

Scheme
of
B. TECH. COMPUTER SCIENCE AND ENGINEERING
(ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)
By

Skill Department of Computer Science & Engineering
Skill Faculty of Engineering & Technology



w.e.f. Academic Session 2026-27

Shri Vishwakarma Skill University

Dudhola, Palwal-121102, Haryana

Transit office: Plot 147, Sector 44, Gurugram-122001, Haryana

Website: www.svsu.ac.in

Contact No: +91-124-2746800

It is certified that this version of Scheme and Syllabus, revised and checked by us, is completed in all respects.

Dr. Monika Jangra
Skill Assistant Professor/Program Coordinator,
Dept of CSE, SFET

Prof. Usha Batra
Chairperson, Skill Associate Professor, Dept of CSE, SFET

Prof. Ashish Shrivastava
Dean, Skill Faculty of Engineering and Technology, SVSU

Prof. Vikarm Singh
Dean Academics, SVSU



w.e.f. Academic Session 2026-27

Shri Vishwakarma Skill University

Dudhola, Palwal-121102, Haryana

Transit office: Plot 147, Sector 44, Gurugram-122001, Haryana

Website: www.svsu.ac.in



Scheme and Syllabus

w.e.f. Academic Session 2026-27

Semester I												
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks					
							I	E	Total		Domain	
1	24UPHY03	Applied Physics	3	1	0	4	15	35	50		BS	
2	24UPHY04	Applied Physics Lab	0	0	2	1	35	15	50		BS	
3	24UCSE01	Programming with C	2	0	0	2	30	70	100		PC	
4	24UCSE02	Programming with C Lab	0	0	4	2	35	15	50		PC	
5	24UELE01	Basic Electrical & Electronics Engineering	3	0	0	3	30	70	100		ES	
6	24UELE02	Basic Electrical & Electronics Engineering Lab	0	0	2	1	35	15	50		ES	
7	24UENG01	English Language and Business Communication	1	0	0	1	15	35	50		HS	
8	24UENG02	English Language and Business Communication Practical	0	0	2	1	35	15	50		HS	
9	24UMTH03	Engineering Mathematics-I	3	1	0	4	30	70	100		BS	
10	24UEVS01	Environmental Science	2	0	0	2	30	70	100		HS	
11	26UCSE01	Introduction to Disruptive Technologies	1	0	0	1	30	70	100		PC	
Total			15	0	10	22						
Semester II												
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks					
							I	E	Total			
1	24UMTH04	Engineering Mathematics - II	3	1	0	4	30	70	100		BS	
2	24UCEE02	Digital Electronics	3	0	0	3	30	70	100		ES	
3	24UCEE03	Digital Electronics Lab	0	0	2	1	35	15	50		ES	
4	24UCSE03	Data Structures	3	0	0	3	30	70	100		PC	
5	24UCSE04	Data Structures Lab	0	0	2	1	35	15	50		PC	
6		Biology for Engineers	2	0	0	2	15	35	50		BS	

7	26UCEC01	Basics of Python Programming	3	0	0	3	30	70	100	PC	
8	26UCEC02	Basics of Python Programming Lab	0	0	4	2	35	15	50	PC	
9	24UCSE05	Design Project-I	0	0	2	1	35	15	50	PC	
Total			16	0	12	20					

Note: It is a mandatory requirement for students to undergo Summer Internship (4-6 weeks) between 2nd and 3rd semester. For continuing students, it will be evaluated in 3rd semester via viva voce. For students, opting exit after 1st year will be evaluated as Summer Break completes and credits will be counted towards fulfilment of UG Certification.

For Exit after 1st year : To obtain the UG Certificate in Computer Science and Engineering (Artificial Intelligence/Machine Learning), the student must fulfil following credit requirements.

Skill Component Courses after 1st Year										
Sr. No.	Course Code	Course Title	L	T	P	Credits	Remarks			
1	26UCEW01	Summer Internship-I/Project I (min. 4 weeks)	-	-	-	4	The 4 credits will be counted as Skill Component/Vocational Course Credits for UG Certification in relevant field (preferably in the field of AI and ML or any other disruptive technology.)			
Total			-	-	-	4				

Entry requirement for 2nd year: Candidate with Diploma in appropriate branch of Engineering/ UG Certificate/ Equivalent Vocational or Technical Program level 4.5. Bridge courses to be identified and offered as per requirement.

Semester III										
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks			
							I	E	Total	
1	24UCSE06	Discrete Mathematics	4	0	0	4	30	70	100	PC
2	24UCSE07	Computer Organization and Architecture	4	0	0	4	30	70	100	PC
3	24UCSE08	Database Management Systems	3	0	0	3	30	70	100	PC
4	24UCSE09	Database Management Systems Lab	0	0	2	1	35	15	50	PC
5	24UCSE10	Artificial Intelligence	3	0	0	3	30	70	100	PC
6	24UCSE11	Artificial Intelligence Lab	0	0	2	1	35	15	50	PC
7	24UCSE12	Design and Analysis of Algorithms	3	0	0	3	30	70	100	PC

8	24UCSE13	Design and Analysis of Algorithm Lab	0	0	2	1	35	15	50	PC	
9	26UCEW01	Summer Internship I (4-6 weeks)* / Project I	-	-	-	4	70	30	100	PW	
10	24UYHS01	Yoga and Health Skills-II	2	0	0	-	30	70	100	AU	
Total			19	0	6	24					
Semester IV											
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks				
							I	E	Total		
1	24UCSE14	Operating Systems	3	0	0	3	30	70	100	PC	
2	24UCSE15	Operating System Lab	0	0	2	1	35	15	50	PC	
3	24UCEC05	Computer Networks Essentials	3	0	0	3	30	70	100	PC	
4	24UCSE17	Machine Learning	3	0	0	3	30	70	100	PC	
5	24UCSE18	Machine Learning Lab	0	0	2	1	35	15	50	PC	
6	24UCSE19	Object Oriented Programming using C++	3	0	0	3	30	70	100	PC	
7	24UCSE20	Object Oriented Programming using C++ Lab	0	0	2	1	35	15	50	PC	
9	24UHPE01	Human Values and Professional Ethics	2	0	0	2	30	70	100	HS	
10	24UCSE21	Software Engineering	3	0	0	3	30	70	100	PC	
11	24UCEW02	Minor Project-I	0	0	4	2	35	15	50	PW	
Total			17	0	10	22					

Note: It is a mandatory requirement for students to undergo Summer Internship (4-6 weeks) between 2nd and 3rd semester. For continuing students, it will be evaluated in 3rd semester via viva voice. For students, opting exit after 1st year will be evaluated as Summer Break completes and credits will be counted towards fulfilment of UG Certification.

For Exit after 2nd Year: UG Diploma in Computer Science and Engineering (Artificial Intelligence/Machine Learning), for earning the student, the student must fulfil following credit requirements.

Skill Component Courses after First Year											
Sr. No.	Course Code	Course Title	L	T	P	Credits	Remarks				

1	26UCEW04	Summer Internship-II/Project II (min. 4 weeks)	-	-	-	4	The 4 credits will be counted as Skill Component/Vocational Course Credits for UG Certification in relevant field (preferably in the field of AI and ML or any other disruptive technology.)			
Total			-	-	-	4				

Entry requirement for 3rd year: A candidate with 10+3+1/12+2/ UG Diploma (Engg.) in appropriate domain with level 5. Bridge courses to be identified and offered as per requirement.

Semester V										
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks			
							I	E	Total	
1	24UCSE22	Theory of Computation	4	0	0	4	30	70	100	PC
2	24UCSE23	Deep Learning	3	0	0	3	30	70	100	PC
3	24UCSE24	Deep Learning Lab	0	0	2	1	35	15	50	PC
4	26UCSE02	Optimization Techniques	3	0	0	3	30	70	100	PC
5	24UCSE26-28	Program Elective-I	3	0	0	3	30	70	100	PE
6	24UCSE29-31	Program Elective- I Lab	0	0	2	1	35	15	50	PC
9	24UENG03	Employability skills	1	0	0	1	15	35	50	AEC
10	24UENG04	Employability skills Practical	0	0	2	1	35	15	50	AEC
11	26UCEW04	Summer Internship II(4-6 weeks) /Project-II	-	-	-	4	70	30	100	CS
12	24UCEW03	Minor Project-II	0	0	4	2	70	30	100	PW
Total			18	0	12	23				
Semester VI										
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks			
							I	E	Total	
1	24UCSE34	Advanced ML	3	0	0	3	30	70	100	PC
2	24UCSE35	Advanced ML Lab	0	0	2	1	35	15	50	PC
3	24UCSE36	Compiler Design	4	0	0	4	30	70	100	PC
4	24UCSE37-39	Program Elective II	3	0	0	3	30	70	100	PE
5	24UCSE40-42	Program Elective II Lab	0	0	2	1	35	15	50	PE
6		Open Elective (MOOC-I)	2	0	0	2	30	70	100	OE
7	24UCEW05	Capstone Project - I	0	0	10	5	210	90	300	PW
8	24UBPM10	Entrepreneurship	1	1	0	2	30	70	100	AEC
Total			14	1	14	21				

Note: It is a mandatory requirement for students to undergo Summer Internship (4-6 weeks) between 2nd and 3rd semester. For continuing students, it will be evaluated in 3rd semester via viva voice. For

students, opting exit after 1st year will be evaluated as Summer Break completes and credits will be counted towards fulfilment of UG Certification.

For Exit after 3rd Year: No exit

Entry requirement for 4th year: No Entry

Semester VII											
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks				
							I	E	Total		
1	24UCSE43	Soft Computing	3	0	0	3	30	70	100	PC	
2	24UCSE44	Soft Computing Lab	0	0	2	1	35	15	50	PC	
2	24UCSE45-48	Program Elective III	3	0	0	3	30	70	100	PE	
5	24UCSE49-52	Program Elective III Lab	0	0	2	1	35	15	50	PE	
3	24UCSE53-56	Program Elective IV	3	0	0	3	30	70	100	PE	
6	24UCSE57-60	Program Elective IV Lab	0	0	2	1	35	15	50	PE	
7	24UCEW06	Capstone Project - II	0	0	10	5	210	90	300	PW	
8	26UCEW07	Summer Internship III/Project III(6 weeks) *	-	-	-	4	70	30	100	PW	
		Total	9	0	16	24					
Semester VIII											
Sr. No.	Course Code	Course Title	L	T	P	Credits	Marks				
							I	E	Total		
1	26UCEW08	Internship	-	-		10	350	150	500	PW	
2		Open Elective-II via (MOOC-II)	2	0	0	2	30	70	100	OE	
		Total	3	0	20	12					
TOTAL CREDITS						168					

For Exit after 4th Year: Bachelor of Technology (B.Tech.) in Computer Science and Engineering (Artificial Intelligence and Machine Learning).

List of Professional/ Program Elective courses for B. Tech. CSE (AI/ML) Program

Program Elective I

Subject Code	Subject Name
24UCSE26	AI in Healthcare

24UCSE27	AI in Agriculture
24UCSE32	Natural Language Processing
24UCSE29	AI in Healthcare Lab
24UCSE30	AI in Agriculture Lab
24UCSE33	Natural Language Processing Lab
Note: New courses may be introduced at the time of offering as per change in current trends and technologies.	

Program Elective II

Subject Code	Subject Name
24UCSE37	Big Data Analytics
24UCSE38	Data Warehouse and data Mining
24UCSE39	Cloud Computing
24UCSE40	Big Data Analytics Lab
24UCSE41	Data Warehouse and data Mining Lab
24UCSE42	Cloud Computing Lab
Note: New courses may be introduced at the time of offering as per change in current trends and technologies.	

Program Elective III

Subject Code	Subject Name
24UCSE45	Multi-agent Intelligent
24UCSE46	Web Technologies
24UCSE47	Feature Engineering
24UCSE48	Modelling and simulation
24UCSE49	Multi-agent Intelligent Lab
24UCSE50	Web Technologies Lab
24UCSE51	Feature Engineering Lab
24UCSE52	Modelling and simulation Lab
25UCSE01	Human Computer Interface
25UCSE02	Human Computer Interface Lab
25UCSE03	Quantum Computing
25UCSE04	Quantum Computing Lab
Note: New courses may be introduced at the time of offering as per change in current trends and technologies.	

Program Elective IV

Subject Code	Subject Name
24UCSE53	Digital Image Processing
24UCSE54	Information Retrieval
24UCSE55	Internet of Things
24UCSE56	Wireless Communication
24UCSE57	Digital Image Processing Lab
24UCSE58	Information Retrieval Lab
24UCSE59	Internet of Things Lab
24UCSE60	Wireless Communication Lab
25UCSE05	Generative AI
25UCSE06	Generative AI Lab
25UCSE07	Explainable AI (XAI)
25UCSE08	Explainable AI Lab (XAI)

Note: New courses may be introduced at the time of offering as per change in current trends and technologies.

- Codes may be assigned by the department committee at the time of offering the courses and also the more courses may be added at the time of offering the PE based on emerging technologies.

Table 5. List of Open Elective courses

The open elective courses may be decided at the time of offering and may be taken from the following fields; but not limited to

- 1 Entrepreneurship Development
- 2 Rural Technology & Community Development
- 3 Bioinformatics
- 4 Economics
- 5 Real Time Operating System
- 6 Game Theory with Engineering Applications
- 7 Embedded Systems
- 8 Cyber Law and Ethics

Category Wise Courses:

Humanities and Social Science Courses						
S.No.	Course	L	T	P	Credits	Domain
		(hours per week)				
1	English Language and Business Communication	1	0	0	1	HS
2	Environmental Sciences	2	0	0	2	HS
3	English Language and Business Communication Lab	0	0	2	1	HS
Total					4	
Basic Science Courses						
S. No.	Course	L	T	P	Credits	Domain
		(hours per week)				
1	Applied Physics	3	1	0	4	BS
2	Engineering Mathematics-I	3	1	0	4	BS
3	Applied Physics Lab	0	0	2	1	BS
4	Engineering Mathematics - II	3	1	0	4	BS
5	Biology for Engineers	2	0	0	2	BS
Total					15	
Engineering Science Courses						
S.No.	Course	L	T	P	To	
1	Programming with C	2	0	0	2	ES
2	Basic Electrical & Electronics Engineering	3	0	0	3	ES

3	Basic Electrical & Electronics Engineering Lab	0	0	2	1	ES
4	Digital Electronics	3	0	0	3	ES
5	Python Programming	3	0	0	3	ES
6	Digital Electronics Lab	0	0	2	1	ES
7	Python Programming Lab	0	0	4	2	ES
8	Programming with C Lab	0	0	4	2	ES
Total					17	
Program Core Courses						
Sr. No.	Course Title	L	T	P	Credits	
1	Data Structures	3	0	0	3	PC
2	Data Structures Lab	0	0	2	1	PC
3	Discrete Mathematics	4	0	0	4	PC
4	Computer Organization and Architecture	4	0	0	4	PC
5	Database Management Systems	3	0	0	3	PC
6	Design and Analysis of Algorithms	3	0	0	3	PC
7	Artificial Intelligence	3	0	0	3	PC
8	Database Management Systems Lab	0	0	2	1	PC
9	Design and Analysis of Algorithm Lab	0	0	2	1	PC
10	Artificial Intelligence Lab	0	0	2	1	PC
11	Operating Systems	3	0	0	3	PC
12	Object Oriented Programming using C++	3	0	0	3	PC
13	Machine Learning	3	0	0	3	PC
14	Computer Networks	4	0	0	4	PC
15	Software Engineering	3	0	0	3	PC
16	Operating System Lab	0	0	2	1	PC
17	Object Oriented Programming using C++ Lab	0	0	2	1	PC
18	Machine Learning Lab	0	0	2	1	PC
19	Theory of Computation	4	0	0	4	PC
20	Deep Learning	3	0	0	3	PC
21	Optimization Techniques	3	0	0	3	PC
23	Deep Learning Lab	0	0	2	1	PC
24	Advanced ML	3	0	0	3	PC
25	Compiler Design	4	0	0	4	PC
26	Advanced ML Lab	0	0	2	1	PC
27	Soft Computing	3	0	0	3	PC
28	Soft Computing Lab	0	0	2	1	PC
Total					71	
Professional Elective Courses						
	Course Title	L	T	P	Credits	

1	Program Elective I	3	0	2	4	PE
2	Program Elective II	3	0	2	4	PE
3	Program Elective III	3	0	2	4	PE
4	Program Elective IV	3	0	2	4	PE
Total					16	
Open Elective Courses						
	Course Title	L	T	P	Credits	
1	Open Elective-I	3	0	0	3	OE
2	Open Elective-II	3	0	0	3	OE
Total					6	
Project Work, Seminar and Internship in Industry						
	Course Title	L	T	P	Credits	
1	Design Project-I	0	0	2	1	PW
2	Minor Project-I	0	0	4	2	PW
3	Minor Project -II	0	0	4	2	PW
4	Summer Internship I(4-6 weeks)	-	-	-	2	PW
5	Summer Internship II(6 weeks)	-	-	-	3	PW
6	Summer Internship III(6 weeks)	-	-	-	3	PW
7	Internship	-	-	-	10	PW
8	Capstone Project - I	0	0	10	5	PW
9	Capstone Project - II	0	0	10	5	PW
Total					33	
Ability Enhancement Courses						
SNo	Course Title	L	T	P	Credits	
1	Yoga and Health Skills-II	2	0	0	0	AEC /AU
3	Employability Skills	1	0	2	2	AEC
4	Entrepreneurship	1	1	0	2	AEC
5	Human Values and Professional Ethics	2	0	0	2	AEC
Total					6	

Evaluation Scheme

w.e.f. Academic Session 2026-27

Type of Exam	Internal	External	Total
Theory Subject	30	70	100
Practical Subject	35	15	50

Division of Theory Internal Marks

Class Attendance	Assignment / Quiz / Presentation / Class Performance / Conduct	Sessional 1	Sessional 2	Total
5	15	5	5	30

Division of Practical Internal Marks

Lab Attendance	Practical Performance / Conduct	Practical File	Viva -Voce	Total
5	10	10	10	35

Division of Practical External Marks

Lab Written Exam	Practical Performance	Viva -Voce	Total
5	5	5	15

Table 1. Division of Internal Marks

Examination	Attendance/ Conduct	Synopsis	Presentation	Report	Viva -Voice	Total
Minor Project - I	5	5	5	10	10	35
Minor Project - II	10	10	10	20	20	70
Summer Internship – I, II and III	10	-	20	20	20	70

Capstone Project - I and II	30	30	30	30	90	210
-----------------------------	----	----	----	----	----	-----

Table 2. Division of Internship / OJT Internal Marks

Examination	Attendance / Conduct	Internship / OJT Performance or Presentation				Report	Mid Term Viva -Voce	End Term Viva -Voce	Total
		After 1st month	After 2nd month	After 3rd month	After 4th month				
Internship / OJT	30	30	30	30	30	40	80	80	350

Table 3. Division of External Marks

Examination	Presentation	Report	Viva -Voce	Total
Minor Project - I	5	5	5	15
Minor Project - II	10	10	10	30
Summer Internship – I, II and III	10	10	10	30
Capstone Project - I and II	20	20	50	90
Internship / OJT	30	30	90	150

Instruction for External Practical Examination*:

Exams duration will be as following:

1. Theory exams will be of 03 hours duration.
2. External Practical exams will be of 03 hours duration.
3. External Summer Internships / Minor Projects / Capstone Projects / Internship / OJT exams will be of 02 hours duration.

Instruction for Theory Paper Examination*:

1. There should be 09 questions in the End Term Examination question paper.
2. The Question paper consists of two Sections. All sections are compulsory.
3. Section A comprises 1 question and 10 sub-parts / sub-questions of short answer type and covers the entire syllabus. All questions are compulsory. Each question carries 2 marks.
4. Section B comprises 8 long answer type questions out of which students must attempt any 5. Each question carries 10 marks. The paper shall consist of 5 units as per the syllabus. Every unit shall have two questions. Individual questions may contain sub-parts / sub-questions.
5. Each unit shall have a marks weightage of 14.

6. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
7. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

*- Format of the Question Paper may be changed as per University Examination Ordinance / Policy in vogue at the time of examination.

Syllabus-Semester I

Applied Physics							
B.Tech (Common for all Branches)							
Semester – I							
L	T	P	Credits	Core Course	Internal Examination	:	15
3	1	0	4	24 UPHY03	External Examination	:	35
Effective from Session:				2024-2025	Total	:	50
Date of BoS approval:				23-07-2024	Duration of Exam	:	3 Hrs
Prerequisite							

Course Objective:

The objective of the course is to strengthen the fundamentals of physics and then build an interface of theoretical concepts with their industrial/engineering applications.

Course Outcome:

By the end of this course, the student will be able to:

CO1 . Understand the role interference, diffraction and polarization.

CO2 . Develop the basic understanding of lasers and fibres with their applications in various fields.

CO3. Understand and apply the basic phenomenon of quantum mechanics.

CO4. Explain the basics of electrostatics, magneto statics and electromagnetic laws.

CO5. Apply the acquired knowledge in understanding and designing the nano technology.

UNIT I

Wave optics: Interference of light by amplitude division; Interference due to thin films: Newton's rings, Michelson interferometer. Farunhoffer diffraction from a single slit, double slit, and N-slit, Diffraction gratings, Rayleigh criterion for limit of resolution; Resolving power of grating and telescope. Polarization in light, Double refraction, Nicol prism, Quarter and half wave plates, Production and analysis of plane, Circularly and elliptically polarized light, specific rotation, Polarimeter.

UNIT II

Lasers and Fiber Optics: Properties of laser beams, Different types of lasers: solid-state laser (ruby), gas laser (He-Ne), semiconductor laser; applications of lasers in science, and engineering. Need for fiber Optic Communication, Total Internal Reflection (TIR), Acceptance angle and numerical aperture, Step index and graded index fibers, Applications of optical fibers.

UNIT III:

Quantum Physics: Inadequacy of classical physics, need for quantum physics, Historical overview, Plank's hypothesis, Quantization of energy, Origin of quantum theory, Photoelectric effect, de Broglie hypothesis – matter waves, Wave Particle duality, Wave-packets, Phase velocity and Group velocity, Experimental evidence of de Broglie's hypothesis: Davisson–Germer experiment, Heisenberg uncertainty principle.

UNIT IV: Electromagnetic Theory: Faraday's law, Lenz's law, Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields, energy stored in a magnetic field. displacement current and magnetic field arising from time-dependent electric field, Maxwell's equation in vacuum and non-conducting medium.

UNIT V: Nanoscience and technology

Nanomaterials, types of nanomaterials, properties of nanomaterials; Density of states (0 dimensional, 1-dimensional, 2-dimensional, 3-dimensional), Top-down and bottom up approaches, Characterization of nanomaterials (Scanning Electron microscopes and Transmission electron microscopes).

Textbook

- 1 . David Griffiths, Introduction to Electrodynamics
- 2 . Nouredine Zettili, Quantum Mechanics: Concepts and Applications 3 . A. Ghatak, Optics, 7th Edition, McGraw Hill Education (India) Pvt Ltd.
- 4 . O. Svelto, Principles of Lasers, 5th Edition, Springer.
- 5 . Shotwell, K. Thyagarajan, Introduction to Fiber Optics, 1st Edition, Pearson Education India
6. Avadhanulu M. N. and P G Kshirsagar, A Text Book of Engineering Physics, 7th Edition, S. Chand
7. H K Malik and A K Singh, Engineering Physics, 2nd Edition, McGraw Hill Education (India) Pvt Ltd.

Applied Physics Lab							
B.Tech (Common for all Branches) Semester – I							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1	24 UPHY04	External Examination	:	15
Effective from Session:				2024-2025	Total	:	50
Date of BoS approval:				23-07-2024	Duration of Exam	:	3 Hrs
Prerequisite							

Course Objectives: The objective of the course is to strengthen the fundamentals of physics and then build an interface of theoretical concepts with their industrial/engineering applications.

Course Outcomes:

After completing this subject, student should be able to:

CO1 . Understand the motion of electrons in the magnetic field and resonance phenomenon.

CO2. Apply the knowledge learned in calculating the charge and mass of an electron.

CO3. Understand basic concepts of quantum mechanics through experiments.

CO4. Apply the tunneling concept for building new-age technology.

CO5. Solve Schrodinger equation using C and Python programming languages.

List of Experiments :

- 1 . RC, LC, RL and LCR circuits.
 - a. Series and Parallel RC, LC, RL and LCR circuits.
 - b. Resonance in Series and Parallel RC, LC, RL and LCR circuits.
- 2 . The magnetic field from the Helmholtz coil.
 - a. Variation of the magnetic field due to a circular current-carrying coil on an axial point.
 - b. Determination of Helmholtz Coil radius.
 - c. Verification of Superposition principle using Helmholtz coil.
- 3 Experiments on electromagnetic induction and electromagnetic braking.
 - a. Study of the electromotive force (EMF) induced as a function of the velocity of the magnet.
 - b. Study of the charge delivered due to induction.
 - c. Study of electromagnetic (EM) damping.
- 4 Cathode ray experiment

- a. Study of Lorentz force in a vacuum tube
- b. Measurement of specific charge (e/m) in a vacuum tube
- 5 Experimental Verification of the Heisenberg Uncertainty Principle
- 6 Determine the wavelength of He-Ne Laser using a double slit experiment.
- 7 Photoelectric effect
 - a. Determine Planck's constant and Work function
 - b. Verify the inverse square law of.
- 8 . Measurement of Lorentz force in a vacuum tube.
- 9 . Electron Spin Resonance (ESR) Spectrometer Experiment.
 - a. Determine magnetic field as a function of frequency.
 - b. Determine Lande's g -factor for free electrons.
- 10 . Determine the wavelength of He-Ne Laser using a double slit experiment.
- 11 . Oil drop experiment
 - a. Measurement of the terminal velocity of the drop.
 - b. Determine the charge on a drop.
- 12 . Solution of the one-dimensional Schrodinger equation for "particle in a harmonic potential" using C and Python programming.

Note: Minimum 8 Experiments to be performed

Textbooks:

1. David Griffiths, Introduction to Electrodynamics
2. H.C. Verma, Quantum Physics

References:

- 1 . B.Sc. Practical Physics, Geeta Sanon
- 2 . B.Sc. Practical Physics, C. L. Arora
- 3 . Halliday and Resnick, Physics
- 4 . W. Saslow, Electricity, magnetism and light

Programming with C (24UCSE01)							
B. Tech. CSE (AI/ML)							
Semester – I							
L	T	P	Credits	Core Course	Internal Examination	:	30
2	0	0	2		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hours
Prerequisite							

Course Objectives:

The Students will try to learn:

- To acquire problem solving skills
- To be able to develop flowcharts
- To understand structured programming concepts
- To be able to write programs in C Language

Course Outcomes:

After completion of the course, the student will be able to:

- CO1. Recall and understand the basics constructs of a programming language.
- CO2. Demonstrate the problem solving and critical thinking skills.
- CO3. Applying the knowledge of programming skills in problem solving using C language.
- CO4. Analyzing the Different programs in terms of their complexity and efficiency
- CO5. Test the program for its correctness from all possible inputs.
- CO6. Design the program in C language to solve any problem.

Course Content:

Unit 1

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal. Introduction to C Language: Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements, Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

Unit-2

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do- While and Examples. Continue, Break and Go to statements. Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.

Unit 3

Preprocessors: Preprocessor Commands

Arrays: Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

Unit 4

Pointers: Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L value and R value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions,

Command- line Arguments. Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions.

Unit 5

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/output Functions, Character Input/output Functions.

Textbook:

1. B.A. Forouzan and R.F. Gilberg, “*A Structured Programming Approach in C*”, Cengage Learning, 2007

Reference:

1. Kernighan BW and Ritchie DM, “The C Programming Language”, 2nd Edition, Prentice Hall of India, 2006.
2. Rajaraman V, “The Fundamentals of Computer”, 4th Edition, Prentice-Hall of India, 2006.

Programming with C Lab (24UCSE02)							
B. Tech. CSE (AI/ML)							
Semester-1							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	4	2		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:				22-7-24	Duration of Exam	:	
Prerequisite							

Course Objectives:

The objective of the course is to give exposure to the student about the implementation of different algorithm in C language.

Course Outcome:

At the end of the course, the student will be able to

CO1. Understand the fundamentals of programming in C Language

CO2. Write, compile and debug programs in C

CO3. Formulate given problems and give solutions by programming it in C.

CO4. To be able to effectively choose programming components to solve computing problems in real-world.

Course Content:

1. Finding the maximum and minimum of given set of numbers
2. Finding Roots of a Quadratic Equation
3. Sin x and Cos x values using series expansion
4. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
5. Generating a Pascal triangle and Pyramid of numbers
6. Recursion: Factorial, Fibonacci, GCD
7. Matrix addition and multiplication using arrays
8. Bubble Sort, Selection Sort
9. Programs on Linear Search and Binary Search using recursive and non-recursive procedures.
10. Functions for string manipulations
11. Finding the No. of characters, words and lines of given text file
12. File Handling programs.

Textbook:

1. B.A. Forouzan and R.F. Gilberg, “A Structured Programming Approach in C”, Cengage Learning, 2007

Reference:

1. Kernighan BW and Ritchie DM, “The C Programming Language”, 2nd Edition, Prentice Hall of India, 2006.
2. Rajaraman V, “The Fundamentals of Computer”, 4th Edition, Prentice-Hall of India, 2006.

Course Title	Basic Electrical and Electronics Engineering && Basic Electrical and Electronics Engineering Lab	Course No	24UELE01 (Theory) 24 UELE02 (Lab)			
Specialization	Engineering Science	Structure (LTPC)	3	0	1	4
Offered for	UG	Status	Core √		Elective	
Faculty	SFET	Type	New		Modification √	
Pre-requisite	Nil	To take effect from	2024-2025			
Submission date	23-07-2024	Date of approval by BoS	25-07-2024			
Course Objective:	The objective of this course is to provide students with a fundamental understanding of electrical and electronics principles, circuits, machines, semiconductor devices and their applications, energy generation and distribution, as well as troubleshooting and safety practices.					
Course Outcome:	After completion of the course, the student will be able to: CO1: Apply fundamental electrical concepts to analyze and solve DC circuit problems. CO2: Apply fundamental electrical concepts to analyze and solve AC circuit problems. CO3: Comprehend the principles and working of electrical machines and transformers. CO4: Understand the characteristics and applications of semiconductor devices and logic gates. CO5: Analyze and interpret electrical energy generation, distribution systems and diagnose & rectify electrical faults while ensuring safety.					

Contents of the course	UNIT I: DC Circuit Analysis Fundamentals of Electric Circuits: Charge, Current, Resistance, Voltage, Ohm's Law, Kirchhoff's Laws, Ideal DC voltage and current sources, Electric Power and sign convention, open circuit voltage, short circuit current, voltage division rule, current division rule, Practical DC voltage and current sources, Source Transformation UNIT II: AC Circuit Analysis AC Networks: Energy storage elements-Inductance and Capacitor, Generation of sinusoidal emf, phasor representation of alternating quantities, Average and RMS values, Peak Factor, Form Factor, AC circuit analysis through: Purely resistive, inductive & capacitive circuit, RL, RC and RLC circuit, Active Power, Reactive Power, Apparent Power, Power Factor, Impedance, Admittance, Resonance in series and parallel RLC circuit, Star and Delta connection in three phase system, voltage and current relations in star and delta connections UNIT III: Electrical Machines and Transformers Transformer: Principle of Operation, Concept of Ideal Transformer, EMF Equation, Voltage transformation ratio and current ratio, Classification: Core Type and Shell Type DC Machines: Principle and Construction of DC Generator, EMF equation of DC generator, Types of DC generators: Separately and Self-Excited, DC Motors: Types and Applications Three phase Induction Motor: Principle of operation, slip, applications UNIT IV: Semiconductors and its Applications Semiconductor materials: Intrinsic and Extrinsic, n-type and p-type semiconductor, p-n junction, p-n junction diode, forward bias and reverse bias, V-I characteristics of diode, Zener Diode
	UNIT V: Electrical Energy Generation, Distribution and Safety Power generation and power plants, Transmission and distribution systems, Electrical substations and switchgear, Power factor correction, Energy meters and energy management Troubleshooting techniques for electrical systems, Safety procedures and precautions in electrical work, Protection devices (Fuse, MCB) and grounding systems, Electrical codes and regulations, Introduction to electrical maintenance and repair.
Textbook	1. Principles and applications of Electrical Engineering by Giorgio Rizzoni, McGraw Hill Education. 2. "Electric Circuits" by James W. Nilsson and Susan A. Riedel, Pearson. 3. "Electric Machinery Fundamentals" by Stephen J. Chapman. 4. "Semiconductor Physics and Devices" by Donald A. Neamen. 5. "Electrical Power Systems: Design and Analysis" by Mohamed E. El-Hawary. 6. "Electrical Safety Handbook" by John Cadick and Mary Capelli-Schellpfeffer.

	7. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010. 8. S. Ghosh, “Fundamentals of Electrical and Electronics Engineering”, PHI Publications. 9. J.B. Gupta, “Text book of Basic Electrical and Electronics Engineering”, S.K.Kataria Publications. 10. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
References	1. V.D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India. 2. D.P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010. 3. Hughes Edward, Electrical & Electronic Technology, Pearson Education, 2007. 4. Alexander. C. K. & Mathew. N. O. Sadiku, Fundamentals of Electrical circuits, Tata McGraw Hill, 2008. 5. P.S. Bimbhra, “Electrical Machinery”, Khanna Publishers. 6. Milman & Halkias, “Integrated Electronics” TMH. 7. M. Morris Mano, “Digital Logic and Computer Design” Pearson.
Laboratory Content	<u>List of Experiments</u> 1. Introduction of tools, electrical materials and abbreviations 2. To verify Ohm's Law using a DC circuit. 3. To study and verify Kirchhoff's Laws using a DC circuit. 4. To measure resistances using various methods: color coding and multimeter. 5. To verify series and parallel combinations of resistors. 6. To study running and reversing and working principle of Single-Phase Induction Motor 7. To determine the turn ratio of the transformer 8. To study voltage-current characteristics of a diode in forward and reverse bias conditions. 9. To measure input resistance, output resistance and current gain of a PNP/NPN transistor in common collector configuration. 10. To troubleshoot electrical circuits: identification and rectification of faults 11. To wire up a circuit in the conduit system two lamps and a socket out let each controlled independently. 12. To wire up a circuit in a conduit system one lamp is controlled by two switches (stair case wiring) from different places. Note: Minimum 8 Experiments to be performed

English Language and Business Communication 24UENG01							
B. Tech. CSE (AI/ML) Semester-1							
L	T	P	Credits	Core Course	Internal Examination	:	15
1	0	0	1		External Examination	:	35
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hours
Prerequisite							

Course Objectives:

To train students to enhance their skills in written as well as oral communication through practical conduct of this course. This course will help students in understanding the principles and techniques of business communication.

Course Outcome:

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

- CO1. Students would be able to understand the nature, structure, types and process of various dimensions of communication and apply them in communication.
- CO 2. Students would be able to make effective presentations in various business/professional situations incorporating the ethics of good negotiations and assertive behavior.
- CO 3. Students would develop competency to understand and perform the diversity of the globalized multicultural world.
- CO 4. Students would be able to draft various types of documents used inside the organization for various types of communication.
- CO 5. Students would develop interview skills and competency incorporating the use of different social media platforms for networking.

Course Contents

Unit I Communication Skills - Meaning, Process and Types of Communication; Principles of Effective Communication;

Unit II Grammar and Vocabulary - Use of Tenses, Articles, Prepositions, Conjunctions, Subject-verb concord, Word formation: Base, Prefixes, Suffixes Synonyms, Antonyms, One-word substitutes

Unit III Listening Skills - Process and types of listening, deterrents to listening process, Essentials of good listening.

Listening Comprehension and Note Taking

Unit IV Writing Skills - Report writing, Agenda and Minutes; Letter Writing: Business letters,

Cover letters, Electronic mail; Resume Writing

Unit V Speaking Skills - Preparing for interviews- Types of interviews, Group discussion; Effective ways of performing well in interviews; Public Speaking **Recommended Readings:**

- Joseph, C. J., Myall, E. G., and A. Biswas, eds. A Comprehensive Grammar of Current English. New Delhi: Inter University P, 2014.
- Lata, Pushp, and Sanjay Kumar. Communication Skills. 2 nd ed. New Delhi: OUP, 2019.

- Monippally, Matthukutty, M. Business Communication: From Principles to Practice. NewDelhi: McGraw Hill Pub., 2018.
- Mukerjee, H. S. Business Communication: Connecting at Workplace. New-Delhi: Oxford University Press, 2012. • Murphy, H. A., Hildebrandt, H.W., and Thomas, J.P. Effective Business Communication. Boston: McGraw-Hill Companies, 1997.
- Ramesh, Gopalaswamy, and Mahadevan Ramesh. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Noida: Pearson, 2019.
- Sandra, M. O. Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied. New Delhi: Routledge, 2004.
- Sinha, K. K. Taxmann's Business Communication.4th Revised ed. New Delhi: Taxmann's Pub., 2018.
- Sinha, R. P. Current English and Usage with Composition. New Delhi: OUP, 2013.
- Taylor, Grant. English Conversation Practice. Indian ed. Chennai: McGraw Hill Education Pvt. Ltd.

English Language and Business Communication Lab 24UENG02							
B. Tech. CSE (AI/ML) Semester-1							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hrs.
Prerequisite							

Course Objectives:

This course is designed to strengthen the communication abilities of the learners by providing them hands-on practice.

Course Outcome:

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

1) Demonstrate knowledge and understanding of a range of professional or public communication situations. 2) Perform effectively in diverse professional and public communication situations like interviews and negotiations, drafting emails and resume etc.

Course Contents:

1. Situational Conversations
2. Listening Skills
3. Resume Writing
4. Mock Interviews
5. Group Discussion
6. Presentation Skills
7. Negotiation Skills
8. Email Writing
9. Public Speaking

Note: The teacher should play the role of the facilitator and allow the learners maximum time to practice these activities. The focus should be primarily on helping the learners overcome the LSWR barrier and gradually move towards honing these skills to enable the learners use them in professional communication situations.

Course Title	Environmental Science	Course Code	24 UEVS01		
Specialization	Value Added Course/ Audit Course	Structure (LTP)	2	0	0
Offered for	UG	Status	Core √	Elective	
Faculty	SFASH	Type	New √	Modification	
Credits	2	Marks	Internal	30	
Hours	30		External	70	
Prerequisite	Nil	To take effect from	2024-2025		
Submission date	13-07-2024	Date of approval by BoS	23-07-2024		
Course Objective	To develop foundation on principles of environmental studies and concept of structure and function of different compartments of the environment.				
Course Outcome	On completion of this course, students will be able to: CO1 : Understand the fundamentals of environmental studies. CO2: Comprehend ecosystems and their dynamics. CO3: Implement corrective measures for the abatement of pollution. CO4 : Understand the waste management techniques. CO5: Grasp environmental policies, legislation, and issues.				
Contents of the course	Unit 1: Indian Knowledge System- Indigenous Practices, Air & Environment Environment: Nature, Scope and Importance, Need for Public Awareness. Renewable and Non-Renewable Resources, Atmosphere: Introduction, layers of the atmosphere, Traditional agricultural practices - Organic farming, Crop rotation, Intercropping), Water management techniques - Stepwells, Tankas, Baolis, Forest management and conservation methods - Sacred groves, Agroforestry Unit 2: Ecosystems Concept, Structure and Function of an Ecosystem, Energy Flow in the Ecosystem, Biogeochemical Cycles, Types of Ecosystem: Forest Ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic Ecosystems. Unit 3: Environmental Pollution Environmental Pollution: Definition, Causes, Effects and Control Measures, Different Types of Pollutions, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Environmental issues: Climate change, global warming, acid rain, ozone layer depletion Unit 4: Waste Management, Environmental policies and legislation Solid waste management Municipal solid waste management techniques: Bio Composting, Vermicomposting, Incineration, Landfill sites, Liquid waste management: Waste water and Standards for its discharge given by CPCB, Wastewater treatment: Effluent Treatment Plant and Sewage treatment plant (STP), Wildlife Protection Act 1972, Forest Conservation Act 1980, Water (Prevention and control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986				

Field Work	• Visit to a local area to document environmental assets river/forest/grassland/hill/mountain • Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural • • Participation in plantation drives and nature camps. • Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.
Text Books	1. Singh, J.S., Singh, S.P. & Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications. 2. Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders. 3. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson).
References	1. Deevedi M. (2021). Environment and ecology in the Indian knowledge system. Vidyanidhi prakashan. 2. Melissa K. Nelson and Daniel Shilling. (2018). Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability. Cambridge University Press. 3. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK. 4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. 5. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/ 6. Ahluwalia, V. K. (2015). <i>Environmental Pollution, and Health</i>. The Energy and Resources Institute (TERI).

24UMTH03 : Engineering Mathematics - I							
B. Tech. Semester – I							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	1	0	4	24 UMTH03	External Examination	:	70
Effective from Session:				2024-2025	Total	:	100
Date of BoS approval:				23-07-2024	Duration of Exam	:	3 Hrs.
Prerequisite							

Course Objective:

The objective of the paper is to facilitate the student with the basics of Applied Mathematics that are required for an engineering student. To impart basic knowledge on complex numbers, series, basics of calculus, linear algebra and matrices.

Course Outcomes:

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

- CO1. Apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions. Explain the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- CO2. Discuss the tool of power series and Fourier series for learning advanced Engineering Mathematics.
- CO3. Explain the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing with engineering problems.
- CO4. Students should be able to apply linear algebra techniques to solve engineering problems.
- CO5. Illustrate the mathematical tools needed in evaluating matrices and linear equations.

Course Contents:

Unit I

Calculus : Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Unit II

Sequences and Series : Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Unit III

COMPLEX VARIABLES: Real and complex numbers, basic properties and geometry. Cauchy-Riemann equations, Analytic functions, Harmonic functions, Derivatives of analytic functions, Contour integrals, Taylor's, Maclaurin's, Laurent's series. Zeros and poles, Cauchy Residue Theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Unit IV

Linear Algebra : Vector spaces, Subspaces, basis and dimension, linear transformations, representation of transformations by Matrices, linear functionals, transpose of linear transformations, canonical forms. Linear functionals and adjoints, Bilinear forms, symmetric bilinear forms, skew symmetric bilinear forms.

Unit V

Matrices : Linear Systems of Equations; Linear Independence; Determinants; Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Text books:

- 1 . Reena Garg, Engineering Mathematics - I, Khanna Book Publishing Company, 2020.
2. B.S Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Reference Books:

1. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th edition, McGraw Hill, 1990.

Introduction to Disruptive Technologies (26UCSE01)							
B. Tech. CSE (AI/ML) Semester – I							
L	T	P	Credits	Core Course	Internal Examination	:	30
1	0	0	1		External Examination	:	70
Effective from Session:				w.e.f. 2026-2027	Total	:	100
Date of BoS approval:				5 June, 2026	Duration of Exam	:	3 Hrs
Prerequisite							

Course Objectives

The objectives of this course are to:

1. Introduce students to the concept and significance of disruptive technologies in the digital era.
2. Familiarize students with major emerging technologies and their real-world applications.
3. Develop awareness of technology-driven innovation and digital transformation across industries.
4. Enable students to identify potential career, certification, and internship opportunities in emerging technology domains.
5. Encourage lifelong learning and responsible use of emerging technologies.

Course Outcomes (COs)

Upon successful completion of this course, the students will be able to:

CLO1: Explain the concepts and importance of disruptive technologies in modern society and industry.

CLO2: Identify the key features and applications of emerging technologies such as AI, IoT, Cloud Computing, and Blockchain.

CLO3: Illustrate the role of disruptive technologies in solving real-world problems across various sectors.

CLO4: Analyze emerging technology trends and their impact on future careers and industries.

CLO5: Evaluate opportunities for skill development, certifications, and internships in emerging technology domains.



UNIT – I : Introduction to Disruptive Technologies

Technology Evolution, Digital Transformation, Industry 4.0 and Industry 5.0, Characteristics of Disruptive Technologies, Emerging Technology Landscape, Impact of Disruptive Technologies on Society and Industry.

UNIT – II : Artificial Intelligence and Data Technologies

Artificial Intelligence, Machine Learning, Generative AI, Data Science, Big Data Analytics, Applications of AI in Healthcare, Education, Finance, and Manufacturing.

UNIT – III : Internet of Things and Cloud Computing

Internet of Things (IoT), Smart Devices and Connected Systems, Smart Cities, Industrial IoT, Cloud Computing Fundamentals, Cloud Services and Applications.

UNIT – IV : Blockchain and Cyber Security

Blockchain Fundamentals, Cryptocurrencies, Smart Contracts, Applications of Blockchain, Cyber Security Fundamentals, Digital Privacy, Cyber Threats and Security Awareness.

UNIT – V : Future Technologies and Innovation

Robotics and Intelligent Automation, Extended Reality (AR/VR), Digital Twins, Quantum Computing Overview, Green and Sustainable Technologies, Future Technology Trends and Innovation Opportunities.

Text Books

1. Bernard Marr, *Tech Trends in Practice: The 25 Technologies That Are Driving the Fourth Industrial Revolution*, Wiley.
2. Klaus Schwab, *The Fourth Industrial Revolution*, Crown Business.

Reference Books

1. Melanie Mitchell, *Artificial Intelligence: A Guide for Thinking Humans*, Farrar, Straus and Giroux.
2. Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order*, Houghton Mifflin Harcourt.
3. Bernard Marr, *Future Skills: The 20 Skills and Competencies Everyone Needs to Succeed in a Digital World*, Wiley.

Semester-2

Digital Electronics 24UCEE02							
B. Tech. CSE (AI/ML) Semester – II							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hrs.
Prerequisite							
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective: The objectives of the course are -

- To understand the basics of Boolean algebra.
- To understand the combinational and sequential circuit with the difference between them.
- To understand A/D and D/A converters.

Course Outcomes:

The course will enable the student to:

- CO1. Recall the basic concepts of digital logic and systems
- CO2. Understand the working of digital logic families and logic gates.
- CO3. Design and implement Combinational and Sequential logic circuits.
- CO4. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- CO5. Be able to use PLDs to implement the given logical problem.

Course Contents:

Unit I: Fundamentals of Digital Systems and Boolean Algebra

Information Representation: Number Systems - binary, signed binary, octal, decimal, hexadecimal; Binary Arithmetic, one's and two's complements arithmetic, Fixed-point and Floating-point representation of



numbers, BCD Codes, Error detecting and correcting codes, Character Representation – ASCII, EBCDIC, Unicode. Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations.

Binary Logic: Boolean Algebra, Boolean Theorems, Boolean Functions and Truth Tables, Canonical and Standard forms of Boolean functions, Simplification of Boolean Functions –Venn Diagram, Karnaugh Maps

Unit II: Combinational Digital Circuits

Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, DeMultiplexer / Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker / generator, code converters.

Unit III: Sequential circuits and systems

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T- and D-types flip flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Unit IV: A/D and D/A Converters

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

Unit V: Digital logic families, Semiconductor memories and PLDs

Digital logic families: Examples of IC gates, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory (RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Suggested Text Book(s):

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

Reference Books:

1. "Digital Principles and applications", Donald P Leach, Albert Paul Malvino, GoutamSaha. McGrawHill , 8th Edition, 2015.

2. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012.
3. Digital Logic Design, R.D. Sudhakar Samuel, Elsevier.

Digital Electronics Lab 24UCEE03							
B. Tech. CSE (AI/ML) Semester-II							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hrs.
Prerequisite							

Course Objective:

The objectives of the course are to make students aware about the practical implementation of Boolean logics, combinational and sequential circuits.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1. Recall theory and correlate with the practical

CO2. Understand working of logic families and logic gates

CO3. Design and implement Combinational and Sequential logic circuits for a given problem

CO4. Demonstrate the implementation of various flip-flops and their applications.

Course Content:

1. Implementation of AND, OR and NOT gate
2. Implement NAND and NOR gate, and show these are universal gates
3. To study and perform logic gates.
4. To study and perform De'Morgan's Theorem.
5. To study and perform NAND and NOR as a universal gate.
6. To design and implement a circuit that converts binary code to Grey code.
7. To study and perform about Half Adder and full Adder.
8. To study and perform about Half subtractor and full subtractor.
9. To design a 3-bit odd/even parity generator and checker.
10. To study and perform R-S and D flip flops.
11. To study and perform a J-K and T flip flop.
12. To study and perform a Master slave JK flip flop.
13. To realize Boolean functions using a multiplexer.
14. To study and perform about Decoder and Demultiplexer.

15. To study the use of decoder for BCD to seven segment LED display.

Text books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

References books:

1. "Digital Principles and applications", Donald P Leach, Albert Paul Malvino, Goutam Saha, McGrawHill, 8th Edition, 2015.
2. Digital Logic & State Machine Design, David J. Comer, Oxford University Press, 3rd Reprinted Indian Edition, 2012
3. Digital Logic Design, R.D. Sudhakar Samuel, Elsevier

Data Structures 24UCSE03							
B. Tech. CSE (AI/ML) Semester-II							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:				22-7-24	Duration of Exam	:	3 Hrs.
Prerequisite							
Instruction for Paper Setter: - There should be 9 questions in the end term examinations question paper. - The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. - Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. - Each Unit shall have a marks weightage of 14. - The questions are to be framed keeping in view the learning outcomes of the course / paper as per the Revised Bloom Taxonomy. The standard / level of the questions to be asked should be at the level of the prescribed textbook. - The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objectives:

The students will try to learn:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Course Outcomes:

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

- CO1. Recall all the data structures and their operations
- CO2. Understand the fundamental difference among different data structures
- CO3. Analyse the algorithms to determine the time and computation complexity and justify the correctness.
- CO4. Implement suitable representation (in form of a data structure) of given data for a given problem.
- CO5. Differentiate among the various data structure and their time and space requirements

Course Content:

Unit 1

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks:

Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.



Unit 3

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Unit 4

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit 5

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text books:

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, and Computer Science Press.

Reference books:

1. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education.

Data Structure Lab 24UCSE04							
B. Tech. CSE (AI/ML) Semester-II							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:					Duration of Exam	:	
Prerequisite							

Course Objective:

To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees

Course Outcome:

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

- CO1. Recall the basic theory concepts
- CO2. Implement basic data structure and its various operations to represent given data
- CO3. Differentiate among the use of data structure
- CO4. Provide an algorithm with suitable data structure to solve a given problem.

Course Content:

- Write a program to search an element in an array using: linear search and binary search
- Write a menu-driven program to perform array operations: search, insert at beginning, insertion at end, insertion after a given number, insertion before a given number, deletion from beginning, deletion from t end, deletion after a given number, deletion before a given number,
- Write a Program to implement the operations of Singly Linked Lists.
- Write a Program to implement the operations of doubly Linked Lists.
- Write a Program to implement the operations of Circular Linked Lists.
- Write a C program that uses stack operations to convert a given infix expression into its Postfix
- Write a Program to Implement Queue Operations by using Array and Linked Lists.
- Write a Program to implement factorial of n using stack.
- Write a Program to Implement Circular Queue operations by using array and linked list.
- Write a Program to Sort the set of elements: (i.e., numbers or strings)
 - Quick Sort
 - Heap Sort
 - Merge Sort
- Write a Program to Implement the Binary Search Tree Operations.
- Write a Program to Perform the Tree Traversal Techniques by using the Iterative Method
- Write C programs for implementing the following graph traversal algorithms:
 - Depth first traversal
 - Breadth first

traversal **Text books:**

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer

Science Press. **References books:**

1. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education

Python Programming							
24UCEC02							
B. Tech. CSE (AI/ML)							
Semester-II							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:				22 -7- 2024	Duration of Exam	:	3hr
Prerequisite							

Course Objective:

The objective of this course is to introduce students to the Python programming language.

- To understand various data structures
- To visualize data in 2D
- To read files and handle exceptions

Course Outcomes:

The course will enable the student to:

- CO1. Create, run and manipulate Python programs using core data structures like lists, tuples, dictionaries and use regular expressions.
- CO2. Demonstrate proficiency in handling strings and file systems.
- CO3. Implement Object Oriented Programming concepts in Python.
- CO4. Analyze data with Python libraries. CO5. Understand the basic concepts of scripting and construct scripts in Python language.

Course Contents:

Unit I: Fundamentals of Python Programming

Python Introduction: Overview of Python, Features, History and versions, Python Applications and associated framework introduction, Installing and setting Python environment, Execution of Python program. Python Data Model: Objects, Identity, Type and Value, Mutable and Immutable Objects, Built-in Data Types, identifiers, variables, keywords. Operators and Operators precedence.

Unit II: Python Programming Constructs I: Standard Types and Operations.

Numbers: Introduction, Integers, Floating Point Real Numbers, Complex Numbers, Conversion and functions.

Sequences: Strings, Lists, Tuples, Sets, Dictionary.

Strings: Sequence operations, String Methods, Pattern Matching.

Regular Expressions: Introduction, Special Symbols and Characters, RE and Python, Pattern matching and searching, Password, email, url validation using regular expression.

Lists: Basic Operations, Iteration, Indexing, Slicing and Matrixes, List Functions and Methods.

Tuples: Basic Operations, Iteration, Indexing, Slicing And Matrices, Tuple Functions.

Sets; Dictionaries: Basic dictionary operations, Dictionary Functions and Methods.

Unit III: Python Programming Constructs-II: Control Structures and Functions

Control Statements: If, If-else, Nested If, For, While, range() function, Break, Continue, Pass.

Functions: Definition, Call, Arguments, Return statement, Scope rules, Name resolution, Passing Function to Functions, Python Built-In Functions, Related Modules.

Unit IV: Object Oriented Programming and Modules

Object Oriented Programming in Python: Classes, Objects, Accessing Attributes, Inheritance, Polymorphism, Constructors and Destructors, Operator Overloading and Function Overloading, Overriding methods, Data Hiding.

Modules: Modules and Files, Namespaces and scoping, Module Coding Basics, Creating and importing modules and attributes, Module Built-in Functions, dir(), globals(), locals(), reload(), Executing Modules as Scripts, Compiled Python files(.pyc), Standard Modules: OS, SYS, Math,

Random, Statistics, Packages, Package creation and importing, Other features of modules, Date and Time modules.

Unit V: File and Exception Handling

File Handling: File Objects, Methods and Attributes, Standard Files, Command line Arguments

Exception Handling: Errors and Exception detection and handling, Default Exception Handler Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, Creating User-Defined Exceptions, User Defined Package with Python.

Python Programming Lab 24UCEC03							
B. Tech. CSE (AI/ML) Semester-II							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	4	2		External Examination	:	15

Effective from Session:	w.e.f. 2024-2025	Total	:	50
Date of BoS approval:	22 -7- 2024	Duration of Exam	:	3hr
Prerequisite				

Objective:

The objective of this course is to do hands-on practice of the Python programming language concepts and its frameworks and libraries.

List of Laboratory / Practical

1. Study and implementation of Python variables, identifiers, literals, keywords, comments, and basic input/output operations.
2. Program to demonstrate arithmetic, relational, logical, bitwise, assignment operators, and operator precedence.
3. Program to explore Python objects, data types, type checking, and type conversion.
4. Program to demonstrate the use of numeric data types and built-in numeric functions.
5. Program to perform user interaction and simple calculations using console-based input and output.
6. Program to perform string operations including indexing, slicing, concatenation, and string methods.
7. Program to implement pattern matching and searching using regular expressions.
8. Program for email, URL, and password validation using regular expressions.
9. Program to perform list operations including insertion, deletion, searching, sorting, and list traversal.
10. Program to implement matrix operations using nested lists.
11. Program to demonstrate tuple operations including indexing, slicing, and built-in tuple functions.
12. Program to perform set operations such as union, intersection, difference, and symmetric difference.
13. Program to implement dictionary operations including creation, update, deletion, and traversal.
14. Program to develop a menu-driven application using conditional statements (if, if-else, nested if).
15. Program to generate patterns and number series using for and while loops.
16. Program to demonstrate the use of range(), break, continue, and pass statements.
17. Program to create and invoke user-defined functions with different types of arguments.
18. Program to demonstrate recursive functions and scope rules in Python.
19. Program to use built-in functions and related modules for common computational tasks.
20. Program to create classes and objects and demonstrate constructors, attributes, and methods.
21. Program to demonstrate inheritance, polymorphism, method overriding, and operator overloading.
22. Program to create, import, and use user-defined modules and packages.
23. Program to use standard Python modules such as os, sys, math, random, statistics, and datetime.
24. Program to perform file handling operations including reading, writing, appending, and processing text files.

25. Program to implement exception handling, assertions, user-defined exceptions, and command-line argument processing.

Suggested Text Books:

1. Downey, A.B., (2015), Think Python – How to think like a Computer Scientist, 3rd edition.
O'Reilly Media.
2. Taneja, S. & Kumar, N., (2017), Python Programming- A Modular Approach. Pearson Education.

Reference Books:

1. Head First Python by Paul Barry, O'Reilly, 2010.
2. Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Co., Delhi.
3. Learning Python, 5th Edition, by Mark Lutz, O'Reilly Media, Inc., ISBN: 9781449355739.
4. Guttag, J.V.(2016), Introduction to computation and programming using Python. MIT Press.
5. Liang, Y.D. (2013), Introduction to programming using Python. Pearson Education.
6. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.

Semester 3

Discrete Mathematics 24UCSE06							
B. Tech CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	30
4	0	0	4		External Examination	:	70
To be effect from:				w.e.f. 2024-2025	Total	:	100
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hours
Prerequisite							
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objectives:

The Students will try to learn:

- To introduce the concept of Mathematical Logic, concepts of sets, relation and functions
- to understand the induction principle and counting technique
- To introduce the concept of propositional logic
- To understand Group theory and related examples
- To use Graph theory for solving problems

Course Outcomes:

After the completion of this course students will be able to:

- CO1. Ability for constructing mathematical logic to solve problems
- CO2. Ability to analyse/ quantify the efficiency of a developed solution (algorithm) of a computational problem
- CO3. Ability to understand mathematical preliminaries to be used in the subsequent courses of the curriculum. This includes Boolean algebra, number theory, group theory, and combinatorics.
- CO4. Ability to understand diverse relevant topics in discrete mathematics and computation theory with an emphasis on their applicability as mathematical tools in computer science.

Course Content:

Unit 1: Sets, Relation and Function

Operations and Laws of Sets, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets Cartesian Products, Disjunctive and Conjunctive Normal Form Binary Relation : representation of relations, Partial Ordering Relation, Equivalence Relation, Image of a Set, Function: Sum and Product of Functions, Bijective functions, Inverse and Composite.

Unit -2: Principles of Mathematical Induction

The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic **Basic counting techniques**-inclusion and

exclusion, pigeon-hole principle, permutation and combination. Introduction to recurrence relations and generating functions.

Unit-3: Propositional Logic

Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof, Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Unit 4: Algebraic Structures and Morphism

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function. **Unit 5: Graph Theory** Graph Terminology, Planar graphs, Euler's formula (proof), Euler and Hamiltonian path/circuit. Chromatic number of a graph, five color theorem (proof), Shortest path and minimal spanning trees and algorithms, Depth-first and breadth first search, trees associated with DFS & BFS, Connected components. Complexity Analysis of the graph MST.

Text Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Reference Books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and It's Application to Computer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
3. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, Discrete Mathematics, Tata McGraw - Hill

Computer organization and Architecture 24UCSE07							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	30
4	0	0	4		External Examination	:	70
To be effect from:				w.e.f. 2023-2024	Total	:	100
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hrs.

Instruction for Paper Setter:

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives:

The students will try to learn:

1. Understand the organization and architecture of computer systems and electronic computers.
2. Study the assembly language program execution, instruction format and instruction cycle.
3. Design a simple computer using hardwired and micro-programmed control methods.
4. Study the basic components of computer systems besides the computer arithmetic.
5. Understand input-output organization, memory organization and management, and pipelining.

Course Outcome:

After completion of the course the students are able to:

- CO1. To understand the functional blocks of a computer and their working.
 CO2. Analyse the CPU organization along with Instruction Level Architecture, different addressing modes
 CO3. Apply and analyse the pipelining for speed-up processing CO4. Understand the working principles of I/O devices.
 CO5. Understand and the current state of art in memory system design.
 CO6. Analyse the suitable computer architecture for the real life application.

Course Content:

Unit 1: Functional blocks of a Computer

CPU, Memory, input/output subsystems, control unit, Multilevel viewpoint of a machine: digital logic, micro architecture, ISA, operating systems, high level language , RTL Computer Buses (basic design using multiplexers), Bus width, Bus clocking(synchronous , asynchronous), bus arbitration, Bus examples(ISA bus, PCI bus, Universal serial bus) . Data representation: signed number representation, fixed and floating point representations.

Unit 2: CPU Organization:

Instruction set architecture of a CPU, interpretation of instructions, Instruction set based classification of processors (RISC, CISC, and their comparison), CPU Architecture types (accumulator, register, stack, memory/ register) Instruction cycle (Fetch-Decode-Execute)
 Addressing modes (register, immediate, direct, indirect, indexed); Operations in the instruction set; Arithmetic and Logical, Data Transfer, Control Flow; Instruction set formats (fixed, variable, hybrid)

Unit 3: Pipelining

Basic concepts, throughput and speedup, hazards, Arithmetic Pipeline, Instruction Pipeline, Pipeline conflicts: Resource conflict, Data dependency, Branch Instructions. Solution for the data dependency: hardware interlock, operand forwarding, delayed load. Solution for branch instruction: prefetch target instruction, branch target buffer, loop buffer, branch prediction, delayed branch

Unit 4: Input /Output & Control Unit

Input Output Interface, Asynchronous data transfer (Strobe control, handshaking, serial transfer); Serial Vs parallel data transmission; Modes of data transfer, Programmed I/O, Interrupt driven, Direct Memory access (DMA). **Control Unit design:** Control unit design methods (hardwired & microprogrammed) Control Memory, Address Sequencing, Micro instructions.

Unit 5: Memory Organization:

Memory device characteristics (access/ cycle time, cost per bit, volatility, storage density); Memory hierarchy; Main memory Design (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types, their comparison); Associative memory Design, Match logic, Locality of reference principle (Temporal & Spatial) Cache mapping (Direct, associative, set associative); Cache writing policies (Copy-Back, Write-through); Virtual Memory (Address space, memory space, Address mapping using pages, Page replacement)

Text Books:

1. Computer System Architecture by M. Mano, Prentice-Hall.
2. Structured Computer Organisation by A.S. Tanenbaum, 6th edition, Prentice-Hall of India, Eastern Economic Edition

Reference Books:

1. Computer Organization, 5th Edi, by Carl Hamacher, Zvonko Vranesic, 2002, SafwatZaky.
2. Computer Organization and Design, 2nd Ed., by David A. Patterson and John L. Hennessy, Morgan 1997, Kauffmann.
3. Computer Architecture and Organization, 3rd Edi, by John P. Hayes, 1998, TMH
4. Computer Organisation & Architecture: Designing for performance by W. Stallings, 4th edition, 1996, Prentice-Hall International edition.

Database Management Systems 24UCSE08							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
To be effect from:				w.e.f. 2024-2025	Total	:	100
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hrs.

Instruction for Paper Setter:

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks.
3. Apart from question 1 which is compulsory, the rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objective:

The objectives are:

- To inculcate the basic understanding of the basic concepts and applications of database systems • To inculcate understanding of the relational database design principles

Course Outcome:

After completion of the course, the student will be able to:

- CO1. Recite the fundamental concepts of database management system
- CO2. Understand basics of database systems, need of normalization
- CO3. Demonstrate the basic elements of a relational database management system
- CO4. Identify a suitable data model for a given problem
- CO5. Explain the main issues related to transaction and data storage with probable solution

Course Content:**Course Content:****Unit 1**

Database system architecture: - Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: - Entity-relationship model, network model, relational and object-oriented data models, integrity constraints, data manipulation operations.

Unit 2

Entity Relationship Modelling: Entity Type, Entity Set, Attributes, Keys, Relationship Degree, Role Names, and Recursive Relationships, Weak Entity Sets, ER Modelling, subclasses, Superclass, inheritance. ER to Relational Mapping

Unit 3

Relational query languages:- Relational algebra, Tuple and domain relational calculus, SQL latest version, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB latest version, SQL server. Relational database design: - Domain and data dependency, Armstrong's axiom, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: - Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit 4

Database consistency, ACID properties.

Concurrency control Techniques: Two-Phase Locking Techniques for Concurrency Control- Basic, Conservative, Strict, and Rigorous Two-Phase Locking. Deadlock Prevention Protocol, Deadlock Detection, Concurrency Control Based on Timestamp Ordering

Unit 5

Disk Storage: Secondary Storage Device, Buffering of Blocks, Records and Record Types, Allocating File Blocks on Disk, and its operations, Hashing Techniques: Internal and External Hashing Techniques, Parallelizing Disk Access Using RAID Technology

File structure: Indexing structure for files, Primary Indexes, Clustering Indexes, Secondary Indexes, Multilevel Indexes, Indexes on Multiple Keys

Text Books:

1. “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education.

REFERENCES BOOKS:

1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
3. “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, AddisonWesley

Database Management System lab 24UCSE09							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
To be effect from:				w.e.f. 2024-2025	Total	:	50
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hrs.

Course Objective:

The students will try to learn:

- To create a database and query it using SQL, design forms and generate reports
- Understand the significance of integrity constraints, referential integrity constraints, triggers, assertions.

Course Outcome:

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

- CO1. Recite the syntax of different type of query languages like, data manipulation language, data control language and data definition language
- CO2. Understand the database creation and imposing different constraints on the database

CO3. Fetch the required data from the database by writing appropriate query CO4. Differentiate among the different types of normalization and join operations **Course Content:**

Tentative list of practical's:

Create the following schemas:

EMPLOYEE Schema

Field	Type	NULL	KEY
Empno	char(3)	NO	PK
Ename	VARCHAR(10)	NO	NIL
Job	VARCHAR(9)	NO	NIL
Mgr	INT	YES	FK
Hiredate	DATE	NO	NIL
Salary	NUMERIC(7,2)	NO	NIL
Commission	NUMERIC(7,2)	YES	NIL
Deptno	INT	NO	FK

DEPARTMENT Schema

Field	Type	NULL	KEY
deptno	INT	NO	PK
deptName	VARCHAR(50)	YES	NIL
Location	VARCHAR(30)	YES	NIL

Perform the following queries:

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than \$2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of \$1500 and \$2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.
10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees who either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manager's Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.

18. Query to display Name and calculate the number of months between today and the date each employee was hired.
19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
20. Query to display Name with the 1st letter capitalized and all other letters lowercase and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
21. Query to display Name, Hire Date and Day of the week on which the employee started.
22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an 'A' in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manager's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies \$100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.
35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department **Text Book:**

1. Elmasri, R., & Navathe, S.B. (2015). *Fundamentals of Database Systems*. 7th edition. Pearson Education.

References:

1. Date, C. J. (2004). *An Introduction to database systems*. 8th edition. Pearson Education.
2. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2010). *Database System Concepts*. 6th edition. McGrawHill

Design and Analysis of Algorithms 24UCSE12							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
To be effect from:				w.e.f. 2024-25	Total	:	100
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hours
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type questions of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

The objective of this paper is to teach the students various problem solving strategies like divide and conquer, Greedy method, Dynamic programming and also the mathematical background for various algorithms. After doing this course, students will be able to select an appropriate problem solving strategies for real world problems. This will also help them to calculate the time, complexity and space complexity of various algorithms.

Course Outcome:

After Completion of the course students will be able to:

- CO1. To be able to analyse a problem in terms of processing steps, time and space complexity.
- CO2. To be able to design and implement the algorithms for any given application.
- CO3. To be able to develop software applications using various programming languages in collaborative groups.
- CO4. To apply the principles learnt in solving problems encountered in career or real-life situations.

Course Content:

Unit-I

Brief Review of Graphs, Sets and disjoint sets, union, sorting and searching algorithms and their analysis in terms of space and time complexity. Divide and Conquer: General method, binary search, merge sort, quick sort, selection sort, Strassen's matrix multiplication algorithms and analysis of algorithms for these problems.

Unit-II

Greedy Method: General method, knapsack problem, job sequencing with deadlines, minimum spanning trees, single source paths and analysis of these problems.

Dynamic Programming: General method, optimal binary search trees, O/I knapsack, the traveling salesperson problem.

Unit-III

Back Tracking: General method, 8 queen's problem, graph colouring, Hamiltonian cycles, analysis of these problems.

Unit-IV

Branch and Bound: Method, O/I knapsack and traveling salesperson problem, efficiency considerations. Techniques for algebraic problems, some lower bounds on parallel computations.

Unit-V

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph and NP scheduling problems some simplified NP hard problems.

Text books:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ., 2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson And Ronald L Rivest: 1990, TMH **Reference books:**

1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
3. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetniemi, 1997, MGH.
4. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H. .

Design and Analysis of Algorithms Lab 24UCSE13							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
To be effect from:				w.e.f. 2024-2025	Total	:	50
BoS approval Date:				22 -7- 2024	Duration of Exam	:	-

List of Practical's:

- Sort a given set of elements using the Quicksort method and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Using OpenMP, implement a parallelized Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.
- Obtain the Topological ordering of vertices in a given digraph.
- Compute the transitive closure of a given directed graph using Warshall's algorithm
- Implement 0/1 Knapsack problem using Dynamic Programming.
- From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
- Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm.
- i) Print all the nodes reachable from a given starting node in a digraph using BFS method.
ii) Check whether a given graph is connected or not using DFS method.
- Find a subset of a given set $S = \{s_1, s_2, \dots, s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if $S = \{1, 2, 5, 6, 8\}$ and $d = 9$ there are two solutions $\{1, 2, 6\}$ and $\{1, 8\}$. A suitable message is to be displayed if the given problem instance doesn't have a solution.
- Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
- Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.
- Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.
- Implement N Queen's problem using Back Tracking

Text books:
1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ., 2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson And Ronald L Rivest: 1990, TMH

Reference books:

- The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
- Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
- Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetniemi, 1997, MGH.
- Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H

Artificial Intelligence (24UCSE10)							
B. Tech. CSE(AI/ML) Semester – III							
L	T	P	Credits	Core Course	Internal Examination	:	30

3	0	0	3		External Examination	:	70
To be effect from:				w.e.f. 2024-2025	Total	:	100
BoS approval Date:				22 -7- 2024	Duration of Exam	:	3 Hrs.
Instruction for Paper Setter: - There should be 9 questions in the end term examinations question paper. - The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. - Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. - Each Unit shall have a marks weightage of 14. - The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. - The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science. This course will give the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence (AI).

Course Outcome:

After undergoing this course, the students will be able to: CO1. Recognize the basic concept of AI

CO2. Understand different searching algorithms and the difference among their working principal. Also, basic understanding of probability theory

CO3. Identify a search algorithm for a given problem and estimate its time and space complexities

CO4. Learn optimization and inference algorithms for model learning

CO5. Model a given scenario in the form of knowledge representation and frames CO6.

Implement basics AI programming in python **Course Content:**

Unit-1

Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

Unit-2

Search Algorithms: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

Unit-3

Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

Unit-4

Knowledge Representation and Reasoning

First Order Logic, building knowledge-bases, Logic based Reasoning Systems, Semantic Networks, Frames

Unit-5

Prolog Programming Prolog Programming: Introduction to Programming in Logic (PROLOG), Lists, Operators, basic Input and Output.

Text Books:

- Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill
- Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall
- Bratko, I. (2011). *Prolog Programming for Artificial Intelligence*. 4th edition. Pearson Education **References:**

1. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.
2. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011
3. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press.

Artificial Intelligence Lab (24UCSE11)							
B. Tech. Semester – III AI/ML w.e.f. 2023-2024							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
To be effect from:				w.e.f. 2024202 5	Total	:	50
BoS approval Date:				22 -7- 2024	Duration of Exam	:	-

Course Objective:

This course will give an opportunity to learn programming in PROLOG.

Course Outcome:

After undergoing this course, the students will be able to:

- CO1. Recall the basic syntax and semantics of PROLOG
- CO2. Understand the knowledge representation in PROLOG
- CO3. Implement small programs in PROLOG
- CO4. Differentiate the basic difference between AI programming and programming in other languages

List of Practicals:

1. Write a prolog program to calculate the sum of two numbers.
2. Write a Prolog program to implement $\max(X, Y, M)$ so that M is the maximum of two numbers X and Y.
3. Write a program in PROLOG to implement factorial (N, F) where F represents the factorial of a number N
4. Write a Prolog program to implement $\text{member}(A, S)$: to check whether A is a member of S or not.
5. Write a Prolog program to implement $\text{multiply}(X1, X2, M)$: where X1 and X2 denotes the numbers to be multiplied and M represents the result.
6. Write a Prolog program to implement GCD of two numbers
7. Write a program in PROLOG to implement $\text{palindrome}(S)$ which checks whether a list S is a palindrome or not
8. Write a Prolog program to implement $\text{maxlist}(S, M)$; $\text{minList}(S, M)$ so that M is the maximum/minimum number in the list.
9. Write a Prolog program to merge two lists.
10. Write a prolog program to implement $\text{insert_nth}(I, N, S, R)$ that inserts an item I into Nth position of list S to generate a list R
11. Write a prolog program to implement $\text{delete_nth}(N, S, R)$ that removes Nth position item of list S to generate a list R.

Text Books:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
2. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall
3. Bratko, I. (2011). *Prolog Programming for Artificial Intelligence*. 4th edition. Pearson Education

References books:

1. Trivedi, M.C., "A Classical Approach to Artificial Intelligence", Khanna Publishing House, Delhi.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
3. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.

Semester- 4

Operating system 24UCSE14							
B. Tech. CSE (AI/ML) Semester – IV							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							
Instruction for Paper Setter: - There should be 9 questions in the end term examinations question paper. - The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. - Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions. - Each Unit shall have a marks weightage of 14. - The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. - The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

The students will try to learn:

1. Problem-solving through programming
2. Programming language, programming, reading a set of Data, stepwise refinement, concepts of Loops, Functions, Control structure, Arrays, Structure, Pointer and File concept.
3. To build efficient programs in 'C' language essential for future programming and software engineering courses.

Course Outcome:

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

- CO1. Understand how an operating system manages all the resources in a computer system efficiently.
- CO2. Learn algorithms for CPU scheduling, deadlock handling, page replacement and disk scheduling used by an operating system.
- CO3. Use shell commands to efficiently operate a computer system.
- CO4. Learn and use system calls for process creation and termination, inter-process communication, process synchronization, memory management and file system management.
- CO5. analyses segmentation and paging techniques.
- CO6. Compare file naming in Linux and Windows

Course Content:

Unit-I

Introduction: Introduction to Operating System Concepts (including Multitasking, multiprogramming, multi user, Multithreading etc)., Types of Operating Systems: Batch operating system, Time-sharing systems, Distributed OS, Network OS, Real Time OS; Various Operating system services, architecture, System programs and calls.

Unit-II

Process Management: Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms -First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin(RR), Multilevel Queue Scheduling.

Unit-III

Memory Management: Logical & Physical Address Space, swapping, contiguous memory allocation, non-contiguous memory allocation paging and segmentation techniques, segmentation with paging; virtual memory management - Demand Paging & Page-Replacement Algorithms; Demand Segmentation.

Unit-IV

Process-Synchronization & Deadlocks: Critical Section Problems, semaphores; methods for handling deadlocks- deadlock prevention, avoidance & detection; deadlock recovery.

File System: Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms, Introduction to distributed file system.

Unit V

I/O Systems: I/O Hardware, Application I/O Interface, Kernel, Transforming I/O requests, Performance Issues. Unix System And Windows NT Overview: Unix system call for processes and file system management, Shell interpreter, Windows NT architecture overview, Windows NT file system.

Text Books:

1. Operating System Concepts by Silberchatz et al, 5th edition, 1998, Addison-Wesley.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice Hall

Reference Books:

1. Operating System by Peterson, 1985, AW.
2. Operating System by Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix & Windows By Colin Ritchie, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems – Advanced Concepts By MukeshSinghal , N.G. Shivaratri, 2003, T.M.H

Operating System Lab 24UCSE15
B. Tech. CSE (AI/ML) Semester-IV

L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:					Duration of Exam	:	-
Prerequisite							

Course Objective:

The students will try to learn:

Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.

Course Outcome:

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

- CO1. Understand how an operating system manages all the resources in a computer system efficiently.
- CO2. Learn algorithms for CPU scheduling, deadlock handling, page replacement and disk scheduling used by an operating system.
- CO3. Use shell commands to efficiently operate a computer system.
- CO4. Learn and use system calls for process creation and termination, inter-process communication, process synchronization, memory management and file system management.

List of Practical's

1. Write a program to implement CPU scheduling for first come first serve.
2. Write a program to implement CPU scheduling for shortest job first.
3. Write a program to perform priority scheduling.
4. Write a program to implement CPU scheduling for Round Robin.
5. Write a program for page replacement policy using a) LRU b) FIFO c) Optimal.
6. Write a program to implement first fit, best fit and worst fit algorithm for memory management.
7. Write a program to implement reader/writer problem using semaphore.
8. Write a program to implement Banker's algorithm for deadlock avoidance

Text Books:

1. Operating System Concepts by Silberchatz et al, 5th edition, 1998, Addison-Wesley.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice Hall

Reference Books:

1. Operating System by Peterson, 1985, AW.
2. Operating System by Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix & Windows By Colin Ritchie, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems – Advanced Concepts By MukeshSinghal, N.G. Shivaratri, 2003, T.M.H

Object Oriented Programming using C++
24UCSE19
B. Tech. CSE (AI/ML) Semester
– IV

L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 202 4-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs.
Prerequisite				Programing with C			
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objectives:

The students will try to learn:

1. To introduce the basic Concepts of Object Oriented Programming (data types, operators and functions) using C++
2. To introduce concepts of Classes and Objects with the examples of C++ programming
3. To understand object oriented features such as Inheritance and Polymorphism
4. To use various object oriented concepts (exceptional handling) to solve different problems

Course Outcomes:

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

CO1: Ability to have an in-depth knowledge of object-oriented programming paradigm

CO2: To be able to develop basic C++ programming skills

CO3: To be able to apply various object-oriented features using C++

CO4: Ability to understand generic programming & standard templates

Course Contents:

Unit 1: Basic Concepts of Object Oriented Programming

Procedural Vs. Object oriented Programming, C++ Standard Library, Pre-processor Directives, illustrative Simple C++ Programs. Header Files and Namespaces, library files. Object Oriented Concepts: Introduction to Objects and Classes, Data Abstraction, Encapsulation (Information Hiding), Access Modifiers: Controlling access to a class, method, or variable (public, protected, private),

Polymorphism, Inheritance, and Reusability

Classes: - Introduction, Structure Vs. Class, Class Scope and Accessing Class Members

Unit 2: Constructors in a class

Specifying a class, Member Functions, Encapsulation, information hiding, abstract data types, objects & classes, Arrays of Objects, Constructors & Destructors, Parameterized Constructors, Copy Constructors, Dynamic Constructors, Destructors, identity and behaviour of an object, C++ garbage collection, dynamic memory allocation, Explicit Type Conversions.

Unit 3: Function and Overloading

Static Member function: Friend Function and Friend Classes, Using This Pointer, Container Classes and Iterators, Function overloading, Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading Binary

Operators (+, -, *, /, =), Overloading Unary Operators(-, ++, --,)

Unit 4: Inheritance and Virtual Functions

Introduction, Types of Inheritance, Base Classes and Derived Classes, Virtual Base class, Casting Base Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base - Class Members in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes, Composition Vs. Inheritance, Overloading Vs. Overriding, Run Time Polymorphism, Introduction to Virtual Functions, Pure Virtual Functions, Abstract Base Classes and Concrete Classes, Dynamic Binding, Virtual Destructors, Dynamic Binding.

Unit 5: Files, Templates and Exception Handling

Files and I/O Streams and various operation on files. Stream Input/output Classes and Objects, Stream Output, Stream Input, Unformatted I/O (with read and write), Stream Manipulators, Stream Format States, Stream Error States.

Templates & Exception Handling: - Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters, Templates and Inheritance, Templates and Friends.

Basics of C++ Exception Handling: - Try Throwing, Catch, and Throwing an Exception; - Catching an Exception, Re-throwing an Exception, Processing Unexpected Exceptions, Constructors, Destructors and Exception Handling.

Text Books:

1. Object Oriented Programming in Turbo C++ by Robert Lafore ,1994, The WAITE Group Press.
2. Programming with C++ By D Ravichandran, 2003, T.M.H 3. Object oriented Programming with C++ by E Balagurusamy, 2001, Tata McGraw-Hill.

Reference Books:

1. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall 2. Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley, 3. The Complete Reference in C++ By Herbert Schildt, 2002, TMH.
4. C++ Programming Fundamentals by Chuck Easttom, Firewall Media

Object Oriented Programming using C++ Lab 24UCSE20							
B. Tech. CSE (AI/ML) Semester-IV							
L	T	P	Credits		Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective Session: from				w.e.f. 2024-2025	Total	:	50

Date of approval:	BoS		Duration of Exam	:	
Prerequisite					

Course Objectives:

The students will try to learn:

1. To introduce the basic Concepts of Object-oriented Programming (data types, operators and functions) using C++
2. To introduce concepts of Classes and Objects with the examples of C++ programming
3. To understand object-oriented features such as Inheritance and Polymorphism
4. To use various object-oriented concepts (exceptional handling) to solve different problems

Course

Outcomes:

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

CO1. understand an in-depth knowledge of object-oriented programming paradigm

CO2. Develop basic C++ programming skills

CO3. Apply various object-oriented features using C++

CO4. Understand generic programming & standard templates CO5. Understand and implement Function and Operator Overloading

List of Practical's:

1. Write a program for multiplication of two matrices using OOP.
2. Write a program to perform addition of two complex numbers using constructor overloading. The first constructor which takes no argument is used to create objects which are not initialized, second which takes one argument is used to initialize real and imag parts to equal values and third which takes two argument is used to initialize real and imag to two different values.
3. Write a program to find the greatest of two given numbers in two different classes using friend function.
4. Implement a class string containing the following functions: - Overload + operator to carry out the concatenation of strings. - Overload = operator to carry out string copy. - Overload <= operator to carry out the comparison of strings. - Function to display the length of a string. - Function tolower() to convert upper case letters to lower case. - Function toupper() to convert lower case letters to upper case.
5. Create a class called LIST with two pure virtual function store() and retrieve(). To store a value call store and to retrieve call retrieve function. Derive two classes stack and queue from it and override store and retrieve.
6. Write a program to define the function template for calculating the square of given numbers with different data types.
7. Write a program to demonstrate the use of special functions, constructor and destructor in the class template. The program is used to find the bigger of two entered numbers.
8. Write a program to perform the deletion of white spaces such as horizontal tab, vertical tab, space, line feed, new line and carriage return from a text file and store the contents of the file without the white spaces on another file.
9. Write a program to read the class object of student info such as name , age ,sex ,height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again the same file is opened for reading and displaying the contents of the file on the screen.
10. Write a program to raise an exception if any attempt is made to refer to an element whose index is beyond the array size.

Machine Learning 24UCSE17							
B. Tech. CSE (AI/ML) Semester – IV							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objectives:

The students will try to learn:

- Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
- Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- Explore Deep learning technique and various feature extraction strategies

Course Outcomes:

After Completion of this course the students will be able to:

- CO1. Understand use of the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.
- CO2. Understand decision trees, support vector machines in optimizing basic methods of regression
- CO3. Apply the key issues and applications in clustering and dimensionality reduction.
- CO4. Apply matrix factorization used to process reduction in unsupervised learning.
- CO5. Apply algorithms in optimizing statistical learning theory and methods in machine learning.

Detailed Contents:

UNIT-1: Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes

Linear models: Linear Regression, Logistic Regression, Generalized Linear Models

Support Vector Machines, Nonlinearity and Kernel Methods

Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

UNIT-2: Unsupervised Learning

Clustering: K-means/Kernel K-means

Dimensionality Reduction: PCA and kernel PCA

Matrix Factorization and Matrix Completion

Generative Models (mixture models and latent factor models)

UNIT-3: Machine Learning

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT-4: Modelling Techniques

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.

UNIT-5: Scalable Machine Learning

Scalable Machine Learning (Online and Distributed Learning)

A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Recent trends in various learning techniques of machine learning and classification methods for IOT applications, various models for IOT applications.

Text Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.

Reference Books:

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

B. Tech. CSE (AI/ML) Semester-IV							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:					Duration of Exam	:	
Prerequisite							

Course Objectives:

The students will try to learn:

1. Learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
2. Design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
3. Explore supervised and unsupervised learning paradigms of machine learning.
4. Explore Deep learning technique and various feature extraction strategies

Course Outcomes:

After Completion of this course the students will be able to:

- CO1. Understand use of the basic methods of supervised learning with linear models and binary classification included in multi-class outputs.
- CO2. Understand decision trees, support vector machines in optimizing basic methods of regression
- CO3. Apply the key issues and applications in clustering and dimensionality reduction.
- CO4. Apply matrix factorization used to process reduction in unsupervised learning.
- CO5. Apply algorithms in optimizing statistical learning theory and methods in machine learning.

List of Practical's:

1. Study and Implement the Naive Bayes learner. (The datasets taken can be: Breast Cancer data file or Reuters data set).
2. Study and Implement the Decision Tree learners. (The datasets taken can be: Breast Cancer data file or Reuter's data set).
3. Estimate the accuracy of decision classifier on breast cancer dataset using 5-fold cross-validation. (You need to choose the appropriate options for missing values).
4. Estimate the precision, recall, accuracy, and F-measure of the decision tree classifier on the text classification task for each of the 10 categories using 10-fold cross-validation.
5. Develop a machine learning method to classifying your incoming mail.
6. Develop a machine learning method to Predict stock prices based on past price variation.
7. Develop a machine learning method to predict how people would rate movies, books, etc.
8. Develop a machine learning method to Cluster gene expression data, how to modify existing methods to solve the problem better
9. Select two datasets Each dataset should contain examples from multiple classes. For training purposes assume that the class label of each example is unknown (if it is known, ignore it). Implement the Kmeans algorithm and apply it to the data you selected. Evaluate performance by measuring the sum of Euclidean distance of each example from its class centre. Test the performance of the algorithm as a function of the parameter k.
10. Implement the EM algorithm assuming a Gaussian mixture. Apply the algorithm to your datasets and report the parameters you obtain. Evaluate performance by measuring the sum of Mahalanobis distance of each example from its class centre. Test performance as a function of the number of clusters.
11. Suggest and test a method for automatically determining the number of clusters. Using a dataset with known class labels compare the labelling error of the K-means and EM algorithms. Measure the error by assigning a class label to each example. Assume that the number of clusters is known.

Text book/Reference Books:

1. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC; 2nd edition (8 October 2014)
2. Bishop, C.M., Pattern recognition and machine learning. Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition (15 February 2010)
3. Tom Mitchell, Machine Learning, McGraw Hill Education; First edition (1 July 2017)

Computer Networks 24UCSE16							
B. Tech. CSE (AI/ML) Semester – IV							
L	T	P	Credits	Core Course	Internal Examination	:	30
4	0	0	4		External Examination	:	70

Effective from Session:	w.e.f. 2024-2025	Total	:	100
Date of BoS approval:		Duration of Exam	:	3 Hrs
Prerequisite				
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.				

Course Objectives:

The students will try to learn:

1. The modern network architectures from a design and performance irrespective.
2. The basics and challenges of network communication.
3. Provide an opportunity to do network programming using TCP/IP.
4. The operation of the protocols that are used inside the Internet.

Course outcomes:

After Completion of this course students will be able to:

- CO1. Acquire a thorough understanding of the state-of-the-art in modern network architecture, protocols, networked systems and applications
- CO2. Understand proficient to develop software for modern networking devices
- CO3. To have sufficient background knowledge to conduct networking research and develop innovative ideas.
- CO4. Analyze Congestion Control Techniques LAN
- CO5. Understand and Implement Protocols of Application Layers

Course Content:

Unit 1: Introduction

Fundamentals of Digital Communication, Network Classification, Protocol Architecture: Design Issues for the Layers, The TCP/IP Protocol Architecture, The ISO/OSI Model, Other protocols such as SNA, Appletalk, Netware etc.
Physical Layer: Data Transmission Concepts, Transmission Media, Signal Encoding Techniques, Digital Data Communication Techniques - Asynchronous and Synchronous Transmission, Error Detection, Error Correction, Multiplexing – FDM, TDM, ADSL, xDSL

Unit 2: Data Link Layer

Main Functions, Framing, Error Control, Flow Control, Error Correcting Codes, Error-Detecting Codes, Data Link Protocols: Stop-and-Wait Protocol, One-Bit Sliding Window Protocol, Go Back N, Selective Repeat, Medium Access Control Sublayer: Channel Allocation: Static, Dynamic, MAC PROTOCOLS – ALOHA, CSMA, Collision-Free Protocols, Limited-Contention Protocols, Detailed Study of Ethernet, 802.11 WIRELESS LANS

Unit 3: Network Layer

Functions, Design Issues, Internetworks: Principle, Protocols and Operations, IP Protocol: IPv4 Header, Addresses, Operation, Subnetting, Classless Interdomain Routing, Network Address Translation, Internet Control Protocol - ARP, RARP, BOOTP, DHCP, OSPF, BGP, IGMP; Problems of IPv4, IPv6, Routing Algorithms.

Unit 4: Congestion Control Techniques LAN

Topologies and Transmission Media, Protocol Architecture, Bridges, Switches WAN: Switched Communications Networks, ATM Communication

Transport Layer: Functions, Design Issues, TCP, UDP

Unit 5: Application Layer

Internet Applications: FTP, Telnet, DNS, HTTP, SMTP, SNMP Security in Computer Networks: Fundamentals of Network Security, Encryption, Cryptography, Securing E-mail, Securing TCP Connections: SSL
Network-Layer Security: IPsec, Securing Wireless LANs, Operational Security: Firewalls and Intrusion Detection Systems.

Text Books:

1. Andrew S. Tanenbaum, “Computer Networks”, 5th Edition, Pearson Education **Reference Books**
1. William Stallings, “Data and Computer Communication”, 10th Edition, Pearson Education
2. James F. Kurose & Keith W. Ross, “Computer Networking: A Top –down approach”, 6th Edition, Pearson Education
3. Behrouz A. Forouzan, “Data Communications and Networking”, 5th Edition, McGraw-Hill Education.

Software Engineering 24UCSE21							
B. Tech. CSE (AI/ML) Semester – IV							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							

Instruction for Paper Setter:

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams **Course Outcomes:**

After Completion of this course students will be able to:

- CO1. Understand the basic principles of Software engineering and its development processes. CO2. Analyze the software requirement in terms of functional and non-functional
- CO3. Create and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- CO4. Evaluate and experience and/or awareness of testing problems and will be able to develop a simple testing report
- CO5. Apply and evaluate the metrics for the assessment of the software quality **Course Contents:**

UNIT – I: Introduction to Software Engineering

The evolving role of software, changing nature of software, Software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

UNIT – II: Software Requirements

Functional and non-functional requirements, user requirements, system Requirements, interface specification, the software requirements document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

System models: Context models, behavioral models, data models, object models, structured methods.

UNIT – III: Design Engineering

Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modelling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

UNIT – IV: Testing Strategies

A strategic approach to software testing, test strategies for conventional software, black-box and whitebox testing, validation testing, system testing, the art of debugging.

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

UNIT – V: Metrics for Process and Products

Software measurement, metrics for software quality. Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

Text Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. K. K. Aggarwal & Yogesh Singh, "Software Engineering", 2ndEd., New Age International, 2005
3. Software Engineering- Sommerville, 7th edition, Pearson Education.
4. The unified modelling language user guide Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meier page-Jones: Pearson

Semester 5

Theory of Computation 24UCSE22							
B. Tech. CSE (AI/ML) Semester – V							
L	T	P	Credits	Core Course	Internal Examination	:	30
4	0	0	4		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							

Instruction for Paper Setter:

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objective:**The students will try to learn:**

1. To give an overview of the theoretical foundations of computer science from the perspective of formal languages
2. To illustrate finite state machines to solve problems in computing
3. To explain the hierarchy of problems arising in the computer sciences.
4. To familiarize Regular grammars, context free grammar.

Course Outcome:**At the end of this course, the student will be able to:**

- CO1. Demonstrate advanced knowledge of formal computation and its relationship to languages.
- CO2. Distinguish different computing languages and classify their respective types.
- CO3. Recognize and comprehend formal reasoning about languages.
- CO4. Understand operation and application of Turing Machine
- CO5. Apply the Recursive and recursively enumerable languages

Course Content:**Unit-I**

Basic Computational Constructs: Finite State Systems, Basic Definitions Non-Deterministic finite automata (NFA), Deterministic finite automata (DFA), Equivalence of DFA and NFA Finite automata with E-moves, Regular Expressions, Equivalence of finite automata and Regular

Expressions, Regular expression conversion and vice versa. Conversion of NFA to DFA by Arden's Method Concept of basic Machine, Properties and limitations of FSM, Moore and Mealy Machines, Equivalence of Moore and Mealy machines.

Unit-II

Regular Sets & Grammars: The Pumping Lemma for Regular Sets, Applications of the pumping lemma, Closure properties of regular sets, Myhill-Nerode Theorem and minimization of finite Automata, Minimization Algorithm. Context free and Context sensitive grammar, Ambiguity regular grammar, Reduced forms, Removal of useless Symbols and unit production, Chomsky Normal Form (CNF), Greibach Normal Form (GNF).

Unit-III

Pushdown Automata & Turing Machines: Introduction to Pushdown Machines, Applications of Pushdown Machines Deterministic and Non-Deterministic

Unit IV: Turing Machines

Definitions of Turing machines, Computable languages and functions, Techniques for Turing machine construction, Multi head and Multi tape Turing Machines, The Halting problem, Partial Solvability, Problems about Turing machine-Chomsky hierarchy of languages.

Unit-V

Unsolvability Problems and Computable Functions, Primitive recursive functions, Recursive and recursively enumerable languages, Universal Turing machine, Measuring and classifying complexity - Tractable and Intractable problems, Tractable and possibly intractable problems, P and NP completeness, Polynomial time reductions, NP-complete problems from other domains: graphs (clique, vertex cover, independent sets, Hamiltonian cycle), number problem (partition), set cover.

Text book:

1. Introduction to automata theory, language & computations- Hopcroft & O. D. Ullman, R Mothwani, Addison Wesley Publishers

Reference books:

1. Theory of Computer Sc.(Automata, Languages and computation): K. L. P. Mishra & N. Chandrasekaran, 2000, PHI.
2. Introduction to formal Languages & Automata-Peter Linz, 2001, NarosaPubl.
3. Fundamentals of the Theory of Computation- Principles and Practice by Ramond Greenlaw and H. James Hoover, 1998, Harcourt India Pvt. Ltd.

Deep Learning 24UCSE23							
B. Tech. CSE (AI/ML) Semester – V							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite				Machine Learning			

Instruction for Paper Setter:

1. There should be 9 questions in the end term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 14.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.

Course Objective:

The objective of this course is to cover the fundamentals of neural networks as well as some advanced topics such as recurrent neural networks, long short term memory cells and convolutional neural networks. The course also requires students to implement programming assignments related to these topics.

Course Outcome:

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

CO1. Understand the fundamental principles of deep learning.

CO2. Analyse the deep learning algorithms for various types of learning tasks in various domains. CO3. Apply deep learning algorithms and solve real-world problems CO4. Evaluate the performance of different optimization techniques.

CO5. Analyse the uses of CNNs and RNN

CO6. Create an application using Deep Learning Models.

Course Content:**UNIT - I**

Basics: Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.

Feedforward Networks: Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, autoencoders.

UNIT – II

Deep Neural Networks: Difficulty of training deep neural networks, Greedy layer wise training.

Better Training of Neural Networks: Newer optimization methods for neural networks (Adagrad, adadelata, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

UNIT - III

Recurrent Neural Networks: Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs

Convolutional Neural Networks: LeNet, AlexNet.

UNIT - IV

Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines.

Recent trends: Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning

UNIT - V

Applications: Vision, NLP, Speech (just an overview of different applications in 2-3 lectures)

Textbooks

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

References Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996

2. Pattern Recognition and Machine Learning, Christopher Bishop, 2007

Optimization Technique 24UCSE25							
B. Tech. CSE (AI/ML) Semester – V							
L	T	P	Credits	Core Course	Internal Examination	:	30
4	0	0	4		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite				Machine Learning			
Instruction for Paper Setter: 1. There should be 9 questions in the end term examination question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

1. Operation research models using optimization techniques based upon the fundamentals of engineering mathematics (minimization and Maximization of objective function).
2. The problem formulation by using linear, dynamic programming, game theory and queuing models.
3. The stochastic models for discrete and continuous variables to control inventory and simulation of manufacturing models for the production decision making.
4. Formulation of mathematical models for quantitative analysis of managerial problems in industry.

Course Outcome:

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

- CO1. Understand the overview of optimization techniques, concepts of design space, constraint surfaces and objective function.
- CO2. Analyse differential calculus in finding the maxima and minima of functions of several variables.
- CO3. Evaluate real-life problems with Linear Programming.
- CO4. Apply the Linear Programming models using graphical and simplex methods.
- CO5. apply real-life transportation, assignment and travelling salesman problems to find the optimum solution using transportation algorithms
- CO6. Analyse the Queuing model for effective customer satisfaction
- CO7. Apply dynamic programming to optimize multi stage decision problems.

Course Content:

UNIT - I

Introduction to Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.

Classical Optimization Techniques: Single variable Optimization, Multi variable Optimization with and without constraints, Multivariable Optimization with equality constraints - solution by method of Lagrange multipliers, Multivariable Optimization with inequality constraints - Kuhn – Tucker conditions. **UNIT – II**

Linear Programming: Various definitions, statements of basic theorems and properties, Advantages, Limitations and Application areas of Linear Programming, Graphical method of Linear Programming problem.

Simplex Method : Phase I and Phase II of the Simplex Method, The Revised Simplex method, Primal and Dual Simplex Method, Big –M method.

UNIT - III

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. (Including assignment and travelling salesman problems) (No degeneracy problems)

Queuing: Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1 : ∞ /FCFS, M/M/1 : N/FCFS, M/M/C : ∞ /FCFS, M/M/C : N/FCFS.

UNIT - IV

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

Integer Programming: Pure and mixed integer programming problems, Solution of Integer programming problems – Gomory's all integer cutting plane method and mixed integer method, branch and bound method, Zero-one programming.

UNIT - V

Simulation Modeling: Introduction, Definition and types, Limitations, Various phases of modeling, Monte Carlo method, Applications, advantages and limitations of simulation **Text Books:**

1. Engineering optimization: Theory and practice"-by S.S.Rao, New Age International (P) Limited.
2. Operations Research: An Introduction" by H A Taha, 5th Edition, Macmillan, New York.
3. Operations Research by NVR Naidu, G Rajendra, T Krishna Rao, I K International Publishing house, New Delhi.

Reference Books:

1. Optimization Methods in Operations Research and systems Analysis” – by K.V. Mittal and C. Mohan, New Age, International (P) Limited, Publishers
2. Operations Research – by S.D.Sharma, Kedarnath Ramanath & Co 3. Linear programming, G. Hadley, Narosa Publishing House, New Delhi.
4. Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai & co

Natural Language Processing 24UCSE32							
B. Tech. CSE (AI/ML) Semester – V							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite				Machine Learning			
Instruction for Paper Setter: 1. There should be 9 questions in the end term examination question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

The students should be able to study language and the tools that are available to efficiently study and analyse large collections of text. They should learn about and discuss the effects of electronic communication on our language.

Course Outcome:

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

- CO1. Understand language and the tools that are available to efficiently study and analyse large collections of text.
 CO2. Analyse and discuss the effects of electronic communication on our language
 CO3. Analyse natural language processing with manual and automated approaches.
 CO4. Apply computational frameworks for natural language processing.

Course Content:

UNIT I

A computational framework for natural language, description of English or an Indian language in the frame work, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, the different

analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.

UNIT II

Word level and syntactic analysis Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine-readable dictionaries and lexical databases, RTN, ATN.

UNIT III

Semantic analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.

UNIT IV

Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.

UNIT V

Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmer.

Text Books:

1. Natural Language understanding by James Allen, Pearson Education, 2002.
2. NLP: A Paninian Perspective by Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal, Prentice Hall, 2016.

Suggested References:

3. Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
4. An Introduction to Natural Language Processing, Computational Linguistics, and Speech 5. Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
6. Natural language processing in Prolog by Gazdar, & Mellish, Addison-Wesley
7. <https://www.coursera.org/specializations/natural-language-processing>

Program Elective I - AI in Healthcare (24UCSE26)							
B. Tech. CSE (AI/ML) Semester-V							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course outcome

- CO1: To understand the fundamentals of artificial intelligence and machine learning and their applications in medicine.
- CO2: To explore advanced AI techniques, including deep learning, reinforcement learning, and natural language processing.
- CO3: To learn about the use of AI in medical imaging, diagnostics, disease prediction, and treatment planning.
- CO4: To examine the ethical, legal, and social implications of AI in medicine, including issues of bias, privacy, and equity.
- CO5: To gain hands-on experience with AI tools and platforms through practical exercises and projects. CO6: To critically evaluate research studies and applications of AI in healthcare.

Unit 1:

Introduction to Artificial Intelligence in Medicine, Definition and scope of AI in healthcare, Historical perspective and milestones in AI research, Applications of AI in clinical practice and biomedical research.

Unit 2:

AI in Medical Imaging, Image classification, segmentation, and registration, Radiomics and quantitative imaging biomarkers, Applications of AI in radiology, pathology, and ophthalmology. AI in Diagnostics and Disease Prediction, Predictive modeling for disease risk assessment, Diagnostic decision support systems, Early detection of diseases using AI algorithms

Unit 3:

Natural Language Processing (NLP) in Healthcare, Text mining and information extraction from clinical notes, Clinical language understanding and medical coding, Applications of NLP in electronic health records (EHR) analysis and clinical documentation

Unit 4:

AI in Personalized Medicine and Treatment Planning, Pharmacogenomics and precision medicine, Treatment recommendation systems, Drug discovery and repurposing using AI approaches.

Unit 5

Ethical, Legal, and Social Implications (ELSI) of AI in Medicine, Bias and fairness in AI algorithms, Privacy and security of healthcare data, Regulation and policy considerations for AI in healthcare

Textbooks

Mesko, B., 2017. A guide to artificial intelligence in healthcare. Budapest, Hungary: The Medical Futurist. leanpub. com.

Reference Books

1. Artificial Intelligence in Healthcare by Dr Parag Suresh Mahajan MD
2. AI in Health: A Leader's Guide to Winning in the New Age of Intelligent Health Systems (HIMSS Book Series) by Tom Lawry

Program Elective I - AI in Healthcare Lab (24UCSE29)							
B. Tech. CSE (AI/ML) Semester-V							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course outcome

CO1: To understand the fundamentals of artificial intelligence and machine learning and their applications in medicine.
 CO2: To explore advanced AI techniques, including deep learning, reinforcement learning, and natural language processing.
 CO3: To learn about the use of AI in medical imaging, diagnostics, disease prediction, and treatment planning.
 CO4: To examine the ethical, legal, and social implications of AI in medicine, including issues of bias, privacy, and equity.
 CO5: To gain hands-on experience with AI tools and platforms through practical exercises and projects. CO6: To critically evaluate research studies and applications of AI in healthcare.

Project

Students have a make a project based on the use case for AI in Health care.

Program Elective I - AI in Agriculture (24UCSE27)							
B. Tech. CSE (AI/ML) Semester-V							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Outcomes

At the end of this training course participants will have better understanding on:

CO1: Advantage of implementing AI in Agriculture and Food Industry.

CO2: AI for improved crop management practices - efficient ways to produce, harvest and sell essential crops.

CO3: AI solutions to solve the challenges like climate variation, soil nutrition, infestation of pests and weeds that reduces yields by farmers.

CO4: Strengthened knowledge on efficient and sustainable agro-based businesses using AI and other ICT tools.

Unit 1

Introduction to AI (Artificial Intelligence) - A brief introduction to AI, Types of AI capabilities & techniques used, AI and its potential for different types of organizations (public and private), Understanding the limitations of AI

Unit 2

AI in Agri-Business and Food Industry, Appropriate AI techniques and operational opportunities, Technology available for AI relevant to Agro-Industry and Food Supply, AI in decision making for agricultural professionals and farmers

Unit 3

The Future of AI- - A positive future with AI and ML (Machine Learning), the Symbiosis of Distributed Ledger and Machine Learning as a Relevance for Autonomy in the Internet of Things (IoT),

Unit 4:

Benefits and Risks of AI, Impact and Benefits of AI for a sustainable future Agri-Business and Food Industry

Unit 5

Case Studies on application of AI in Agriculture and Food Supply -- Autonomous Tractors and Agricultural Robots, Crop and Soil Monitoring, Controlling Pest Infestation, Precision Farming with Predictive Analytics

Textbooks

Artificial Intelligence In Agriculture (1) Hardcover – 26 June 2020 by Rajesh Singh & Anita Gehlot

Mahesh Pratap Gehlot & Bhupendra Singh

Reference Books

1. Artificial Intelligence in Indian Agriculture by R. K Naresh., Sudhir Kumar, S.K. Gupta, Jairam Choudhary
2. IoT and AI in Agriculture: Self- sufficiency in Food Production to Achieve Society 5.0 and SDG's Globally Hardcover by Tofael Ahamed

Program Elective I - AI in Agriculture Lab (24UCSE30)
B. Tech. CSE (AI/ML) Semester-V

L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Outcomes

At the end of this training course participants will have better understanding on:

CO1: Advantage of implementing AI in Agriculture and Food Industry.

CO2:AI for improved crop management practices - efficient ways to produce, harvest and sell essential crops.

CO3:AI solutions to solve the challenges like climate variation, soil nutrition, infestation of pests and weeds that reduces yields by farmers.

CO4: Strengthened knowledge on efficient and sustainable agro-based businesses using AI and other ICT tools.

Project

Students have a make a project based on the use case for AI in Health care.

Program Elective II- Big Data Analytics 24UCSE37							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70

Effective from Session:	w.e.f. 2024-2025	Total	:	100
Date of BOS approval:	22-7-2024	Duration of Exam	:	
Prerequisite				

Course Outcomes:

The students will be able to:

CO1: Identify Big Data and its Business Implications.

CO2: List the components of Hadoop and Hadoop Eco-System and process Data on Distributed File System

CO3: Manage Job Execution in Hadoop Environment CO4: Develop Big

Data Solutions using Hadoop Eco System

CO5: Analyze Infosphere BigInsights Big Data Recommendations.

CO6: Apply Machine Learning Techniques using R

Syllabus

Unit I : Introduction To Big Data And Hadoop

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

Unit II : HDFS(Hadoop Distributed File System)

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III: Map Reduce

Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Unit IV: Hadoop Eco System

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig

Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined

Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL:

Introduction

UNIT V : Data Analytics with R

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering.

Big Data Analytics with BigR.

Text Books

- Tom White “Hadoop: The Definitive Guide” Third Edit on, O’reily Media, 2012.
- Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Reference Book

- Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
- Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
- Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
- Anand Rajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press

Program Elective II- Big Data Analytics Lab 24UCSE40							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Objectives: This course is designed to:

1. Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
2. Experiment MapReduce in Hadoop frameworks

3. Implement MapReduce programs in variety applications
4. Understand different approaches for building Hadoop MapReduce programs for real-time applications

Experiments:

1. Install Apache Hadoop
2. Develop a MapReduce program to calculate the frequency of a given word in a given file.
3. Develop a MapReduce program to find the maximum temperature in each year.
4. Develop a MapReduce program to find the grades of students.
5. Develop a MapReduce program to implement Matrix Multiplication.
6. Develop a MapReduce to find the maximum electrical consumption in each year given electrical consumption for each month in each year.
7. Develop a MapReduce to analyze weather data set and print whether the day is sunny or cool day.
8. Develop a MapReduce program to find the number of products sold in each country by considering sales data containing fields like

Transaction Date	Product	Price	Payment Type	Name	City	State	Country	Account Created	Last Login	Latitude	Longitude
------------------	---------	-------	--------------	------	------	-------	---------	-----------------	------------	----------	-----------

9. Develop a MapReduce program to find the tags associated with each movie by analyzing movie lens data.

Program Elective II- Data Warehouse and Data Mining 24UCSE38								
B. Tech. CSE (AI/ML) Semester-VI								
L	T	P	Credits	Core Course	Internal Examination	:	30	
3	0	0	3		External Examination	:	70	
Effective from Session:				w.e.f. 2024-2025	Total	:	100	
Date of BOS approval:				22-7-2024	Duration of Exam	:		
Prerequisite								

Course Outcomes:

After undergoing the course, Students will be able to understand

CO1: Design a data mart or data warehouse for any organization

CO2: Develop skills to write queries using DMQL CO3: Extract knowledge using data mining techniques

CO4: Adapt to new data mining tools.

CO5: Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

UNIT - I

INTRODUCTION TO DATA MINING: Motivation, Importance, Definition of Data Mining, Kind of Data, Data Mining Functionalities, Kinds of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives, Integration of A Data Mining System With A Database or Data Warehouse System, Major Issues In Data Mining, Types of Data Sets and Attribute Values, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity.

PREPROCESSING: Data Quality, Major Tasks in Data Preprocessing, Data Reduction, Data Transformation and Data Discretization, Data Cleaning and Data Integration.

UNIT - II

DATA WAREHOUSING AND ON-LINE ANALYTICAL PROCESSING: Data Warehouse basic concepts, Data Warehouse Modeling - Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

DATA CUBE TECHNOLOGY: Efficient Methods for Data Cube Computation, Exploration and Discovery in Multidimensional Databases.

UNIT - III

MINING FREQUENT PATTERNS, ASSOCIATIONS AND CORRELATIONS: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Are All the Pattern Interesting, Pattern Evaluation Methods, Applications of frequent pattern and associations.

FREQUENT PATTERN AND ASSOCIATION MINING: A Road Map, Mining Various Kinds of Association Rules, Constraint-Based Frequent Pattern Mining, Extended Applications of Frequent Patterns.

UNIT - IV

CLASSIFICATION: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, RuleBased Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Classification, Bayesian Belief Networks, Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT - V

CLUSTER ANALYSIS: Basic Concepts of Cluster Analysis, Clustering structures, Major Clustering Approaches, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model Based Clustering - The Expectation-Maximization Method, Other Clustering Techniques, Clustering HighDimensional Data, Constraint-Based and User-Guided Cluster Analysis, Link-Based Cluster Analysis, Semi-Supervised Clustering and Classification, Bi-Clustering, Collaborative Clustering.

OUTLIER ANALYSIS: Why outlier analysis, Identifying and handling of outliers, Distribution Based Outlier Detection: A Statistics-Based Approach, Classification-Based Outlier Detection, ClusteringBased Outlier Detection, Deviation-Based Outlier Detection, Isolation-Based Method: From Isolation Tree to Isolation Forest.

Text Books:

1. Jiawei Han, MichelineKamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3rd edition, Elsevier, United States of America.

Reference Books:

1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition, Pearson Education, New Delhi, India.
2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India.
3. Xingdong Wu, Vipin Kumar (2009), the Top Ten Algorithms in Data Mining, CRC Press, UK.

Program Elective II- Data Warehouse and Data Mining Lab 24UCSE41							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Outcomes:

Students can able

- To evaluate the different models of OLAP and data preprocessing.
- To enlist various algorithms used in information analysis of Data Mining Techniques.
- To demonstrate the knowledge retrieved through solving problems

List of Experiments

1. Explore various commands given in PL/SQL in Oracle 8.0
2. Execute multi-dimensional data model using SQL queries.
3. Implement various OLAP operations such as slice, dice, roll up, drill up, pivot etc.
4. Implementation of Text Mining on the data warehouse
5. Explore the correlation-ship analysis between the data set
6. Evaluate attribute relevance analysis on a weather data warehouse
7. Evaluate Information Gain of an attribute in the student database

8. Experiment to predict the class using the Bayesian classification
9. Find out a weight & bias updating using the Back Propagation Neural Network
10. To perform various data mining algorithms on the give data base using

Program Elective II- Cloud Computing 24UCSE39							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Outcomes:

At the end of this course student will:

- CO1: Understand the concept of virtualization and how this has enabled the development of Cloud Computing
- CO2: Know the fundamentals of cloud, cloud Architectures and types of services in cloud
- CO3: Understand scaling, cloud security and disaster management
- CO4: Design different Applications in cloud
- CO5: Explore some important cloud computing driven commercial systems

UNIT 1

Introduction to Cloud: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments. Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V. Before the Move into the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications

UNIT 2

Cloud Computing Architecture : Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. Ready for the Cloud: Web Application Design, Machine Image Design, Privacy Design, Database Management, Data Security, Network Security, Host Security, Compromise Response.

UNIT 3

Defining the Clouds for Enterprise: Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service. Scaling a cloud infrastructure - Capacity Planning, Cloud Scale. Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

UNIT 4

Aneka: Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.

UNIT 5

Cloud Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming. Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure

Text Books

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. George Reese Cloud Application Architectures, First Edition, O'Reilly Media 2009.

References

1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
2. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India 2012.
3. Cloud Computing – web based Applications that change the way you work and collaborate Online – Micheal Miller. Pearson Education

Program Elective II- Cloud Computing Lab 24UCSE42							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BOS approval:				22-7-2024	Duration of Exam	:	
Prerequisite							

Course Objective:

To develop web applications in cloud

To learn the design and development process involved in creating a cloud based application To learn to implement and use parallel programming using Hadoop

List of Experiments:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows 7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presenting CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

Semester 6

Advanced ML 24UCSE34

B. Tech. CSE (AI/ML) Semester – VI							
L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

Course Outcomes:

After successfully completion of this course students will be able to:

CO1. Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.

CO2. Apply various machine learning algorithms in a range of real-world applications.

CO3. Integrate and apply their expertise to produce solutions for real-world problems.

CO4. Interpret and Analyze results with reasoning using different ML techniques. CO5. Apply

Ensemble Methods **Course Contents:**

Unit 1: Artificial Neural Network

Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization

Unit II: Bayesian Learning

Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets.

Unit III: Decision Trees

Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.

Unit V: Reinforcement Learning

Reinforcement learning through feedback network, function approximation.

Unit V: Ensemble Methods

Bagging, boosting, stacking and learning with ensembles. Random Forest.

Text Book:

1. Tom Mitchell, Machine Learning, McGraw Hill, 1997.

Reference Books:

1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
3. Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.
4. Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press, 2012.

Advanced ML Lab 24UCSE35							
B. Tech. CSE (AI/ML) Semester-VI							
L	T	P	Credits	Core Course	Internal Examination	:	35
0	0	2	1		External Examination	:	15
Effective from Session:				w.e.f. 2024-2025	Total	:	50
Date of BoS approval:					Duration of Exam	:	
Prerequisite				Machine Learning			

Course Objective:

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

Course Outcomes:

After successfully completion of this course students will be able to:

- CO1. Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.
 CO2. Apply various machine learning algorithms in a range of real-world applications.
 CO3. Integrate and apply their expertise to produce solutions for real-world problems. CO4. Interpret and Analyze results with reasoning using different ML techniques.

List of Experiments:

Implementation of following machine learning algorithms in various projects using Python:

1. Classification and regression algorithms.
2. K-Means Clustering.
3. Artificial Neural Network (with back-propagation).
4. Decision Trees.
5. Random Forest.

*The experiments may be added at the time of implementing.

Text Book:

1. Tom Mitchell, Machine Learning, McGraw Hill, 1997.

Reference Books:

1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
3. Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.

Compiler Design 24UCSE36							
B. Tech. CSE (AI/ML) Semester – VI							
L	T	P	Credits	Core Course	Internal Examination	:	30

4	0	0	4		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite				Theory of Computation			
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objective:

- To teach concepts of language translation and phases of compiler design
- To describe the common forms of parsers
- To inculcate knowledge of parser by parsing LL parser and LR parser
- To demonstrate intermediate code using technique of syntax directed translation
- To Illustrate the various optimization techniques for designing various optimizing compilers

Outcome:

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

- CO1. Understand the compiler construction tools and describes the Functionality of each stage of compilation process
- CO2. Apply Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques
- CO3. Analyse different representations of intermediate code.
- CO4. Create new compiler for new languages.
- CO5. Apply and evaluate code generation and code optimization techniques

Course Content:

UNIT - I

Introduction to compilers: Definition of compiler, interpreter and its differences, the phases of a compiler, role of lexical analyser, regular expressions, finite automata, from regular expressions to finite automata, pass and phases of translation, bootstrapping, LEX-lexical analyser generator.

Parsing: Parsing, role of parser, context free grammar, derivations, parse trees, ambiguity, elimination of left recursion, left factoring, eliminating ambiguity from dangling-else grammar, classes of parsing, top down parsing - backtracking, recursive descent parsing, predictive parsers, LL(1) grammars.

UNIT - II

Bottom up parsing: Definition of bottom up parsing, handles, handle pruning, stack implementation of shift-reduce parsing, conflicts during shift-reduce parsing, LR grammars, LR parsers-simple LR, canonical LR(CLR) and Look Ahead LR (LALR) parsers, error recovery in parsing, parsing ambiguous grammars, YACC-automatic parser generator.

UNIT - III

Syntax directed translation: Syntax directed definition, construction of syntax trees, S-attributed and Lattributed definitions, translation schemes, emitting a translation.

Intermediate code generation: intermediate forms of source programs– abstract syntax tree, polish notation and three address code, types of three address statements and its implementation, syntax directed translation into three-address code, translation of simple statements, Boolean expressions and flow-of-control statements.

UNIT - IV

Type checking: Definition of type checking, type expressions, type systems, static and dynamic checking of types, specification of a simple type checker, equivalence of type expressions, type conversions, overloading of functions and operators.

Run time environments: Source language issues, Storage organization, storage-allocation strategies, access to non-local names, parameter passing, symbol tables and language facilities for dynamic storage allocation.

UNIT - V

Code optimization: Organization of code optimizer, basic blocks and flow graphs, optimization of basic blocks, the principal sources of optimization, the directed acyclic graph (DAG) representation of basic block, global data flow analysis.

Code generation: Machine dependent code generation, object code forms, the target machine, a simple code generator, register allocation and assignment, peephole optimization.

Text Books:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman (2007), Compilers Principles, Techniques and Tools, 2nd edition, Pearson Education, New Delhi, India.

Reference Books:

1. Alfred V. Aho, Jeffrey D. Ullman (2001), Principles of compiler design, Indian student edition,
2. Pearson Education, New Delhi, India.
3. Kenneth C. Loudon (1997), Compiler Construction– Principles and Practice, 1st edition, PWS
4. Publishing.
5. K. L. P Mishra, N. Chandrashekar (2003), Theory of computer science- Automata Languages
6. and computation, 2nd edition, Prentice Hall of India, New Delhi, India.
7. Andrew W. Appel (2004), Modern Compiler Implementation C, Cambridge University Press, UK.

Semester 7

Soft Computing (24UCSE43)
B. Tech. CSE (AI/ML) Semester
– VII

L	T	P	Credits	Core Course	Internal Examination	:	30
3	0	0	3		External Examination	:	70
Effective from Session:				w.e.f. 2024-2025	Total	:	100
Date of BoS approval:					Duration of Exam	:	3 Hrs
Prerequisite							
Instruction for Paper Setter: 1. There should be 9 questions in the end term examinations question paper. 2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 20 marks. 3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 10 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / subquestions. 4. Each Unit shall have a marks weightage of 14. 5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook. 6. The requirement of (scientific) calculators / log-tables / data – tables may be specified if required.							

Course Objectives:

The students will try to learn:

1. The fuzzy logic and reasoning for handling uncertainty in problem solving
2. Introduce the ideas of neural networks, fuzzy logic.
3. The basics of intelligence techniques and methodologies of soft computing
4. The design and analysis of problem-solving using concepts of neural networks, neuro modeling, several neural networks paradigms.

Course Outcomes:

After successful completion of the course, the student will be able to:

- CO1. Apply the importance of knowledge representation and processing in intelligent system CO2. Understand the characteristics and constitutes of soft computing for decision making systems.
- CO3. Apply the models of artificial neural systems for classification problems.
- CO4. Apply the learning rules and its working principle for computer vision and image processing applications.
- CO5. Apply the importance of auto and hetero associative memories for distinct cases of neural network systems.

Course Contents:

UNIT-1: Introduction to Neural Networks

Introduction: Fundamental concept, evolution of neural networks, models of artificial neural networks, important technologies, applications, McCulloch, Pitts Neuron, linear separability, Hebb network; Supervised learning network: Perception networks, adaptive linear neuron, multiple adaptive linear neurons, back propagation network, radial basis function network.

UNIT-2: Associative Memory and Unsupervised Learning Networks & Fuzzy Logic

Associative memory networks: Training algorithms for pattern association, auto associative memory network, hetero associative memory network, bidirectional associative memory, Hopfield networks,

iterative auto associative memory network, temporal associative memory network; Unsupervised learning networks: Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network. Fuzzy logic: Introduction to classical/crisp sets and fuzzy sets, classical/crisp relations and fuzzy relations, tolerance and equivalence relations, noniterative fuzzysets. Membership functions: Fuzzification, methods

of membership value assignments, defuzzification, and Lambda cuts for fuzzy sets and fuzzy relations, defuzzification methods.

UNIT-3: Neural Networks

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-4: Genetic Algorithms

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition

UNIT-5: Matlab/Python Lib

Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques **Text Books:**

1. Jyh: Shing Roger Jang, Chuen: Tsai Sun, Eiji Mizutani, Neuro: Fuzzy and Soft Computing, Prentice: Hall of India, 2003.
2. J.S.R .Jang, C. T. Sun, E. Mizutani, Neuro, “Fuzzy and Soft Computing”, PHI, Pearson Education, 1st Edition, 2004.
3. S. N. Sivanandan, S. N. Deepa, “Principles of Soft Computing”, Wiley India, 2nd Edition, 2007. **Reference**

Books:

1. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, Prentice Hall, 1995.
2. MATLAB Toolkit Manual
3. I. S. Rajasekaran, G.A.V.Pai,“Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 1st Edition,2003.
4. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw Hill, 3rd Edition, 1997.
5. Stamatios V. Kartalopoulos “Understanding Neural Networks and Fuzzy Logic Basic Concepts and Applications”, IEEE Press, PHI, New Delhi, 2004.