing using Selenium.
12. Develop test cases for the above containerized application sing selenium.

Text Books

1. Joyner, Joseph., DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and It Professionals, 1st Edition Mihails Konoplows, 2015.
2. Alisson Machado de Menezes., Hands-on DevOps with Linux, 1st Edition, BPB Publications, India, 2021.

Reference Books

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10
2. Gene Kim Je Humble, Patrick Debois, John Willis. The DevOps Handbook, 1st Edition, IT Revolution Press, 2016.
3. Verona ,Joakim Practical DevOps, 1st Edition, Packt Publishing, 2016.
4. Joakim Verona. Practical Devops, Second Edition. In gram short title; 2nd edition (2018). ISBN10: 1788392574
5. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's View point. Wiley publications. ISBN:9788126579952

Web Resources:

4. <https://archive.nptel.ac.in/courses/106/104/106104220/>
5. <https://www.tutorialspoint.com/blockchain/index.htm>



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258B2	L	T	P	C
		3	0	0	3
SECURE CODING (PROGRAM ELECTIVE-IV)					

Course Objectives:

1. Understanding of the various security attacks and knowledge to recognize and remove common coding errors that lead to vulnerabilities.
2. Knowledge of outline of the techniques for developing a secure application.
3. Recognize opportunities to apply secure coding principles

Course Outcomes: At the end of the course, student will be able to (Four to Six)

		Knowledge Level (K) #
CO1	Demonstrate the development of process of software leads to secure coding practices	K3
CO2	CO2 Apply Secure programs and various risk in the software's	K3
CO3	CO3 Classify various errors that lead to vulnerabilities	K4
CO4	CO4 Design Real time software and vulnerabilities	K6

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

(Please fill the above with Levels of Correlation, viz., L, M, H)

UNIT	CONTENTS	Contact Hours
UNIT – 1	Introduction- Need for secure systems, Proactive security development process, Security principles to live by and threat modelling.	10Hrs
UNIT – 2	Secure Coding in C- Character strings- String manipulation errors, String Vulnerabilities and exploits Mitigation strategies for strings, Pointers, Mitigation strategies in pointer based vulnerabilities Buffer Overflow based vulnerabilities	12Hrs
UNIT – 3	Secure Coding in C++ and Java- Dynamic memory management, Common errors in dynamic memory management, Memory managers, Double –free vulnerabilities, Integer security, Mitigation strategies	12Hrs

UNIT – 4	Database and Web Specific Input Issues - Quoting the Input, Use of stored procedures, Building SQL statements securely, XSS related attacks and remedies	12Hrs
UNIT – 5	Software Security Engineering - Requirements engineering for secure software: Misuse and abuse cases, SQUARE process model Software security practices and knowledge for architecture and design	12Hrs
	Total	58Hrs

*Note:

Text Books:

1. Writing Secure Code, 2 nd Edition, Michael Howard, David LeBlanc, Microsoft Press, 2003

Reference Books:

2. Secure Coding in C and C++, Robert C. Seacord, 2 nd edition, Pearson Education, 2013
3. Software Security Engineering: A guide for Project Managers, 1 st ed, Julia H. Allen, Sean J. Barnum, Robert J. Ellison, Gary McGraw, Nancy R. Mead, Addison-Wesley Professional, 2008

UNIT	CONTENTS	Contact Hours
UNIT – 1	What is a Design Pattern, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalogue of Design Patterns, Organizing The Catalog, How Design Patterns solve Design Problems, How to Select a Design pattern, How to Use a Design Pattern.	10Hrs
UNIT – 2	A Case Study: Designing a Document Editor, Design Problems , Document Structure, Formatting , Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary, Creational Patterns, Abstract Factory, Builder , Factory Method, Prototype, Singleton, Discussion of Creational Patterns.	12Hrs
UNIT – 3	Structural Pattern Part-I, Adapter, Bridge, Composite. Structural Pattern Part-II, Decorator, Facade, Flyweight, Proxy.	12Hrs
UNIT – 4	Behavioral Patterns Part: I, Chain of Responsibility, Command, Interpreter, Iterator. Behavioral Patterns Part: II, Mediator, Memento, Observer, Discussion of Behavioral Patterns.	12Hrs
UNIT – 5	Behavioral Patterns Part: III, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. What to Expect from Design Patterns, A Brief History, The Pattern Community, An Invitation, A Parting Thought.	12Hrs
	Total	58Hrs

*Note:

Text Books:

- 1.Design Patterns By Erich Gamma, Pearson Education

Reference Books:

- 1.Patterns in JAVA Vol-I (or) Vol-II By Mark Grand, Wiley Dream Tech.
- 2.Java Enterprise Design Patterns Vol-III By Mark Grand Wiley Dream Tech



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY(Autonomous)
BALUSUMUDI, BHIMAVARAM, W.G. Dist., A.P., PIN-534 202

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D25258B3	L	T	P	C
		3	0	0	3
Any minimum 12 weeks MOOCS/NPTEL courses suggested by BOS (PROGRAM ELECTIVE-IV)					



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D2525803	L	T	P	C
		0	1	2	2
MACHINE LEARNING LAB (Laboratory-3)					

Pre-requisites: Data Base Management Systems, Python Programming

COURSE OBJECTIVES: The main objective of the course is to

1. To learn about computing central tendency measures and Data pre-processing techniques
2. To learn about classification and regression algorithms
3. To apply different clustering algorithms for a problem.

Software's Required: Python/R/Weka

UNIT	CONTENTS	Contact Hours
Experiment- 1	Compute Central Tendency Measures: Mean, Median, Mode Measure of Dispersion: Variance, Standard Deviation.	10Hrs
Experiment- 2	Apply the following Pre-processing techniques for a given dataset. a. Attribute selection b. Handling Missing Values c. Discretization d. Elimination of	12Hrs
Experiment- 3	Apply KNN algorithm for classification and regression	12Hrs
Experiment- 4	Demonstrate decision tree algorithm for a classification problem and perform parameter tuning for better results	
Experiment- 5	Demonstrate decision tree algorithm for a regression problem	12Hrs
Experiment- 6	Apply Random Forest algorithm for classification and regression	12Hrs
Experiment- 7	Experiment- 7 Demonstrate Naïve Bayes Classification algorithm	
Experiment- 8	Experiment- 8 Apply Support Vector algorithm for classification	
Experiment- 9	Demonstrate simple linear regression algorithm for a regression problem	
Experiment- 10	Apply Logistic regression algorithm for a classification problem	
Experiment- 11	Demonstrate Multi-layer Perceptron algorithm for a classification problem	
Experiment- 12	Implement the K-means algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of	

	the Euclidean distance of each example from its class center. Test the performance of the algorithm as a function of the parameters K.	
Experiment – 13	Demonstrate the use of Fuzzy C-Means Clustering	
Experiment – 14	Demonstrate the use of Expectation Maximization based clustering algorithm	
	Total	58Hrs



DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

I Year - II Semester	Course Code: D2525804	L	T	P	C
		0	1	2	2
NATURAL LANGUAGE PROCESSING LAB (Laboratory-4)					

Pre-requisites: Data Base Management Systems, Python Programming

COURSE OUTCOMES: On completion of this course, the student will be able to

1. Design Neural networks to solve real world problems
2. Build RNN, CNN models for classification
3. Choose appropriate pre-trained model to solve real time problem •Apply different NLP techniques using NLTK package.
4. Design solutions to real-world problems using NLP

Software Packages Required:

- Keras
- Tensorflow
- PyTorch
- NLTK

UNIT	CONTENTS	Contact Hours
Experiment- 1	Implement Multilayer Perceptron algorithm for MNIST Handwritten Digit Classification.	10Hrs
Experiment- 2	Experiment- 2 Design Neural Network for following problems i). Movie reviews classification (Binary Classification) using IMDB dataset. ii). News Wires classification (Multiclass Classification) using Reuters dataset.	12Hrs
Experiment- 3	Implement a Recurrent Neural Network(RNN) and LSTM for IMDB movie review classification problem	12Hrs
Experiment- 4	Build a Convolution Neural Network for simple image (dogs and Cats) Classification	
Experiment- 5	Use a Pre-trained Convolution Neural Network LeNet, AlexNet for image classification	12Hrs
Experiment- 6	Implement One Hot Encoding and Word Embeddings on any real world dataset	12Hrs
Experiment- 7	Create Sample list at least 10 words POS tagging and find the POS for any given word	
Experiment- 8	Write a Python program to	

	i). Perform Morphological Analysis using NLTK library ii) Generate n-grams using NLTK N-Grams library iii). Implement N-Grams Smoothing	
Experiment- 9	Write a program to implement Named Entity Recognition(NER) for any corpus	
Experiment- 10	Using NLTK package to convert audio file to text and text file to audio files	
Experiment- 11	Write a program to perform Auto-Correction of spellings for any text	
Experiment- 12	Implement twitter sentiment analysis using NLP.	
		Total 58Hrs



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I Year - II Semester	Course Code: D2525805	L	T	P	C
		0	0	2	1
Seminar-II					



D.N.R. COLLEGE OF ENGINEERING & TECHNOLOGY

AUTONOMOUS

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Accredited with A++ Grade by NAAC & Accredited by NBA (B. TECH – CSE, ECE & EEE)

Ph: 08816-221238 Email: dnrcet@gmail.com website: <https://dnrcet.org>

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Date:20-01-2026

List of Professors for Paper Setting

S.No	Name, Designation & Address
1	Dr. N. Ramakrishnaiah Professor Department of Computer Science & Engineering University College of Engineering Kakinada JNTUK, Kakinada Email: nrkrishna27@gmail.com 9652730019
2	Dr. D Haritha Professor & HoD Department of Computer Science & Engineering University College of Engineering Kakinada JNTUK, Kakinada harithadasari@jntucek.ac.in 7680994555, 9440810901
3	Dr. T Rama Krishnudu Associate Professor Department of Computer Science & Engineering NIT Warangal trk@nitw.ac.in, 9866876842.
4	Dr. Tushar Mishra, Professor, Dept. Of CSE, MIT, Bengaluru Experience:21Y
5	Dr. G Sudhakar Professor Swarnandhra College of Engineering & Technology Department of Computer Science & Engineering sudha.godi@gmail.com Ph: 9705412233, Exp: 15 Y
6	Dr. KSN Prasad, Professor, Dept.Of CSE, Sasi Engineering College, Exp:20Y

7	<p>Dr. D. Marlene Grace Varghese, Asoc. Prof. Dept. Of IT, Vidya Jyothi Institute of Technology(A) , Hyderabad Experience:15Y Degala.marlene@gmail.com</p>
8	<p>Dr. Deepak Sethi Associate Professor Dept. Of IT MIT, Bengaluru, Experience:16Y Deepak.sethi@manipal.edu</p>

Nandakumar
Chairperson Board of Studies /
Head of the Department
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BHIMAVARAM-534 202.

Course Code: D25158A3									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
ADVANCED SOFTWARE ENGINEERING									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1		CO	KL	M			
1.A	i).	Explain the nature of software and software engineering practice .		1	2	6			
	ii).	Explain the generic process model and describe framework activities .		1	3	6			
		OR							
1.B	i).	Discuss process assessment and process improvement in software engineering.		1	3	6			
	ii).	Explain agility and agile process . Discuss Scrum and other agile frameworks .		1	4	6			
		UNIT-2							
2.A	i).	Explain the characteristics and psychology of a software engineer . Describe software team structures .		2	2	6			
	ii).	Discuss the core principles that guide software engineering practice .		2	3	6			
		OR							
2.B	i).	Explain the requirements engineering process including: requirements gathering, use cases, and analysis modeling.		2	4	6			
	ii).	Describe requirements modeling techniques : class-based, functional, and behavioral modeling.		2	3	6			
		UNIT-3							
3.A	i).	Explain the design process, design concepts, and design model .		3	2	6			
	ii).	Discuss software architecture and explain different architectural styles .		3	4	6			
		OR							
3.B	i).	Explain user interface design principles and golden rules of UI design .		3	3	6			
	ii).	Explain design for mobility : mobile architecture, mobile development life cycle, and best practices.		3	4	6			
		UNIT-4							
4.A	i).	Explain software quality and discuss the quality dilemma .		4	2	6			
	ii).	Explain formal and informal reviews and their importance.		4	3	6			
		OR							

4.B	i).	Describe Software Quality Assurance (SQA) process, goals, and metrics.	4	4	6
	ii).	Explain white box testing and black box testing techniques.	4	3	6
UNIT-5					
5.A	i).	Explain integration testing and regression testing .	5	2	6
	ii).	Discuss validation testing and object-oriented integration testing .	5	3	6
OR					
5.B	i).	Explain mobile application testing guidelines and testing strategies.	5	4	6
	ii).	Explain software metrics and analytics . Discuss product, process, and project metrics .	5	4	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D25258A2

DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)

DR25

I M. Tech. I Semester MODEL QUESTION PAPER

ADHOC SENSOR NETWORKS

For Computer Science & Engineering

Time: 3 Hrs.

Max. Marks: 60 M

Answer ONE Question from EACH UNIT

Assume suitable data if necessary

5 x 12 = 60 Marks

UNIT-1			CO	KL	M
1.A	i).	Explain the fundamentals of wireless communication technology and the electromagnetic spectrum .	1	2	6
	ii).	Describe radio propagation mechanisms and explain the characteristics of the wireless channel .	1	3	6
OR					
1.B	i).	Explain Mobile Ad Hoc Networks (MANETs) and Wireless Sensor Networks (WSNs) with their architectures.	1	3	6
	ii).	Discuss the design challenges and applications of Ad Hoc and Sensor Networks .	1	4	6
UNIT-2					
2.A	i).	Explain the issues and design goals of a MAC protocol for Ad Hoc Wireless Networks.	2	2	6
	ii).	Classify MAC protocols for Ad Hoc networks and explain contention-based protocols .	2	3	6
OR					
2.B	i).	Explain contention-based MAC protocols with reservation and scheduling mechanisms .	2	3	6
	ii).	Describe multi-channel MAC protocols and explain IEEE 802.11 MAC in Ad Hoc mode.	2	3	6
UNIT-3					
3.A	i).	Explain the issues in designing routing protocols for Ad Hoc Wireless Networks.	3	3	6
	ii).	Classify routing protocols and explain proactive, reactive, and hybrid routing approaches.	3	4	6
OR					
3.B	i).	Explain the design goals and classification of transport layer protocols for Ad Hoc networks.	3	3	6
	ii).	Discuss network security in Ad Hoc Wireless Networks and explain security requirements .	3	3	6
UNIT-4					
4.A	i).	Explain the single sensor node architecture , including hardware and software components .	4	2	6
	ii).	Describe WSN network architectures and data relaying and aggregation	4	4	6

		strategies.			
OR					
4.B	i).	Explain self-organizing MAC protocols for Wireless Sensor Networks.	4	3	6
	ii).	Explain Hybrid TDMA/FDMA and CSMA based MAC protocols with reference to IEEE 802.15.4	4	4	6
UNIT-5					
5.A	i).	Discuss the issues in WSN routing and explain OLSR protocol .	5	2	6
	ii).	Explain localization techniques in WSNs: absolute, relative, indoor, and sensor network localization .	5	3	6
OR					
5.B	i).	Explain triangulation techniques used for node localization.	5	4	6
	ii).	Discuss QoS in WSNs, energy-efficient design, and synchronization issues .	5	5	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D25258B0							
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)				DR25			
I M. Tech. I Semester MODEL QUESTION PAPER							
BLOCK CHAIN TECHNOLOGIES							
For Computer Science & Engineering							
Time: 3 Hrs.		Max. Marks: 60 M					
Answer ONE Question from EACH UNIT							
Assume suitable data if necessary							
5 x 12 = 60 Marks							
		UNIT-1		CO			
1.A	i).	Explain the history of Bitcoin and the origins of Blockchain technology .	1	2			
	ii).	Explain the fundamentals of Blockchain and describe its key components .	1	3			
	OR						
1.B	i).	Differentiate between permissioned and permission-less blockchain platforms with examples.	1	3			
	ii).	Explain cryptographic concepts in blockchain : SHA-256, ECDSA, hashing vs encryption, symmetric and asymmetric keys.	1	4			
	UNIT-2						
2.A	i).	Explain the Bitcoin blockchain architecture including blocks, wallets, and Merkle trees.	2	2			
	ii).	Explain hash pointers and discuss the hardness of mining in Bitcoin.	2	3			
	OR						
2.B	i).	Explain double spending problem and how Bitcoin ensures transaction verifiability and anonymity .	2	4			
	ii).	Discuss the challenges of Bitcoin and evaluate the solutions proposed .	2	5			
	UNIT-3						
3.A	i).	Explain Proof of Work (PoW) as a random oracle and discuss its working.	3	3			
	ii).	Explain consistency, liveness, and fairness properties in consensus algorithms.	3	4			
	OR						
3.B	i).	Explain Proof of Stake (PoS) based blockchains and hybrid PoW + PoS models .	3	3			
	ii).	Discuss Byzantine fault models and evaluate their impact on blockchain consensus.	3	5			
	UNIT-4						
4.A	i).	Explain Ethereum architecture and the role of the Ethereum Virtual Machine (EVM) .	4	2			
	ii).	Explain Solidity language and the concept of smart contracts with examples.	4	4			
	OR						

4.B	i).	Discuss the Turing completeness of smart contract languages and associated verification challenges .	4	4	6
	ii).	Compare Bitcoin scripting and Ethereum smart contracts . Discuss common attacks on smart contracts .	4	5	6
UNIT-5					
5.A	i).	Explain Hyperledger Fabric architecture and its plug-and-play mechanisms in permissioned blockchains.	5	2	6
	ii).	Explain blockchain applications beyond cryptocurrency , focusing on cyber security and e-governance .	5	3	6
OR					
5.B	i).	Discuss how blockchain ensures integrity of information and contract enforcement mechanisms .	5	4	6
	ii).	Explain the limitations of blockchain technology and critically analyze myths vs reality of blockchain .	5	3	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D25258B1									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
DEVOPS									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1			CO				
1.A	i).	Explain DevOps and describe the DevOps life cycle . How does DevOps improve software delivery?			1				
	ii).	Explain the DevOps workflow and its integration with SDLC and Agile model .			1				
		OR							
1.B	i).	Explain CI/CD automation and its role in build quality and release automation .			1				
	ii).	Discuss DevOps principles and architecture . Analyze how automation improves collaboration between development and operations.			1				
		UNIT-2							
2.A	i).	Explain the need for source code management and the history of version control systems .			2				
	ii).	Explain Git architecture, features, and workflow . Describe working with remote repositories .			2				
		OR							
2.B	i).	Explain Git commands, branching, staging, and collaboration in detail.			2				
	ii).	Explain unit testing and code coverage using JUnit / NUnit .			2				
		UNIT-3							
3.A	i).	Explain build automation and the need for Continuous Integration (CI) .			3				
	ii).	Explain Jenkins architecture and Jenkins workflow .			3				
		OR							
3.B	i).	Explain Jenkins master-slave architecture and pipeline basics (Master, Node, Agent, Executor).			3				
	ii).	Explain how to create, schedule, and manage builds in Jenkins , including user management and slave nodes.			3				
		UNIT-4							
4.A	i).	Explain the importance of Continuous Delivery and Continuous Deployment .			4				
	ii).	Explain containerization using Docker and analyze its advantages.			4				

			OR		
4.B	i).	Explain Docker architecture , images, containers, Dockerfile, and Docker Hub.	4	3	6
	ii).	Explain testing tools – Selenium and JavaScript testing. Analyze their role in DevOps pipelines.	4	4	6
UNIT-5					
5.A	i).	Explain Ansible architecture , tasks, roles, and Jinja2 templating.	5	2	6
	ii).	Explain deployments using Ansible , including Vaults .	5	3	6
OR					
5.B	i).	Explain Kubernetes (OpenShift) architecture – namespaces, pods, services, config maps, and CI/CD on OCP.	5	4	6
	ii).	Compare Ansible, Puppet, and Chef . Evaluate their role in configuration management.	5	5	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D25258B3							
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)				DR25			
I M. Tech. I Semester MODEL QUESTION PAPER							
DESIGN PATTERNS							
For Computer Science & Engineering							
Time: 3 Hrs.		Max. Marks: 60 M					
Answer ONE Question from EACH UNIT							
Assume suitable data if necessary							
5 x 12 = 60 Marks							
		UNIT-1		CO			
1.A	i).	What is a Design Pattern ?Explain Design Patterns in Smalltalk MVC .		1			
	ii).	Explain how Design Patterns solve design problems .Describe the catalogue of design patterns and its organization.		1			
		OR					
1.B	i).	Explain how to select a design pattern for a given problem.		1			
	ii).	Explain how to use a design pattern .Analyze the benefits and consequences of applying design patterns.		1			
		UNIT-2					
2.A	i).	Explain the Document Editor case study and discuss its design problems .		2			
	ii).	Explain how the Document Editor supports document structure and formatting .		2			
		OR					
2.B	i).	Explain Creational Design Patterns .Discuss Abstract Factory and Builder patterns with examples.		2			
	ii).	Explain Factory Method, Prototype, and Singleton patterns.Compare and discuss creational patterns.		2			
		UNIT-3					
3.A	i).	Explain Adapter and Bridge patterns with UML diagrams.		3			
	ii).	Explain Composite pattern and analyze its applicability.		3			
		OR					
3.B	i).	Explain Decorator and Facade patterns with examples.		3			
	ii).	Explain Flyweight and Proxy patterns .Analyze their advantages and limitations.		3			
		UNIT-4					
4.A	i).	Explain Chain of Responsibility and Command patterns .		4			
	ii).	Explain Interpreter and Iterator patterns with use cases.		4			
		OR					

4.B	i).	Explain Mediator and Memento patterns with examples.	4	3	6
	ii).	Explain Observer pattern and discuss behavioral pattern characteristics.	4	4	6
UNIT-5					
5.A	i).	Explain State and Strategy patterns with examples.	5	2	6
	ii).	Explain Template Method pattern and its benefits.	5	3	6
OR					
5.B	i).	Explain Visitor pattern and analyze its applicability.	5	4	6
	ii).	Discuss what to expect from design patterns , their history, and the pattern community .	5	5	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D2515800									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
DATA STRUCTURES AND ALGORITHM ANALYSIS									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1			CO				
1.A	i).	What is a Singly Linked List? Explain its structure and main operations with algorithms			1				
	ii).	Explain Doubly Linked List with a diagram and write insertion & deletion algorithms.			1				
		OR							
1.B	i).	Explain Circular Linked List types and their working with key algorithms.			1				
	ii).	Describe Stack and Queue implementation using Linked Lists with push, pop, enqueue & dequeue algorithms.			1				
		UNIT-2							
2.A	i).	Explain Linear Search and Binary Search with examples and analyze their time complexities.			2				
	ii).	Explain Bubble, Selection, and Insertion Sort algorithms with a comparison.			2				
		OR							
2.B	i).	Define Binary Tree. Explain its properties and representations.			2				
	ii).	Describe Expression Trees with Infix/Prefix/Postfix.			2				
		UNIT-3							
3.A	i).	Define ADT. Explain List ADT, Stack ADT, and Queue ADT operations.			3				
	ii).	Explain Hash Table representation with examples and describe common hash functions.			3				
		OR							
3.B	i).	Explain Separate Chaining and Open Addressing collision resolution techniques.			3				
	ii).	Explain clustering in Linear Probing and analyze how Double Hashing reduces it.			3				
		UNIT-4							
4.A	i).	Define Priority Queue ADT. Compare array, linked list, and heap implementations			4				
	ii).	Explain Heap (Min/Max) and write insertion & deletion algorithms with			4				

		examples			
OR					
4.B	i).	Define Binary Search Tree (BST). Explain its properties and representation.	4	2	6
	ii).	Explain BST searching, insertion & deletion algorithms with best & worst case complexity analysis.	4	4	6
UNIT-5					
5.A	i).	Define AVL Tree. Explain balance factor and height calculation.	5	2	6
	ii).	Explain AVL rotations (LL, RR, LR, RL) with diagrams and algorithms.	5	3	6
OR					
5.B	i).	Define B-Tree. Explain height, insertion & deletion operations.	5	2	6
	ii).	Compare BST, AVL, Red-Black, Splay, and B-Tree based on balancing, efficiency and applications.	5	4	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D25258A0									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
FEATURE ENGINEERING									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1			CO				
1.A	i).	Explain the Machine Learning Pipeline . Discuss the role of data, tasks, models, features, and model evaluation .			1				
	ii).	Explain feature transformation techniques such as binarization, quantization (binning), and log transformation with examples.			1				
		OR							
1.B	i).	Explain feature scaling and normalization techniques : Min–Max scaling, standardization, and ℓ_2 normalization.			1				
	ii).	Discuss interaction features and feature selection techniques . Analyze their impact on model performance.			1				
		UNIT-2							
2.A	i).	Explain Bag-of-Words and Bag-of-n-Grams models for text representation.			2				
	ii).	Explain text preprocessing techniques : stopword removal, frequency-based filtering, and stemming.			2				
		OR							
2.B	i).	Explain Tf–Idf transformation and analyze how it improves over Bag-of-Words.			2				
	ii).	Describe text classification using Logistic Regression . Explain the role of regularization in tuning Logistic Regression .			2				
		UNIT-3							
3.A	i).	Explain categorical variable encoding techniques : One-Hot Encoding, Dummy Coding, and Effect Coding.			3				
	ii).	Discuss feature hashing and bin counting for large categorical variables.			3				
		OR							
3.B	i).	Explain Principal Component Analysis (PCA) with intuition and variance maximization.			3				
	ii).	Discuss PCA implementation, whitening, and ZCA . Evaluate the limitations and considerations of PCA .			3				
		UNIT-4							
4.A	i).	Explain k-Means clustering and the concept of clustering as surface tiling .			4				
	ii).	Explain k-Means based featurization for classification tasks.			4				

			OR		
4.B	i).	Discuss model stacking using k-Means as a nonlinear featurization technique.	4	3	6
	ii).	Analyze the pros, cons, and practical challenges (gotchas) of k-Means featurization.	4	4	6
UNIT-5					
5.A	i).	Explain item-based collaborative filtering and its working principle.	5	2	6
	ii).	Describe the naive academic paper recommender system including data cleaning and feature parsing.	5	3	6
			OR		
5.B	i).	Explain the second pass recommender system with improved engineering and smarter modeling.	5	4	6
	ii).	Discuss the third pass recommender system . Evaluate how adding more features improves recommendation quality.	5	5	6

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Course Code: D25258A1									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
GENERATIVE AI									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1		CO	KL	M			
1.A	i).	Explain the historical overview of generative modeling . Differentiate between Generative AI and Discriminative modeling .		1	2	6			
	ii).	Explain the importance of generative models in AI and Machine Learning. Discuss different types of generative models .		1	3	6			
		OR							
1.B	i).	Explain GANs, VAEs, autoregressive models, and diffusion models . Analyze their working principles.		1	4	6			
	ii).	Discuss the challenges and future of Generative AI . Explain ethical aspects, responsible AI, and real-world use cases .		1	5	6			
		UNIT-2							
2.A	i).	Explain the basics of language models and the building blocks of LLMs .		2	2	6			
	ii).	Describe the Transformer architecture with encoder, decoder, and attention mechanism .		2	3	6			
		OR							
2.B	i).	Explain text generation using BERT and GPT models . Discuss autoencoding and regression-based models .		2	4	6			
	ii).	Explain Prompt Engineering, RLHF, and Retrieval Augmented Generation (RAG) .		2	3	6			
		UNIT-3							
3.A	i).	Explain Generative Adversarial Networks (GANs) and the adversarial training process .		3	3	6			
	ii).	Explain Variational Autoencoders (VAEs) and encoder-decoder architectures .		3	4	6			
		OR							
3.B	i).	Explain Stable Diffusion models and Transformer-based image generation techniques .		3	3	6			
	ii).	Discuss CLIP, ViT, DALL-E2, DALL-E3, and GPT-4V .		3	3	6			
		UNIT-4							
4.A	i).	Explain variants and types of GANs , including Cyclic GAN .		4	2	6			
	ii).	Explain neural style transfer and the use of Cyclic GAN for painting generation .		4	4	6			

			OR		
4.B	i).	Explain music generation using RNNs and MuseGAN .	4	3	6
	ii).	Explain autonomous agents, Deep Q-Learning, and Actor–Critic networks . Evaluate their role in game-playing AI.	4	4	6
UNIT-5					
5.A	i).	Explain training and fine-tuning of generative models . Discuss transfer learning and pretrained models .	5	2	6
	ii).	Explain open-source models such as GPT4All, LLaMA, and Programming LLMs .	5	3	6
OR					
5.B	i).	Explain LangChain, Hugging Face ecosystem, and training vision models like TimeSformer .	5	4	6
	ii).	Discuss deployment of generative models . Evaluate tools like Google Copilot and challenges in real-world deployment.	5	5	6

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KL-KNOWLEDGE LEVEL

M-MARKS

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Course Code: D25158B1									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
HIGH PERFORMANCE COMPUTING									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1		CO	KL	M			
1.A	i).	What is motivating parallelism? Explain the scope of parallel computing		1	2	6			
	ii).	What is implicit parallelism? Explain its role in parallel programming platforms.		1	3	6			
		OR							
1.B	i).	Analyze the trends in microprocessor architectures and explain how memory limitations affect system performance.		1	4	6			
	ii).	Compare and contrast N-wide superscalar architectures and multi-core architectures.		1	4	6			
		UNIT-2							
2.A	i).	Explain the principles of parallel algorithm design with emphasis on decomposition techniques.		2	3	6			
	ii).	Describe the characteristics of tasks and interactions in parallel algorithms.		2	2	6			
		OR							
2.B	i).	Explain mapping techniques for load balancing and analyze methods to contain interaction overheads.		2	4	6			
	ii).	Explain the rise of GPU computing and discuss the features of early GPU architectures.		2	3	6			
		UNIT-3							
3.A	i).	Explain one-to-all broadcast and all-to-one reduction operations in parallel systems.		3	2	6			
	ii).	Explain scatter and gather communication operations.		3	3	6			
		OR							
3.B	i).	Explain all-reduce and prefix-sum operations used in parallel computing.		3	3	6			
	ii).	Explain thread basics, synchronization mechanisms, and OpenMP programming in shared address space platforms.		3	3	6			
		UNIT-4							
4.A	i).	Explain the sources of overhead in parallel programs.		4	2	6			
	ii).	Explain the performance metrics used for evaluating parallel systems.		4	2	6			
		OR							

4.B	i).	Analyze the effect of granularity on performance and discuss the scalability of parallel systems.	4	4	6
	ii).	Explain parallel algorithms for matrix-vector multiplication and matrix-matrix multiplication.	4	3	6
UNIT-5					
5.A	i).	Explain the issues involved in sorting on parallel computers and describe parallel bubble sort.	5	2	6
	ii).	Explain parallel depth-first search and parallel best-first search algorithms.	5	3	6
OR					
5.B	i).	Analyze the parallelization of quick sort algorithm.	5	4	6
	ii).	Explain CUDA architecture and discuss kernel launch, GPU memory management, and synchronization in CUDA C.	5	4	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

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Course Code: D25158A0

DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)

DR25

I M. Tech. I Semester MODEL QUESTION PAPER

IMAGE PROCESSING

For Computer Science & Engineering

Time: 3 Hrs.

Max. Marks: 60 M

Answer ONE Question from EACH UNIT

Assume suitable data if necessary

5 x 12 = 60 Marks

UNIT-1			CO	KL	M
1.A	i).	Explain the components of an Image Processing System with a neat diagram.	1	2	6
	ii).	Describe the image sensing and acquisition process. What are the factors affecting image quality at acquisition stage?	1	3	6
OR					
1.B	i).	Differentiate between image sampling and quantization. Explain uniform and non-uniform quantization.	1	4	6
	ii).	Explain histogram equalization with an example. What are its advantages and limitations?	1	3	6
UNIT-2					
2.A	i).	Explain spatial filtering. Compare smoothing and sharpening filters with examples.	2	2	6
	ii).	Derive the Laplacian filter mask. Explain its role in image sharpening.	2	4	6
OR					
2.B	i).	Explain homomorphic filtering. How does it improve image illumination?	2	3	6
	ii).	Explain noise models in image restoration. Compare arithmetic mean and geometric mean filters.	2	5	6
UNIT-3					
3.A	i).	Explain image compression redundancies (Coding, Interpixel, Psychovisual).	3	2	6
	ii).	Explain Discrete Cosine Transform (DCT) and its role in JPEG compression.	3	4	6
OR					
3.B	i).	Explain LZW coding with an example. Why is it preferred in lossless compression?	3	3	6
	ii).	Compare JPEG, JPEG-2000 and MPEG standards. Include applications and limitations.	3	5	6
UNIT-4					
4.A	i).	Explain multiresolution analysis (MRA) in wavelet compression.	4	2	6

	ii).	Differentiate between Continuous and Discrete Wavelet Transform.	4	3	6
		OR			
4.B	i).	Explain 2-D DWT and Fast Wavelet Transform algorithm.	4	4	6
	ii).	Explain the JPEG-2000 encoding steps using wavelets.	4	5	6
UNIT-5					
5.A	i).	Explain thresholding based segmentation. Compare global and adaptive thresholding.	5	2	6
	ii).	Explain morphological operations (Erosion, Dilation, Opening, Closing) with examples	5	3	6
		OR			
5.B	i).	Explain watershed segmentation. What are its limitations and improvements?	5	4	6
	ii).	Explain Digital Image Watermarking. Discuss its need and applications in copyright protection.	5	2	6

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KL-KNOWLEDGE LEVEL

M-MARKS

NOTE: Questions can be given as A, B splits or as a single Question for 12 marks

Course Code: D2525802									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
INTRODUCTION TO QUANTUM COMPUTING									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1			CO				
1.A	i).	Explain the importance of Mathematics, Physics, and Biology in the development of Quantum Computing.			1				
	ii).	Introduce Quantum Computing and compare it with Classical Computing.			1				
		OR							
1.B	i).	Differentiate between Bits and Qubits.			1				
	ii).	Analyze the differences between Classical logical operations and Quantum logical operations.			1				
		UNIT-2							
2.A	i).	Explain the basics of Linear Algebra and their role in Quantum Computing.			2				
	ii).	Define Hilbert Space and explain probabilities and measurements in Quantum Mechanics.			2				
		OR							
2.B	i).	Explain the principles of Superposition and Entanglement in Quantum Physics.			2				
	ii).	Analyze the Central Dogma of Molecular Biology with reference to Genomics and Proteomics.			2				
		UNIT-3							
3.A	i).	Explain the physical implementations of a Qubit.			3				
	ii).	Describe a Qubit as a quantum unit of information.			3				
		OR							
3.B	i).	Explain the representation of a Qubit using the Bloch Sphere.			3				
	ii).	Define Bell States and explain their significance in Quantum Computing.			3				
		UNIT-4							
4.A	i).	Explain how classical computation can be performed on quantum computers.			4				
	ii).	Explain the relationship between quantum and classical complexity classes.			4				
		OR							

4.B	i).	Explain the working of Deutsch's or Deutsch–Jozsa Algorithm.	4	3	6
	ii).	Analyze either Shor's factorization algorithm or Grover's search algorithm.	4	4	6
UNIT-5					
5.A	i).	Explain the concept of noise in quantum systems and graph states and codes.	5	2	6
	ii).	Explain the need for Quantum Error Correction.	5	3	6
OR					
5.B	i).	Explain the concept of fault-tolerant quantum computation.	5	4	6
	ii).	Compare classical and quantum information theory and explain quantum teleportation.	5	5	6

CO-COURSE OUTCOME

KL-KNOWLEDGE LEVEL

M-MARKS

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I M. Tech. I Semester MODEL QUESTION PAPER

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

For Computer Science & Engineering

Time: 3 Hrs.

Max. Marks: 60 M

Answer ONE Question from EACH UNIT

Assume suitable data if necessary

5 x 12 = 60 Marks

		UNIT-1	CO	KL	M
1.A	i).	Define random experiment, sample space, and events. Explain the axioms of probability with suitable examples.	1	2	6
	ii).	A box contains 5 red and 7 blue balls. Two balls are drawn at random without replacement. Find the probability that both balls are of the same colour.	1	3	6
		OR			
1.B	i).	A card is drawn at random from a standard deck. Find the probability that the card drawn is (i) a king or (ii) a red card given that it is a face card.	1	3	6
	ii).	A discrete random variable X has the probability distribution X: 0 1 2 3 P(X): 0.1 0.2 0.4 0.3 Find the mean and variance of X.	1	4	6
		UNIT-2			
2.A	i).	Distinguish between population and sample. Explain sampling with and without replacement.	2	2	6
	ii).	Explain sampling distributions and frequency distributions.	2	3	6
		OR			
2.B	i).	From a population with mean 100 and variance 25, a sample of size 36 is drawn. Find the mean and variance of the sampling distribution of the sample mean.	2	3	6
	ii).	Explain point estimation and interval estimation. Describe confidence interval estimation for population mean.	2	3	6
		UNIT-3			
3.A	i).	A sample of size 100 has a mean of 54 and a standard deviation of 8. Test whether the population mean is 52 at 5% level of significance.	3	3	6
	ii).	Explain the Chi-square test for goodness of fit. Apply it to test whether the given data follows a specified distribution.	3	4	6
		OR			
3.B	i).	Explain Type-I and Type-II errors and P-value in hypothesis testing.	3	3	6
	ii).	Define statistical hypothesis. Explain null hypothesis, alternative hypothesis, and level of significance.	3	3	6
		UNIT-4			

4.A	i).	Define algebraic systems. Explain semigroups and monoids with examples.	4	2	6
	ii).	Define group and subgroup. State the properties of an abelian group.	4	4	6
		OR			
4.B	i).	Test whether 561 is a prime number using Fermat's theorem.	4	4	6
	ii).	Using Euler's theorem, find the value of $7^{100} \bmod 40$.	4	4	6
		UNIT-5			
5.A	i).	Define graph, subgraph, and isomorphic graphs. Explain adjacency matrix and incidence matrix representations.	5	2	6
	ii).	Define Eulerian graph and Hamiltonian graph. State the necessary conditions for their existence.	5	3	6
		OR			
5.B	i).	Determine whether the given graph is Eulerian or Hamiltonian. Justify your answer.	5	4	6
	ii).	Find the spanning tree of a given graph using an appropriate algorithm.	5	5	6

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M-MARKS

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Course Code: D25258A3									
DNR COLLEGE OF ENGINEERING & TECHNOLOGY(A)					DR25				
I M. Tech. I Semester MODEL QUESTION PAPER									
PRINCIPLES OF NETWORK SECURITY									
For Computer Science & Engineering									
Time: 3 Hrs.		Max. Marks: 60 M							
Answer ONE Question from EACH UNIT									
Assume suitable data if necessary									
5 x 12 = 60 Marks									
		UNIT-1			CO				
1.A	i).	Explain the need for security and the basic principles of security in computer networks.			1				
	ii).	Explain the types of security attacks and the security services provided to counter them.			1				
		OR							
1.B	i).	Explain the security mechanisms and the network security model with reference to cryptography.			1				
	ii).	Explain classical encryption techniques including substitution, transposition, and rotor machines.			1				
		UNIT-2							
2.A	i).	Explain the algebraic structures used in cryptography such as groups, rings, fields, and GF(2).			2				
	ii).	Explain primes, Euler's phi function, and Fermat's Little Theorem with their significance in cryptography.			2				
		OR							
2.B	i).	Explain methods for generating and testing prime numbers in asymmetric cryptography.			2				
	ii).	Explain the Chinese Remainder Theorem and modular exponentiation with cryptographic relevance.			2				
		UNIT-3							
3.A	i).	Explain the principles of block ciphers and describe the DES algorithm.			3				
	ii).	Explain the AES algorithm and block cipher modes of operation.			3				
		OR							
3.B	i).	Explain the working of the RSA algorithm and Diffie–Hellman key exchange.			3				
	ii).	Describe Elliptic Curve Cryptography and compare it with traditional public key cryptosystems.			3				
		UNIT-4							
4.A	i).	Explain the requirements and applications of cryptographic hash functions.			4				
	ii).	Explain Secure Hash Algorithms and hash functions based on cipher block chaining.			4				

OR					
4.B	i).	Explain Message Authentication Codes and the working of HMAC and CMAC.	4	3	6
	ii).	Explain digital signature schemes including ElGamal, ECDSA.	4	4	6
UNIT-5					
5.A	i).	Explain web security considerations and the working of Transport Layer Security and HTTPS.	5	2	6
	ii).	Explain the architecture and components of IP Security including AH and ESP.	5	3	6
OR					
5.B	i).	Explain Internet email security issues and the mechanisms used for comprehensive email security.	5	4	6
	ii).	Discuss S/MIME and PGP as secure electronic mail protocols.	5	4	6

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