MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

MADANAPALLE

(UGC-AUTONOMOUS)

www.mits.ac.in

Estd 1998

COMPUTER SCIENCE & ENGINEERING (ARTIFICIAL INTELLIGENCE)

Course Structure

&

Detailed Syllabi

For the students admitted to

B. Tech. Regular Four Year Degree Programme from the academic year 2020-21

and

B. Tech. Lateral Entry Scheme from the academic year 2021-22

B.TECH. COMPUTER SCIENCE & ENGINEERING (ARTIFICIAL INTELLIGENCE)

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

B. Tech Four Year Curriculum Structure

Branch: COMPUTER SCIENCE & ENGINEERING

(ARTIFICIAL INTELLIGENCE)

Total Credits	160 Credits for 2020(Regular) & 121 Credits for 2021(Lateral Entry) Admitted Batch
	163 Credits for 2021(Regular) & 124 Credits 2022(Lateral Entry) Admitted Batch onwards

I. Induction Program and Holistic Development Activities

Sl.No.	Title	Duration
1	Induction Programe (Mandatory)	Three weeks duration at the start of First Year (Refer Annexure - I)
2	Holistic Development Activities (Every Student from Semester 2 – 8 should register for at least one activity)	Three hours per week (Activity list is enclosed in Annexure - I)
3	Virtual Laboratory (Students are encouraged to choose and register for any of the Virtual laboratories he /she is interested)	As specified by the Virtual Laboratory

R20 - Curriculum Structure

I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT101	Engineering Calculus	3	1	0	4	4
2	BSC	20PHY102	Applied Physics	3	1	0	4	4
3	ESC	20EEE101	Basic Electrical Engineering	3	1	0	4	4
4	ESC	20CSE101	Programming for Problem Solving (Python)	2	0	3	5	3.5
5	HSMC	20ENG201	English for Professional Purposes Laboratory	0	0	2	2	1
6	BSC	20PHY201	Physics Laboratory	0	0	3	3	1.5
7	ESC	20EEE201	Electrical Engineering Laboratory	0	0	3	3	1.5
Total				**11**	**3**	**11**	**25**	**19.5**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20ENG101	Professional English	3	0	0	3	3
2	BSC	20MAT110	Linear Algebra	3	0	0	3	3
3	BSC	20CHE101	Engineering Chemistry	3	0	0	3	3
4	ESC	20CSE102	C Programming and Data Structures	3	0	0	3	3
5	ESC	20ME101	Engineering Graphics	2	0	2	4	3
6	BSC	20CHE201	Chemistry Laboratory	0	0	3	3	1.5
7	ESC	20CSE201	C Programming and Data Structures Laboratory	0	0	3	3	1.5
8	ESC	20CSE202	Engineering and IT Workshop	0	0	3	3	1.5
Total				**14**	**0**	**11**	**25**	**19.5**

(L = Lecture, T = Tutorial, P = Practical)

Dept. of. Computer Science & Engineering (Artificial Intelligence)

II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	BSC	20MAT111	Probability and Statistics for Computer Science	3	0	0	3	3
2	PCC	20CAI103	Computer System Architecture	3	0	0	3	3
3	PCC	20CAI104	Data Structures using Python	3	0	0	3	3
4	PCC	20CAI105	Object Oriented Programming - JAVA	2	1	0	3	3
5	PCC	20CAI106	Fundamentals of Artificial Intelligence	3	0	0	3	3
6	PCC	20CAI203	Data Structures using Python Laboratory	0	0	3	3	1.5
7	PCC	20CAI204	Object Oriented Programming - JAVA Laboratory	0	0	3	3	1.5
8	PCC	20CAI205	Fundamentals of Artificial Intelligence Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course – I (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20CHE901	Environmental Science	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	HSMC	20HUM101	Economics and Financial Accounting for Engineers	3	0	0	3	3
2	BSC	20MAT112	Discrete Mathematical Structures	3	0	0	3	3
3	ESC	20CAI107	Operating Systems Fundamentals	3	0	0	3	3
4	PCC	20CAI108	AI Tools, Techniques and Applications	3	0	0	3	3
5	PCC	20CAI109	Design and Analysis of Algorithms	2	1	0	3	3
6	PCC	20CAI206	Operating Systems Fundamentals Laboratory	0	0	3	3	1.5
7	PCC	20CAI207	AI Tools, Techniques and Applications Laboratory	0	0	3	3	1.5
8	PCC	20CAI208	Design and Analysis of Algorithms Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course - II (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20HUM901	Indian Constitution	2	0	0	2	0
Total				**17**	**1**	**11**	**29**	**21.5**

(L = Lecture, T = Tutorial, P = Practical)

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III Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20CAI110	Computer Networks	3	0	0	3	3
2	PCC	20CAI111	Database Management Systems	3	0	0	3	3
3	PCC	20CAI112	Machine Learning	3	0	0	3	3
4	OE		Open Elective-I	3	0	0	3	3
5	PE		Professional Elective-I	3	0	0	3	3
6	PCC	20CAI209	Database Management Systems Laboratory	0	0	3	3	1.5
7	PCC	20CAI210	Machine Learning Laboratory	0	0	3	3	1.5
8	SC		Skill Oriented Course – III (Refer ANNEXURE-IV)	1	0	2	3	2
9	MC	20CE901	Disaster Management	2	0	0	2	0
10	PROJ	20CAI701	Summer Internship - 1*	0	0	3	3	1.5
Total				**18**	**0**	**11**	**29**	**21.5**

* 2 Months internship during 2nd year summer vacation and to be evaluated in III Year I Semester

III Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PCC	20CAI113	Big Data Analytics	3	0	0	3	3
2	PCC	20CAI114	Deep Learning	3	0	0	3	3
3	PCC	20CAI115	Data Science	3	0	0	3	3
4	OE		Open Elective-II	3	0	0	3	3
5	PE		Professional Elective-II	3	0	0	3	3
6	PCC	20CAI211	Big Data Analytics Laboratory	0	0	3	3	1.5
7	PCC	20CAI212	Deep Learning Laboratory	0	0	3	3	1.5
8	PCC	20CAI213	Data Science Laboratory	0	0	3	3	1.5
9	SC		Skill Oriented Course – IV (Refer ANNEXURE-IV)	1	0	2	3	2
10	MC	20HUM902**/ 20HUM102#	Universal Human Values	2/3	0	0	2/3	0/3
Total				**18/19**	**0**	**11**	**29/30**	**21.5/24.5**

** 20HUM902 Universal Human Values is offered as non-credit mandatory course for 2020 (Regular) & 2021 (Lateral Entry) Admitted Batch

20HUM102 Universal Human Values is offered as three credit course for 2021 (Regular) & 2022(Lateral Entry) Admitted Batch onwards

(L = Lecture, T = Tutorial, P = Practical)

IV Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PE		Professional Elective-III	3	0	0	3	3
2	PE		Professional Elective-IV	3	0	0	3	3
3	PE		Professional Elective-V	3	0	0	3	3
4	OE		Open Elective-III	3	0	0	3	3
5	OE		Open Elective-IV	3	0	0	3	3
6	OE-HSMC		Open Elective-V (Taken from Humanities & Social Science)	3	0	0	3	3
7	SC		Skill Oriented Course – V (Refer ANNEXURE-IV)	1	0	2	3	2
8	PROJ	20CAI702	Summer Internship - 2*	0	0	6	6	3
Total				**19**	**0**	**8**	**27**	**23**

* 2 Months internship during 3rd year summer vacation and to be evaluated in IV Year I Semester

IV Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PROJ	20CAI703	Project Work and Internship	0	0	24	24	12
Total				**0**	**0**	**24**	**24**	**12**

(L = Lecture, T = Tutorial, P = Practical)

ANNEXURE - I

THREE WEEK MANDATORY INDUCTION PROGRAMME

- Yoga and Meditation
- Sports and Games
- NSS
- NCC
- MITS Social Responsibility Club
- Management module
- Design Thinking
- Spoken and Written Communication

Proficiency modules

- Basic Computer Proficiency
- Interpersonal Skills
- Computer Graphics
- Web Programming
- Mobile Apps
- Vocabulary Enhancement

HOLISTIC DEVELOPMENT ACTIVITIES

Description of Activities

1. Physical and Health
2. Culture
3. Literature and Media
4. Social Service
5. Self-Development
6. Nature and Environment
7. Innovation

ANNEXURE - II

OPEN ELECTIVE – I (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M01	Project Management for Managers	Management Studies
2	20HUM3M02	Ethics in Engineering Practice	Management Studies
3	20HUM3M03	E – Business	Management Studies
4	20CE3M01	Integrated Waste Management for Smart City	Civil
5	20CE3M02	Soil and Water Conservation Engineering	Civil
6	20CE3M03	Plastic Waste Management	Civil
7	20CE3M04	Safety in Construction	Civil
8	20ME3M01	Operations Management	Mechanical
9	20ME3M02	Operations Research	Mechanical
10	20ME3M03	Design Thinking and Innovation	Mechanical
11	20EEE3M01	Non-Conventional Energy Sources	EEE
12	20EEE3M02	Design of Photovoltaic Systems	EEE
13	20ECE3M01	Microprocessors and Interfacing	ECE
14	20ECE3M02	Microprocessors and Microcontrollers	ECE
15	20ECE3M04	System Design Through Verilog	ECE
16	20IE3M01	Intellectual Property Rights and Competition Law	Multidisciplinary
17	20IE3M02	Introduction to Research	Multidisciplinary
18	20IE3M03	Roadmap for Patent Creation	Multidisciplinary
19	20IE3M04	Energy Conversion Technologies (Biomass And Coal)	Multidisciplinary
20	20IE3M05	Research Methodology	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – II (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20MAT301	Advanced Numerical Methods	Mathematics
2	20MAT302	Engineering Optimization	Mathematics
3	20PHY301	Optical Physics and its Applications	Physics
4	20PHY302	LASER Physics and Advanced LASER Technology	Physics
5	20CHE301	Introduction to Petroleum Industry	Chemistry
6	20CHE302	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
7	20CE301	Ground Improvement Techniques	Civil
8	20CE302	Environmental Impact Assessment	Civil
9	20CE303	Watershed Management	Civil
10	20ME301	Material Science for Engineers	Mechanical
11	20ME302	Elements of Mechanical Engineering	Mechanical
12	20EEE301	Industrial Electrical Systems	EEE
13	20EEE302	Introduction to MEMS	EEE
14	20ECE301	Bio-Medical Electronics	ECE
15	20ECE302	VLSI Design	ECE
Any new Interdisciplinary Course can be appended in future.			

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OPEN ELECTIVE – III (To be offered under MOOC's Category from SWAYAM – NPTEL)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM3M04	Management Information System	Management Studies
2	20CE3M05	Remote Sensing and GIS	Civil
3	20CE3M06	Wastewater Treatment and Recycling	Civil
4	20CE3M07	Building Materials And Composites	Civil
5	20ME3M04	Power Plant Engineering	Mechanical
6	20ME3M05	Mechatronics and Manufacturing Automation	Mechanical
7	20EEE3M03	Introduction to Smart Grid	EEE
8	20EEE3M04	Transducers For Instrumentation	EEE
9	20IE3M06	Learning Analytics Tools	Multidisciplinary
Any new Interdisciplinary Course offered by SWAYAM NPTEL can be appended in future.			

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OPEN ELECTIVE – IV (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20PHY303	Thin Film Technology and its Applications	Physics
2	20CHE303	Introduction to Nano Science and Technology	Chemistry
3	20CHE304	Computational Methods in Materials Science and Engineering	Chemistry
4	20CE304	Green Buildings and Energy Conservation	Civil
5	20CE305	Environmental Engineering	Civil
6	20ME303	Total Quality Management	Mechanical
7	20ME304	Entrepreneurship	Mechanical
8	20EEE303	Robotics	EEE
9	20EEE304	Electrical Safety	EEE
10	20ECE303	Embedded Systems	ECE
11	20ECE304	DSP Architecture	ECE
Any new Interdisciplinary Course can be appended in future.			

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OPEN ELECTIVE – V (HUMANITIES) (To be offered under Conventional Mode)			
Sl. No.	**Course Code**	**Course Title**	**Course Offered by Department of**
1	20HUM301	Principles of Management	Humanities
2	20HUM302	Human Resource Development	Humanities
3	20HUM303	Soft Skills	Humanities
4	20HUM304	National Cadet Corps	Humanities
Any new Interdisciplinary Course can be appended in future.			

ANNEXURE – III

List of Professional Electives

Professional Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	20CAI401	Distributed Systems
2.	20CAI402	Software Engineering
3.	20CAI403	Web Technologies
4.	20CAI404	Digital Image Processing
5.	20CAI405	Multimedia Technologies
Any advanced courses can be appended in future.		

Professional Elective – II (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	20CAI4M01	Cryptography and Network Security
2.	20CAI4M02	Introduction to Soft Computing
3.	20CAI4M03	Online Privacy
4.	20CAI4M04	Privacy and Security in Online Social Media
5.	20CAI4M05	Social Media Analytics
6.	20CAI4M06	Mobile Computing
7.	20CAI4M07	Theory of Computation and Compiler Design
8.	20CAI4M08	Cloud Computing and Distributed Systems
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

Professional Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	20CAI406	Natural Language Processing
2.	20CAI407	Computer Vision for AI
3.	20CAI408	AI For Cyber Security
4.	20CAI409	Intelligent Agent Systems
5.	20CAI410	GPU Programming using CUDA
6.	20CAI411	Ethics and AI
Any advanced courses can be appended in future.		

Professional Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	20CAI412	Data Visualization Techniques
2.	20CAI413	Business Analytics
3.	20CAI414	Medical Image Data Analysis
4.	20CAI415	Predictive Analysis in IOT
5.	20CAI416	Video Analytics
6.	20CAI417	Healthcare Data Analytics
Any advanced courses can be appended in future.		

Professional Elective – V		
Sl. No.	**Course Code**	**Course Title**
1.	20CAI418	Robotics Process Automation
2.	20CAI419	Edge and Fog Computing
3.	20CAI420	Software Project Management
4.	20CAI421	Blockchain Architecture Design
5.	20CAI422	Design Patterns
6.	20CAI423	Malware Analysis
Any advanced courses can be appended in future.		

ANNEXURE – IV

SKILL ORIENTED COURSES

Skill Oriented Course - I		
Sl. No	**Course Code**	**Course Title**
1	20CAI601	Web Scripting
2	20CAI602	Android Application Development
Any advanced courses can be appended in future		

Skill Oriented Course - II		
Sl. No	**Course Code**	**Course Title**
1	20ENG601	Corporate Communication
Any advanced courses can be appended in future		

Skill Oriented Course - III		
Sl. No	**Course Code**	**Course Title**
1	20CAI603	Multimedia Computing
2	20CAI604	Python for Data Science
3	20CAI610	Network Programming
Any advanced courses can be appended in future		

Skill Oriented Course - IV		
Sl. No	**Course Code**	**Course Title**
1	20CAI605	Full Stack Development
2	20CAI606	UML Design
Any advanced courses can be appended in future		

Skill Oriented Course - V		
Sl. No	**Course Code**	**Course Title**
1	20CAI607	NoSQL
2	20CAI608	Cryptography Algorithms
3	20CAI609	Advanced Machine Learning
Any advanced courses can be appended in future		

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ANNEXURE - V

Honors in Computer Science & Engineering (Artificial Intelligence)

SI.No	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total Contact Hours	
III Year I Semester								
1	**Professional Elective Course (Choose any two from three courses)**	20HDCAI101	Cognitive Science and Analytics	3	0	0	3	3
2		20HDCAI102	Business Intelligence	3	0	0	3	3
3		20HDCAI103	Advanced Algorithms	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
III Year II Semester								
4	**Professional Elective Course (Choose any two from three courses)**	20HDCAI104	Data Warehousing and Mining	3	0	0	3	3
5		20HDCAI105	Expert System	3	0	0	3	3
6		20HDCAI106	Information Theory and Coding	3	0	0	3	3
	Sub Total			**6**	**0**	**0**	**6**	**6**
IV Year I Semester								
7	**Professional Elective Course (Choose any one from three courses)**	20HDCAI107	Human Computer Interaction	3	0	0	3	3
8		20HDCAI108	Machine Translation	3	0	0	3	3
9		20HDCAI109	Federated Machine Learning	3	0	0	3	3
10	**SOC**	20HDCAI601	R Programming	1	0	2	3	2
	Sub Total			**7**	**0**	**2**	**9**	**8**
	Total			**19**	**0**	**2**	**21**	**20**

COMPUTER SCIENCE & ENGINEERING

(Artificial Intelligence)

B. Tech I Year I Semester

B. Tech I Year I Semester

20MAT101 ENGINEERING CALCULUS

L	T	P	C
3	1	0	4

Pre-requisite: Mathematics at Intermediate or Equivalent Level

Course Description:

Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. To introduce the basic concepts of definite integrals, improper integrals, Beta and Gamma functions.
2. To acquire knowledge on mean value theorems in calculus.
3. To illustrate various techniques of testing the convergence of infinite series and introduces the functions of sine and cosine series.
4. To familiarize the knowledge of limit, continuity and the derivatives, extreme values in Multivariable.
5. To emphasize the role of Double and Triple integrals in dealing with area and volume of the regions.

UNIT I INTEGRAL CALCULUS 12 hours

Definite integrals; Applications of definite integrals to evaluate area and length of curves, surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

UNIT II DIFFERENTIAL CALCULUS 12 hours

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders (without proofs); indeterminate forms, Maxima and minima.

UNIT III SEQUENCE AND SERIES 12 hours

Sequence and Series, their Convergence and tests for convergence; Power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

UNIT IV MULTIVARIABLE DIFFERENTIAL CALCULUS 12 hours

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

UNIT V MULTIVARIABLE INTEGRAL CALCULUS 12 hours

Multiple Integration: double integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes (double integration), triple integrals, gradient, curl and divergence, Green's, Stokes and Gauss divergence theorems (without proofs).

Course Outcomes:

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

1. Evaluate the definite integrals, Beta and Gamma functions and calculate length of curve and underlying area.
2. Relate the results of mean value theorems in calculus to Engineering problems.
3. Use the Power series and Fourier series for ascertaining the stability and convergence of various techniques.
4. Apply the functions of several variables to evaluate the rates of change with respect to time and space variables in engineering.
5. Compute the area and volume by interlinking them to appropriate double and triple integrals.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 42th Edition, 2012.

2. G. B. Thomas, Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas' Calculus Pearson education 11th Edition, 2004.

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2 Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3 Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4 Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5 D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6 N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year I Semester

20PHY102 APPLIED PHYSICS

L	T	P	C
3	1	0	4

Pre-requisite: Plus two level physics course

Course Description:

Applied Physics for Electrical, Electronics and Computer Engineers is a basic physics course which provides fundamental knowledge to understand the concepts of Waves, Optics, Quantum Mechanics, Semiconductors, Lasers and Fiber Optics.

Course Objectives:

1. Expose students in understanding the basic laws of nature through wave equation using the principles of oscillations and waves.
2. Analyze and understand the concepts of waves and optics to prepare the students for advanced level courses.
3. Expose students to theoretical and mathematical aspects of Interference, Diffraction techniques, Polarization and Lasers for testing of materials.
4. Develop knowledge and understanding the fundamental concepts of Quantum mechanics, Semiconductors and Fiber Optics.
5. Adaptability to new developments in science and technology.

UNIT I WAVES AND OSCILLATIONS 11 hours

Simple harmonic motion, damped harmonic oscillations, forced harmonic oscillations, resonance, and quality factor. Superposition of vibrations along same direction (equal frequency) and in perpendicular directions, Lissajous figures.

Transverse waves, one dimensional wave equation, solution for wave equation, velocity of a transverse wave along a stretched string, modes of vibration of stretched string, reflection and transmission waves at boundary, standing waves, standing wave ratio.

UNIT II OPTICS 13 hours

Superposition of waves, interference of light by division of wavefront - Young's double slit experiment, interference of light by division of amplitude- interference in thin film by reflection, Newton's rings experiment.

Diffraction, Farunhofer diffraction due to single slit, double slit and Diffraction grating (Nslit).

Polarization, Types of polarization, Polarization by reflection, refraction and double refraction, Nicol's prism. Half wave and Quarter wave plates.

UNIT III QUANTUM MECHANICS 12 hours

De Broglie's hypothesis, Uncertainty principle (Qualitative only), Postulates of quantum mechanics, Time-dependent and time-independent Schrodinger equations for wave function, Free-particle wave function and wave-packets (group velocity & phase velocity), Solution of wave equation: Solution of stationary-state, Schrodinger equation for one dimensional problems – particle in a box, Scattering from a potential barrier and principle of tunnelling- operation of scanning tunnelling microscope.

UNIT IV FREE ELECTRON THEORY & SEMICONDUCTORS 12 hours

Free electron theory of metals (drift velocity and electrical conductivity), Fermi energy level, density of states, Kronig-Penney model (Qualitative only) and origin of energy bands, band structure of metals, semiconductors, and insulators. Direct and indirect bandgap semiconductors, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier concentration and temperature (equilibrium carrier statistics), Drift and Diffusion Current, Hall effect.

UNIT V LASERS & FIBER OPTICS 12 hours

Introduction to lasers, characteristics of laser, spontaneous and stimulated emission, Einstein's coefficients; population inversion, excitation mechanisms, solid-state lasers – ruby laser, gas Lasers - He-Ne Laser, applications of lasers.

Fiber Optics: Principle, Construction and working of optical fiber, Acceptance angle, Numerical aperture, Types of fiber, Fiber optic communication system.

Course Outcomes:

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

1. Describe a mathematical wave equation using the principles of waves and oscillations
2. Apply the knowledge for materials testing using Interference, Diffraction & Polarization techniques.
3. Understand the idea of wave function and to solve Schrodinger equation for simple potentials.
4. Explain the role of semiconductors in different realms of physics and their applications in both science and technology.
5. Acquire the basic knowledge of lasers and fiber optics.

Text Books:

1. Engineering Physics –Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics –K. Thyagarajan, McGraw Hill Publishers.

Reference Books:

1. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
2. Physics Vol I & II, Halliday/Resnick/Krane 5th Edition, John Wiley, 2003.
3. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
4. Concepts of Modern Physics by Arthur Beiser, 7th Edition, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year I Semester

20EEE101 BASIC ELECTRICAL ENGINEERING

L	T	P	C
3	1	0	4

Pre-requisite Intermediate Physics

Course Description:

This course equips the students with a basic understanding of Electrical circuits and machines for specific applications. In specific, the course covers basic of DC circuit & its analysis, introduction to single-phase and three-phase AC Systems, magnetic materials, transformers, DC & AC electrical machines, basic converters and Components of LT Switchgear.

Course Objectives:

1. To learn the basics of the D.C. circuit analysis.
2. To have an idea about single-phase and three-phase A.C. electrical circuits.
3. To gain knowledge about basic magnetic material and transformers.
4. To learn the construction and operation of D.C. and A.C. machines.
5. To understand the operation of basic rectifiers and various components of LT Switchgear.

UNIT I DC CIRCUIT ANALYSIS 12 hours

Electrical circuit elements, voltage and current sources, Series and parallel resistive circuits, Kirchhoff's current and voltage laws, Nodal and Mesh analysis of simple circuits with dc excitation. Source Transformation, Star-Delta Transformation, Superposition Theorem.

UNIT II AC CIRCUIT ANALYSIS 12 hours

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III MAGNETIC MATERIALS AND TRANSFORMERS 12 hours

Magnetic materials, B-H characteristics, ideal and practical transformer, principle of operation, emf equation, equivalent circuit, losses in transformers, regulation and efficiency.

UNIT IV DC AND AC MACHINES 12 hours

Construction, working, emf equation of DC generator, methods of excitation, speed control of dc motor. Introduction to different types of AC motors, Three Phase Induction Motors - Generation of rotating magnetic fields, construction, working and starting methods: D.O.L, Autotransformer starter. Introduction to Alternators.

UNIT V RECTIFIERS AND ELECTRICAL INSTALLATIONS 12 hours

PN junction diode, half wave, full wave and bridge rectifiers. Components of LT Switchgear: switch fuse unit (SFU), MCB, ELCB, MCCB, types of wires and cables – Current carrying capability, Insulation Strength; Earthing.

Course Outcomes:

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

1. To understand and analyze basic DC electric circuits.
2. To measure and analyze various electrical quantities of single phase and three AC electric circuits.
3. To understand magnetic materials and to analyze the transformers.
4. To study the working principles of electrical machines.
5. To create power converters for domestic applications with LT switchgear.

Text Books:

1. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Reference Books:

1. Abhijit Chakrabarti, “Circuit Theory : Analysis and Synthesis”, Dhanpat Rai & Co., 2014.
2. J.B. Gupta, “Theory & Performance of Electrical Machines”, S. K. Kataria & Sons, 2013.
3. John Bird, “Electrical Circuit Theory and Technology”, Fourth edition, Elsevier Ltd., 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year I Semester

20CSE101 PROGRAMMING FOR PROBLEM SOLVING (PYTHON)

L	T	P	C
2	0	3	3.5

Pre-requisite: None

Course Description:

Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience.

This course provides knowledge on how to implement programs in python language and to solve computational problems using the various programming constructs including data structures, functions, string handling mechanisms and file handling concepts

Course Objectives:

This course enables students to

1. Learn Python programming constructs.
2. Implement Python programs with conditional structures and loops.
3. Use functions for structuring Python programs.
4. Handle compound data using Python lists, tuples, and dictionaries.
5. Manipulate data using files handling in Python.
6. Getting exposed to the basics of Object Oriented Programming using Python

UNIT I: INTRODUCTION 12 hours

Algorithms, building blocks of algorithms (flow chart), History of Python, features of Python Programming, Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation. Data Types - Integers, Strings, Boolean.

a) Develop a flowchart for the various arithmetic operations on numbers.
b) Develop a flowchart to check whether the number is positive or negative.
c) Develop a flowchart for finding whether a given number is even or odd.
d) Develop a flowchart for finding biggest number among three numbers.
e) Develop a flowchart for displaying reversal of a number.
f) Develop a flowchart to print factorial of a number using function.
g) Develop a flowchart to generate prime numbers series up to N using function.
h) Develop a flowchart to check given number is palindrome or not using function.
i) Alexa travelled 150 kms by train. How much distance in miles she actually covered?

UNIT II: OPERATORS AND EXPRESSIONS 12 hours

Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations. Control Flow - if, if-elif else, for, while, break, continue, pass.

a) Swapping of two number with and without using temporary variable.
b) If the age of Ram, Sam, and Khan are input through the keyboard, write a python program to determine the eldest and youngest of the three.
c) Develop a program that performs arithmetic operations (Addition, Subtraction, Multiplication, and Division) on integers. Input the two integer values and operator for performing arithmetic operation through keyboard. The operator codes are as follows:

- For code '+', perform addition.
- For code '-', perform subtraction.
- For code '*', perform multiplication.
- For code '/', perform division.

d) Implement the python program to generate the multiplication table.
e) Implement Python program to find sum of natural numbers
f) If the first name of a student is input through the keyboard, write a program to display the vowels and consonants present in his/her name.
g) The marks obtained by a student in 5 different subjects are input through the keyboard. Find the average and print the student grade as per the MITS examination policy as shown below.

% OBTAINED GRADE
90 - 100 O (Outstanding)
80 - 89 A+ (Excellent)
70 - 79 A (Very Good)
60 - 69 B+ (Good)
50 - 59 B (Above)
45 - 49 C (Average)
40 - 44 P (Pass)
< 40 F (Fail)

h) Implement Python Script to generate prime numbers series up to N.
i) Given a number x, determine whether it is Armstrong number or not. Hint: For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371. Write a program to find all Armstrong number in the range of 0 and 999.

UNIT-III: DATA STRUCTURES 12 hours

Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Functions - Defining Functions, Calling Functions, Passing Arguments, variable in python-Global and Local Variables.

a) Write a Python script to
- create a list
- access elements from a list
- slice lists
- change or add elements to a list
- delete or remove elements from a list

b) Write a Python script to read the values from a list and to display largest and smallest numbers from list.
c) Write a Python script to compute the similarity between two lists.
d) Write a Python script to read set of values from a Tuple to perform various operations.
e) Write a Python script to perform basic dictionary operations like insert, delete and display.
f) Write a Python program to count the occurrence of each word in a given sentence.
g) Define a dictionary named population that contains the following data.

Keys	Values
Shanghai	17.8
Istanbul	13.3
Karachi	13.0
Mumbai	12.5

h) Write a Python script to create Telephone Directory using dictionary and list to perform basic functions such as Add entry, Search, Delete entry, Update entry, View and Exit.
i) Implement Python script to display power of given numbers using function.
j) Implement a Python program that takes a list of words and returns the length of the longest one using function.

UNIT-IV:

String Handling -Modules: Creating modules, import statement, from import statement, name spacing

Files and Directories:

a) Implement Python program to perform various operations on string using string libraries.

b) Implement Python program to remove punctuations from a given string.

c) Write a Python program to change the case of the given string (convert the string from lower case to upper case). If the entered string is "computer", your program should output "COMPUTER" without using library functions.

d) Implement Python program to capitalize each word in a string. For example, the entered sentence "god helps only people who work hard" to be converted as "God Helps Only People Who Work Hard"

e) Write a Python script to display file contents.

f) Write a Python script to copy file contents from one file to another.

g) Write a Python script to combine two text files contents and print the number of lines, sentences, words, characters and file size.

h) Write a Python commands to perform the following directory operations.

- List Directories and Files
- Making a New Directory
- Renaming a Directory or a File
- Removing Directory or File

UNIT-V:

Python packages: Predefined Packages and User-defined Packages, Package Creation.

Object Oriented Programming using Python: Introduction to OOP, Creating Classes and Objects in Python, Creating Methods in Python

Brief Tour of the Standard Library: Turtle

a) Create a package named Cars and build three modules in it namely, BMW, Audi and Nissan. Illustrate the modules using class. Finally we create the __init__.py file. This file will be placed inside Cars directory and can be left blank or we can put the initialization code into it.

b) Create a class by name Student with instance variables such as roll_no, name, year_of_study, branch, section, and marks in any five subjects. The class should also contain one method for calculating the percentage of marks and the other method for printing a report as follows:

Roll No.	Name	Year	Section	Branch	M1	M2	M3	M4	M5	Percentage
101	abc	I	A	CSE	58	68	95	47	56	64.8

b) Write a python script to display following shapes using turtle.

Course Outcomes:

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

1. Understand problem solving techniques and their applications
2. Understand the syntax and semantics of python.
3. Demonstrate the use of Python lists and dictionaries.
4. Demonstrate the use of Python File processing, directories.
5. Describe and apply object-oriented programming methodology and Standard Library.

Text Books:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/thinkpython/)

2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

References:

1. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

2. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.

3. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.

4. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers,LLC,2013.

5. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20ENG201 ENGLISH FOR PROFESSIONAL PURPOSES LABORATORY

(Common to all branches)

L	T	P	C
0	0	2	1

Pre-requisite None

Course Description:

English language communication is a social phenomenon and students need to be able to function in the society at large as the communicators before entering the professional world. The present course equips the students with the basic functions of English language communication, which are required not only in their day-to-day lives but also profoundly significant for their future professional, academic training and their careers in the industry. The course mainly focuses on the achievement of communicative proficiency of the students coupled with the necessary linguistic inputs.

Course Objectives:

This course enables the student to –

1. Get aquatinted with the basic communicative functions.
2. Engage effectively in learning various functions of English language communication.
3. Enhance their narration abilities in past experiences and future plans and goals/events.
4. Develop their abilities in expressing opinion.
5. Provide speaking practice in speech.

Course contents:

Greeting and Introductions (L & S)

- Greeting on different occasions and responding to greetings **(L & S)**
- Wishing on various occasions, taking leave and saying goodbye **(L & S)**
- Introducing oneself and others **(L & S)**
- Asking for introduction and responding to introduction **(L & S)**
- Developing a short personal profile **(R &W)**

Describing: (L, S, R & W)

- Using adjectives **(Vocab)**
- Degrees of comparison **(Grammar)**
- Common words, phrases, and expressions used for description **(Vocab)**
- Describing people, places and objects **(L, S, R & W)**
- Reading and writing descriptive paragraphs **(R &W)**

Narrating (L, S, R & W)

- Talking about past experiences and events **(L & S)**
- Talking about memorable incidents or events **(L & S)**
- Techniques of narration and narrative tenses **(Grammar)**
- Composing and narrating a story **(R &W)**

Planning and Predicting (L, S, R & W)

- Talking about future events **(L & S)**
- Making promises and giving assurances **(L & S)**
- Predicting future events **(L & S)**
- Writing and organising a short plan of an event **(R &W)**

Instructions and directions (L, S, R & W)
- Forming imperative sentences (Grammar)
- Reading and writing short instruction manuals **(R &W)**
- Writing a recipe/ procedure **(R &W)**
- Giving directions

Enquiring: (L, S, R & W)
- Open and closed ended questions **(Grammar)**
- Asking for information and giving information **(L & S)**
- Telephonic enquiry **(L & S)**
- Official enquiries through emails and letters **(R &W)**

Requesting: (L, S, R & W)
- Polite expressions
- Modal verbs and key phrases for requesting **(Grammar and vocab)**
- Official requests through emails and letters **(R &W)**

Comparing and contrasting: (L, S, R & W)
- Words and phrases used for comparison and contrast **(Vocab)**
- Comparing qualities/properties/quantities of people, places and objects **(L & S)**
- Composing comparison and contrast paragraphs **(R &W)**

Expressing opinion: (L, S, R & W)
- Language expressions used for expressing opinions **(Vocab)**
- Developing opinion based paragraphs **(R &W)**
- Discourse markers and linkers used in opinion based paragraphs **(R &W)**

Public Speaking: (L, S, R & W)
- Techniques and strategies required for public speaking **(L & S)**
- Developing and organising a short speech **(R &W)**
- Presentation skills required for public speaking **(L & S)**

Course Outcomes:

At the end of the course, students will be able to
1. Develop their confidence while giving introduction, describing a place, & giving directions. (3,4,5)
2. Use various functions of English like asking for & giving information**,** inviting people for events/occasions, & requesting people. (3,4,5)
3. Narrate the past experiences and events in speaking and wring (3,4,5)
4. Express their views and opinions logically and appropriately in spoken and written format. (3,4,5,6)
5. Deliver logically organized speeches and present them without hesitations. (3,4,5, 6)

Text Books:

1. Leo Jones; Functions of English, Published by: Cambridge University Press.
2. Leo Jones; Let's Talk Level 1, 2, 3, Published by: Cambridge University Press.
3. Adrian Doff, Craig Thaine, Herbert Puchta, et al; *Empower: Intermediate (B1+)*; Published by: Cambridge University Press.

References:

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press,2015.
2. Raymond Murphy; English Grammar in Use with CD; Cambridge University Press 2013.
3. K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4. William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006
5. Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P.HUMPHREY, 2006
6. Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7. Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012
8. www.cambridgeenglish.org/in/
9. https://learnenglish.britishcouncil.org/en/english-grammar
10. https://www.rong-chang.com/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year I Semester

20PHY201 PHYSICS LABORATORY

L	T	P	C
0	0	3	1.5

Course Description:

Physics Practical course is meant for making the students to gain practical knowledge to co relate with the theoretical studies. It covers experiments on Principles of Mechanics and Optics, Measurement of Magnetic field and studying Resonance using LCR Circuit.

Course Objectives:

1. Elucidate the concepts of Physics through involvement in the experiment by applying theoretical knowledge.
2. Illustrate the basics of mechanics, waves and optics to analyze the behavior and characteristics of various materials for its optimum utilization.
3. Develop an ability to apply the knowledge of physics experiments in the later studies.

LIST OF EXPERIMENTS:

{Out of 17 experiments any 12 experiments (minimum 10) must be performed in a semester}

1. Spring constant - Coupled Pendulums.
2. Study of resonance effect in series and parallel LCR circuit.
3. Determination of radius of curvature of a curved surface - Newton's Rings.
4. Wavelength of a laser - Diffraction Grating
5. Wavelength of the spectral lines - Diffraction Grating.
6. Magnetic field along the axis of a current carrying coil - Stewart Gees' Apparatus
7. Thickness of a given wire - Wedge Method.
8. Dispersive power of prism – Spectrometer.
9. Frequency of the tuning fork - Melde's apparatus.
10. Determination of particle size using Laser.
11. Width of single slit - Diffraction due to Single Slit.
12. Torsional Pendulum.
13. Determination of the numerical aperture of a given optical fiber and hence to find its acceptance angle.
14. Measurement of *e/m* of electron (Thomson's method)
15. Energy gap of a material of p-n junction.
16. Determination of Planck's constant.
17. Ferroelectric hysteresis (B-H Curve).

Course Outcomes:

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

1. Apply the scientific process in the conduct and reporting of experimental investigations.
2. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
3. Verify the theoretical ideas and concepts covered in lecture by doing hands on in the experiments.
4. Know about the characteristics of various materials in a practical manner and gain knowledge about various optical technique methods.
5. Acquire and interpret experimental data to examine the physical laws.

Reference Books:

1. Physics Laboratory Manual
2. Optics, A. Ghatak, 4th Edition, Tata McGraw-Hill, New Delhi 2011.
3. Fundamentals of Optics, F. A. Jenkins and H. E. White, 4th edition, McGraw-Hill Inc., 1981.
4. Engineering Mechanics, 2nd ed. — MK Harbola
5. Introduction to Electrodynamics- David J Griffiths

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I Semester

20EEE201 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:

The laboratory facilitates the students to deal with electrical instruments, which further strengthen the concepts & operation of various AC & DC circuits, and machines, and their characteristics. The lab also reinforce the concepts discussed in class with a hands-on approach which enable the students to gain significant experience with electrical instruments such as ammeter, voltmeter, digital multimeter, oscilloscopes, tachometer, switches, fuses and power supplies.

Course Objectives:

1. To provide hands on experience in setting up simple electrical circuits (DC and AC).
2. To get exposure to handle different electrical equipment's.
3. To measure various electrical parameters with different measuring instruments.
4. To get hands on experience in operating DC and AC machines.
5. To understand the operation of basic converters and various components of LT Switchgear..

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

DEMONSTRATIONS:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, wattmeter, multi-meter, oscilloscope. Study of passive components - resistors, capacitors and inductors.
2. Demonstration of voltage and current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). In star and delta connections.
3. Demonstration of cut-out sections of transformer and DC & AC machines.
4. Demonstration of induction machine. Motor operation and generator operation of an induction machine driven at super-synchronous speed.
5. Wavelength of the spectral lines - Diffraction Grating.
6. Familiarization of (i) different types of cables/wires and switches and their uses, (ii) different types of fuses & fuse carriers; MCB, ELCB, MCCB their ratings and uses (components of LT switchgear).

EXPERIMENTS:

1. Wiring of a simple circuit for controlling (1) a lamp/fan point, (2) Staircase or Corridor Winding.
2. Wiring of a power circuit for controlling an electrical appliance (16A Socket).
3. Verification of Kirchhoff's current and voltage laws (KCL & KVL).
4. Verification of superposition theorem
5. Sinusoidal steady state response of R-L, and R-C circuits (impedance calculation and verification).
6. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
7. Measurement of voltage, current and power in a single-phase circuit using voltmeter, ammeter and wattmeter. Also, calculate the power factor of the circuit.
8. Open-circuit and short-circuit test on a single-phase transformer.
9. Speed control of separately excited DC motor.
10. Wiring of a power distribution arrangement using single-phase MCB distribution board with ELCB, main switch and energy meter (or residential house wiring).
11. Regulated power supply for generating a constant DC Voltage.
12. Fabrication of a given electronic circuit on a PCB and test the same.

Course Outcomes:

Upon successful completion of the course, the students are expected to

1. Get an exposure to common electrical components and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the usage of common electrical measuring instruments.
4. Understand the basic characteristics of transformers and electrical machines.
5. Get an exposure to the working of various power electronic converters.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

COMPUTER SCIENCE & ENGINEERING

(Artificial Intelligence)

B. Tech I Year II Semester

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year II Semester

20ENG101 PROFESSIONAL ENGLISH

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
Communication takes place in many forms, however the major impact and effectiveness is in its professionalism. This course defines, enlightens and enables learners to engage in Professional Communication by addressing all the areas of communication – Listening, Speaking, Reading and Writing. This course also deals with various types of communication – Verbal, Non-verbal, Storytelling, Crucial Conversations, Written Communication, Vocalics, Eye Contact, Posture, etc.

Course Objectives: This course enables the student to –

1. Engage effectively in a professional environment
2. Understand the intricacies and implications of professional communication
3. Use linguistic skills in any given context
4. Conduct self in a learning environment
5. Be better prepared for employment

UNIT I GRAMMAR & VOCABULARY 9 hours

Grammar - Tense, Reported Speech, Modals, Conditionals; Vocabulary development - prefixes, suffixes, compound words, synonyms & antonyms.

UNIT II READING SKILLS & WRITTEN COMMUNICATION 9 hours

Reading - short comprehension passages, practice in skimming, scanning and predicting; Writing- completing sentences, developing hints; Paragraph writing- topic sentence, main ideas, coherence.

UNIT III VERBAL & NON-VERBAL ASPECTS 9 hours

Verbal - Introducing oneself, exchanging personal information, Using 'Wh'- Questions, asking and answering, yes or no questions- asking about routine actions and expressing opinions; Non-Verbal – Use of body language, combating nervousness.

UNIT IV CONVERSATIONS 9 hours

Listening-short texts & conversing, formal and informal conversations, short group conversations, speaking about oneself, sharing information of a personal kind speaking about one's friend.

UNIT V BUSINESS ENVIRONMENT & ETIQUETTES 9 hours

Greeting & taking leave; Writing e-mails, memos, reports, etc.

Course Outcomes:

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

1. Read articles and understand professional communication
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind and personal letters and emails in English.

Text Books:

1. Guy Brook Hart & Norman Whitby; Cambridge English-Business Benchmark: Pre-Intermediate to Intermediate; Published by: Cambridge University Press.

2. Adrian Doff, Craig Thaine, Herbert Puchta, et al; Empower: Intermediate (B1+); Published by: Cambridge University Press.

Reference Books

1. AJ Thomson & AV Martinet; A Practical English Grammar; Oxford University Press, 2015.
2 Raymond Murphy; English Grammar in Use with CD; Cambridge University Press, 2013.
3 K.S. Yadurajan; Modern English Grammar; Oxford University Press, 2014.
4 William Strunk Jr; The Elements of Style; ITHACA, N.Y.; W.P. HUMPHREY, 2006
5 Joseph Devlin; How to Speak and Write Correctly; ITHACA, N.Y.; W.P. HUMPHREY, 2006
6 Anjana Agarwal; Powerful Vocabulary Builder; New Age Publishers, 2011.
7 Writing Tutor; Advanced English Learners' Dictionary; Oxford University Press, 2012.
8 http://www.cambridgeenglish.org/in/
9 https://www.rong-chang.com/
10 https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year II Semester

20MAT110 LINEAR ALGEBRA

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101**

Course Description:

Linear algebra has widespread applications in engineering and science. In this course, various methods of solving system of linear equations, as applicable in the information technology and electrical circuits are highlighted. The concept of reduction of number of variables in systems has been introduced and effect of change of basis from the view point of computer graphics has been explained. Finally, basics involved in search engine operations by orthogonalisation and least squares optimization have been explained.

Course Objectives:

1. Understanding basic concepts of linear algebra (systems of linear equations, matrix calculus, vectors and basic vector operations).
2. Learn about vector spaces and subspaces.
3. To become proficient in solving computational problems of linear algebra.
4. To understand the axiomatic structure of modern mathematics and learn to construct simple proof.
5. To gain basic knowledge of search engine operations and optimization path.

UNIT I LINEAR EQUATIONS AND MATRICES 9 hours

System of linear equations, Gaussian elimination, Gauss-Jordan method, LU and LDU factorization, block matrices, inverse of matrices, elementary matrices, permutation matrix, Eigen value and Eigen vectors, Cayley -Hamilton Theorem (without proof), applications to cryptography and electrical network.

UNIT II VECTOR SPACE 9 hours

The n-space $R\ n$ and vector space, subspaces, bases, linear combination, span, linear independence, dimensions, finite dimensional, Row and column spaces, Rank and nullity, Bases for subspace, invertibility, application in interpolation.

UNIT III LINEAR TRANSFORMATIONS 9 hours

Basic Properties of Linear transformations, invertible linear transformation, matrices of linear transformations.

UNIT IV VECTOR SPACE OF LINEAR TRANSFORMATIONS 9 hours

Vector space of linear transformations, change of bases, similarity, application to computer graphics.

UNIT V INNER PRODUCT SPACES 9 hours

Dot Products and Inner products, the lengths and angles of vectors, matrix representations of inner products, Gram-Schmidt orthogonalisation, orthogonal projections, relations of fundamental subspaces, orthogonal matrices and isometrics, singular value decomposition (SVD), applications to least square solutions.

Course Outcomes:

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

1. Solve systems of linear equations using Gaussian elimination and matrix inversion.
2. Understand the concepts of vector space and subspace, linear independence and use them in network systems. Apply principles of matrix algebra to linear transformations in solving engineering problems.
3. Use the concepts of similarity of transformations in computer graphics.
4. Demonstrate understanding of inner products, associated norms and interlink to search operations on network.

Text Books:

1. Jin Ho Kwak and Sungpyo Hong, “Linear Algebra”, Second edition, Birkhaüser, 2004.

Reference Books:

1. Stephen Andrilli and David Hecher, Elementary Linear Algebra, 3rd Edition, Academic Press (2006)
2. Charles W. Curtis, Linear Algebra, Springer (2004).
3. Howard Anton and Robert C Busby, Contemporary linear algebra, John Wiley (2003).
4. Gilbert Strang, Introduction to Linear Algebra.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year II Semester

20CHE101 ENGINEERING CHEMISTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

Deals with the basic principles of various branches of chemistry like physical, organic, inorganic, analytical and nanomaterial chemistry.

Course Objectives:

Students will

1. Understand, analyse and determine the impurities present in the water.
2. Appreciate the synthetic organic reactions used in daily life
3. Learn the principles of spectroscopies to analyse them.
4. Value the basic concepts of thermodynamics and electrochemistry.
5. Be exposed to the importance of nano and engineering materials used in their daily life and industry

UNIT I IMPURITIES PRESENT IN WATER AND WATER TREATMENT **9 hours**

Impurities present in Water: Impurities in water (BIS and WHO standards), Hardness of water-determination of hardness - EDTA Method (numerical problems), Alkalinity of water (numerical problems), Estimation of Dissolved Oxygen by Winkler's method and its importance and Chlorides. Disadvantages (industry level) of using hard water (Boiler corrosion, Caustic embrittlement, Scale and Sludges). Softening of water (Ion exchange method), Treatment of brackish water by Reverse Osmosis method. Water treatment for civic applications: coagulation, sedimentation, filtration, sterilization - chlorination and ozonation. Concept of break point chlorination.

UNIT II PERIODIC PROPERTIES AND ORGANIC REACTIONS **7 hours**

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, oxidation states, molecular geometries. Organic Reactions: Introduction to substitution (SN^1 and SN^2), elimination (E_1 and E_2) - Addition, Condensation and Free Radical Polymerization Reaction (only the mechanism).

UNIT III SPECTROSCOPY **8 hours**

Basic Principle and Applications of UV-Visible, FT-IR, Raman, Microwave and Nuclear Magnetic Resonance (NMR) Spectroscopy

UNIT IV THERMODYNAMICS AND ELECTROCHEMISTRY **11 hours**

Thermodynamics: Systems, State Functions, Thermodynamic Functions: Work, Energy, Entropy and Free energy. Estimations of Entropy in Isothermal, Isobaric and Isochoric processes. Electrochemistry: Free energy and EMF. Cell potentials, the Nernst equation and applications. Batteries (Lead-Acid and Lithium ion) and Fuel-Cells (H_2-O_2).

UNIT V ENGINEERING MATERIALS, NANOSCIENCE & NANOTECHNOLOGY **10 hours**

Engineering Materials: Cement Materials and Manufacturing Process. Reactions in setting and hardening of Cement. Lubricants – definition, Properties of lubricants – Viscosity, Viscosity Index, Flash Point and Pour Point. Nanomaterials: Introduction, Classes/Types, Chemical synthesis of Nanomaterials: Chemical Vapor Deposition method (Carbon Nanotubes), Characterization by powder XRD (Scherrer's equation). Applications of Nanomaterials: Solar Energy and Photocatalytic Dye Degradation (TiO_2).

Course Outcomes:

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

1. Analyse and determine the impurities in water such as hardness, alkalinity for sustainable development.
2. Prepare organic compounds/polymers for environmental, safety and society need.
3. Comprehend the principles and applications of spectroscopies.
4. Apply the concept of free energy in thermodynamics, electrochemistry for solving the problems evolve in the engineering processes.
5. Acquire spotlight to the nanomaterials and basic engineering materials used in academics, industry, and daily life.

Text Books:

1. P. W. Atkins & Julio de Paula, 'The Elements of Physical Chemistry', Ninth edition (Oxford University Press, Oxford 2010)
2. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
3. C. N. Banwell, Fundamentals of Molecular Spectroscopy, Fourth Edition, (Tata McGraw Hill, 2008).
4. Dr. S. S. Dara and Dr. S. S. Umare, A Textbook of Engineering Chemistry,1 st Edition., (S. Chand & Company Ltd, 2000).
5. T. Pradeep, Nano: The Essentials, 1 st Edition, (Tata McGraw-Hill Publishing Company Limited, 2017).

Reference Books

1. 'Physical Chemistry', D. W. Ball, First Edition, India Edition (Thomson, 2007).
2. Perry's Chemical Engineers' Handbook, Don W. Green and Marylee Z. Southard, 9th Edition (McGraw Hill, 2018).
3. Engineering Chemistry, Dr. Suba Ramesh and others, 1st Edition (Wiley India, 2011).
4. Jain and Jain, Engineering Chemistry,16th Edition (Dhanpat Rai Publishing Company (P) Ltd, 2016).
5. Amretashis Sengupta, Chandan Kumar Sarkar (eds.), Introduction to Nano Basics to Nanoscience and Nanotechnology (Springer-Verlag, Berlin, Heidelberg, 2015)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year II Semester

20CSE102 C PROGRAMMING AND DATA STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite: 20CSE101

Course Description:

This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:

1. To make the student understand fundamentals of C programming language and problem solving.
2. To understand the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stack, queue, and linked list.

UNIT I INTRODUCTION TO C PROGRAMMING 9 hours

Structure of C Program, C Tokens: Variables, Data types, Constants, Identifiers, key words and Operators, Expressions.

Control Structures: Conditional Statements (Simple if, if-else, Nested -if-else, Switch). Iterative Statements (for, While, Do-While), Jump Statements (break, Continue).

UNIT II FUNCTIONS & ARRAY 9 hours

Functions Introduction, User defined function, Function prototype, Function Definition and Function Call, Storage classes, Recursion **Arrays**: Defining an array, processing an array, one dimensional arrays, two dimensional arrays. Passing array as an argument to function. **Sorting:** Bubble Sort, Insertion Sort, selection sort. **Searching:** Linear and binary search.

UNIT III STRINGS & POINTERS 9 hours

Strings: Declaring and defining a string, Initialization of strings, Strings Library functions.

Pointers: Fundamentals of pointer, Pointer Declarations, Parameter passing: Pass by value, Pass by reference, Dynamic memory allocation.

UNIT IV STRUCTURES & FILES 9 hours

Structures: Defining a structure, processing a structure, Pointer to Structure, Unions.

Files: Opening and closing a data file, Reading and Writing a data file, File I/O Functions.

UNIT V DATA STRUCTURES 12 hours

Stack: stack operations, stack implementations using arrays.

Queue: queue operations, queue implementations using array, Applications of stack and queue.

Linked List: Single linked list operations.

Course Outcomes:

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

1. Understand fundamentals of C programming language and its constructs.
2. Design and implement applications using functions, arrays, sorting and searching techniques.
3. Design and implement applications using strings and pointers.
4. Design and implement applications using structures and File processing.
5. Choose appropriate linear data structure depending on the problem to be solved.

Text Books:

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition, Prentice Hall, India 1988.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

Reference Books:

1. Let us C, Yashavant Kanetkar, 15th Edition, BPB Publications, 2016.
2. Problem Solving & Program Design in C, Hanly, Jeri R and Elliot. B Koffman, Pearson Education, 5th edition, 2007.
3. K. N. King ,"C Programming ": A Modern Approach, 2nd Edition 2nd Edition.
4. Byron Gottfried , Jitender Chhabra , Programming with C (Schaum's Outlines Series)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

B. Tech I Year II Semester

20ME101 ENGINEERING GRAPHICS

L	T	P	C
2	0	2	3

Pre-requisite: None

Course Description:
Introduction to AutoCAD commands, simple drawings, orthographic projections, projection of points, lines, planes; auxiliary projections; projections and sections of solids; development and intersection of surfaces; isometric projections.

Course Objectives:
1. Engineering Graphics is the primary medium for development and communicating design concepts.
2. Through this course the students are trained in Engineering Graphics concepts with the use of AutoCAD.
3. The latest ISI code of practice is followed while preparing the drawings using AutoCAD.
4. Computerized drawing is an upcoming technology and provides accurate and easily modifiable graphics entities.
5. Storage and Retrieval of Drawings is also very easy and it takes very less time to prepare the drawings. Also enhances the creativity.

UNIT I INTRODUCTION TO AUTO CAD 12 hours

Introduction to AutoCAD commands, simple drawings using AutoCAD, Introduction to orthographic Projections – Theory, techniques, first angle projections and third angle projections.

UNIT II PROJECTIONS OF POINTS & LINES 12 hours

Projections of points: Positions, notation system and projections. Projections of lines: Positions, terms used, different cases, traces of lines and finding true length.

UNIT III PROJECTIONS OF PLANES & SOLIDS 12 hours

Projections of planes: Positions, terms used, different cases and projections procedure.
Projections of Solids: Projections of Regular Solids inclined to one plane (resting only on HP).

UNIT IV SECTIONS AND DEVELOPMENTS OF SOLIDS 12 hours

Section of solids: Sectional view of right regular solids (Prism and cylinder), true shapes of the sections.
Development of Surfaces: Development of surfaces of right regular solids (Prism, Cylinder and their Sectional Parts).

UNIT V INTERSECTIONS & ISOMETRIC PROJECTIONS 12 hours

Intersections of surfaces of solids: Intersection between prism Vs prism, prism Vs cylinder, cylinder Vs cylinder.
Isometric Projections: Theory of isometric drawing and orthographic views, Conversion of isometric view into orthographic views.

Course Outcomes:

Student will be able to

1. Identify various commands in AutoCAD software and apply AutoCAD skills to develop the new designs.
2. Draw the projections of points, straight lines using AutoCAD.
3. Draw the projections of the planes, solids using AutoCAD
4. Sketch the developments of solids, sections of solids using AutoCAD.
5. Draw the conversion of the isometric views to orthographic views and intersections of surfaces using AutoCAD.

Text Books:

1. D.M. Kulkarni, A.P. Rastogi and A.M. Sarkar., Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi 2009.

2 N D Bhat, Engineering Drawing, Charotar Publishing House, Gujarath,15th Edition, 2010.

3 K.L. Narayana, P. Kanniah, Engineering Drawing, Scitech Publishers, 2nd Edition, 2010.

Reference Books:

1. Dhananjay A Jolhe, Engineering Drawing: with an introduction to AutoCAD, Tata McGraw Hill, 2008.

2 Warren J. Luzadder & Jon M. Duff Fundamentals of Engineering Drawing, 11th edition, Prentice Hall of India, New Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year II Semester

20CHE201 CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

It deals with basic principles of volumetric and instrumental analytical methods.

Course Objectives:

This Engineering Chemistry Laboratory is common to all branches of I Year B Tech. At the end of the course the student is expected to Students will

1. Learn to estimate the chemical impurities present in water such as hardness, alkalinity, chlorine, etc.
2. Understand and experience the formation of inorganic complex and analytical technique for trace metal determination.
3. Be trained to use the instruments to practically understand the concepts of electrochemistry.
4. Bridge theoretical concepts and their practical engineering applications, thus
5. highlighting the role of chemistry in engineering.

LIST OF EXPERIMENTS

1. Estimation of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of dissolved oxygen by Winkler's method.
4. Determination of molecular weight of a polymer by using Ostwald's viscometer.
5. Determination of rate constant of an ester hydrolysis (Pseudo First Order reaction).
6. Determination of strength of a Strong acid (conc. H_2SO_4) by conductometric titration (Neutralisation Titration).
7. Conductometric titration of $BaCl_2$ Vs Na_2SO_4 (Precipitation Titration).
8. Dissociation constant of weak electrolyte by Conductometry.
9. Determination of percentage of Iron in Cement sample by colorimetry.
10. Estimation of ferrous ion by Potentiometric titration (Redox Titration).
11. Saponification value of oil.
12. Formation of Iron-1,10-phenanthroline complex and determination of iron by colorimetry.

Course Outcomes:

After the completion of the Engineering Chemistry Laboratory experiments, students will be able to

1. Develop and perform analytical chemistry techniques to address the water related problems (for e.g., hardness, alkalinity present in water) technically.
2. Handle electro-analytical instruments like digital conductivity meter and potentiometer to perform neutralization, precipitation, and redox titrations, respectively.
3. Acquire practical skills to handle spectro-photochemical methods to verify Beer Lambert's Law.
4. Operate various instruments for the analysis of materials and produce accurate results in a given time frame.
5. Think innovatively and improve the creative skills that are essential for solving engineering problems.

Textbook:

1. Engineering Chemistry Lab Manual (2017-18), Dept. of Chemistry, Madanapalle Institute of Technology and Science, Madanapalle – 517325, Chittoor Dist., Andhra Pradesh, India.
2. "Vogel's Textbook of Qualitative Chemical Analysis", Arthur Israel Vogel, Prentice Hall, 2000.
3. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house, 2009.

4. A Textbook on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications, 2015.
5. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited, 2009.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech I Year II Semester

20CSE201 C PROGRAMMING AND DATA STRUCTURES LABORATORY

L	T	P	C
0	0	3	1.5

Prerequisite: 20CSE101

Course Description:

This course includes C program basics, control structures, arrays, files, pointers and data structures.

Course Objectives:

1. To make the student understand fundamentals of C programming language and problem solving.
2. To get hands-on practices with the syntax and semantics of C programming language.
3. To develop algorithms for sorting, searching techniques.
4. To design and implement operations on stacks, queues, and linked lists.

LIST OF EXPERIMENTS

1. a) Write a C program to swap the two numbers.
b) Write a C Program to find the eligibility of admission for a Professional course based on the following criteria:

i. Marks in Maths >=65
ii. Marks in Physics >=55
iii. Marks in Chemistry>=50
OR
iv. Total in all three subject >=180

2. a) Write a C program to compute the factorial of a given number.
b) Write a program that reads numbers which are in the range 0 to 100, till it encounters -1. Print the sum of all the integers that you have read before you encountered -1.

3. a) Write a C program to accept a coordinate point in a XY coordinate system and determine in which quadrant the coordinate point lies.
b) The digital root (also called repeated digital sum) of a number is a single digit value obtained by an iterative process of summing digits. Digital sum of 65536 is 7, because 6+5+5+3+6=25 and 2+5 = 7.Write a program that takes an integer as input and prints its digital root.

4. a) Write a C program to find the series of prime numbers in the given range.
b) Write a C program to generate Tribonacci numbers in the given range.

5. a) Write a C program to find sum of digits, Decimal to Binary conversion, reversal of numbers using functions.
b) Write a C program to find Factorial, Greatest Common Divisor, and Fibonacci using recursion.

6. Your program should take as input: dimension of a square matrix N, two matrices of size N x N with integer values, and one operator symbol (+, - ,*). It must perform the corresponding operation given below;
a) Matrix Addition b) Matrix Subtraction c) Matrix Multiplication

7. Implement the following sorting techniques.
a) Bubble sort b) Insertion sort c) Selection sort.

8. Implement the following searching techniques.
a) Linear Search b) Binary Search

9. a) Write a program in C to find the frequency of characters in a string.
b) Write a C program to implement all string operations (string length, string copy, string compare, string concatenation and string reverse) without using string library functions.

10. a) Write a C program to get *N* elements in an array and sort it using Pointer.
b) Write a C program to swap two integers using pass by reference.
c) Write a C program to find the largest element using Dynamic Memory Allocation.

11. a) Write a program in C to count the number of vowels, consonants, digits, special symbols, words in a string using a pointer.
b) Write a C program to print all permutations of a given string using pointers.
12. a) Write a C program to add two distances in the inch-feet system using structures.
b) Write a C program to calculate difference between Two Time Periods (in *Hours*, *Minutes*, *Seconds* format) using structures.
13. Develop an application to match parenthesis of a given expression using Stack.
14. Develop an application to identify Palindrome string using Stack and Queue.
15. Develop an application to add two Polynomial equations using Linked List.

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Understand fundamentals of C programming language and its constructs.
2. Design applications using functions, arrays, sorting and searching techniques.
3. Design and implement solutions using strings and pointers.
4. Design and develop solutions using structures and File processing.
5. Design and develop applications on stack, queue, and linked list depending on the problems to be solved.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year II Semester

20CSE202 ENGINEERING AND IT WORKSHOP

L	T	P	C
0	0	3	1.5

Prerequisite: None

Course Description:

This course will provide students with a hands-on experience on various basic engineering practices CSE and presenting the final product design.

Course Objectives:

1. Introduction to the use of Tools and Machinery in foundry, forging, tinsmith, carpentry, welding, fitting, working, fabrication of plastic components, fabrication of polymer composite materials, simple machine turning and wood turning, basic electrical connections.
2. Introduction of basic electrical engineering.
3. Fabrication of final product design at end of the semester.

LIST OF EXPERIMENTS

1. Carpentry (Cross half lap Joint and Miter Joint)
2. Fitting (Square and 'V' fit)
3. Sheet Metal - Tin smithy (Square tray)
4. Foundry (Solid and Split pattern)
5. Welding (Arc and Gas welding) – SingleV Butt Joint, T-fillet Joint
6. Plastic fabrication (Pen Stand)
7. Metrology (Internal and External dimension)
8. Introduction of Power Tools and CNC (Demo Only)
9. Introduction to 3D Printing (Demo Only)

Course Outcomes:

On successful completion of this course, the student will be able to

1. Fabricate carpentry components with suitable joint and pipe connections including plumbing works.
2. Practice the welding equipment to join the structures
3. Effective the basic machining operations
4. Create the models using sheet metal and plastic works.
5. Illustrate the operations of foundry, fitting and smithy
6. Fabrication product in composite material and product in plastic material
7. Conduct experiment basic electrical wire connection
8. Design and fabrication of final product design

Suggested Text/Reference Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – 1" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998. (v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

IT WORKSHOP

Prerequisite: None

Course Description:

This course helps the students to understand the basic components of a computer, installation of operating systems, working on office productivity tools word-processor, spreadsheet and presentation slides. Also it gives a basic understanding of using Google tools and various email settings in Gmail.

Course Objectives:

1. The course focuses on enhancing student knowledge in computer peripherals and assembling.
2. To install operating system on computers and create new email account.
3. To understand basic software utilities like compression tools, PDF readers and web browser.
4. To provide technical training to the students on software tools like online forms, calendar applications, online drive, online translation tools and image processing applications.
5. To make the students to install software like Integrated Development Environments (IDE),and compliers for different programming languages.

LIST OF EXPERIMENTS

1. Components of Computer & Assembling a Computer: Learning about the different parts of the computer and its advancement
   - Processor
   - Memory – Types
   - Motherboard
   - Peripheral interfaces – I/O devices
   - Learn about the proper connectivity among the devices inside the PC
   - Assembling the different parts of the computer inside the cabinet
2. Install Operating System
   - Partition the disk drive based on the capacity and the OS to be installed.
   - Install ReactOS/Windows
   - Install Ubuntu or any other GNU/Linux
   - Install VirtualBox or VMWare or QEMU
3. Basic PC Troubleshooting
   - Awareness on the possible issues in a computer
   - Troubleshooting the problems using the available tools
   - Removal and repair of existing software
   - Identification of suitable Device driver for Hardware Devices.
4. Learning Basic Software:
   - Installation of simple Productivity tools like file and folder compression utilities and PDF readers.
   - Installation of Image Editor and Web browsers.
   - Basic Software installation in GNU Linux based system.
   - Connect the Printer and Scanner Devices perform printing and scanning operation.
5. Office Productivity Tools:
   - Generate, manipulate, search, aligning content using word processing applications.
   - Creation of spreadsheet with various column and rows applying various formulas on cells.
   - Create Presentation and Visualization – graphs, charts, 2D, 3D.
   - Create a database template using Libreoffice Base, OpenOffice Base or MS Access.
   - Draw flowchart using the Drawing tools – Google Quick draw, sketch up,
6. Introduction to Google Tools
   - Design a Google form and collect a response date among students using Google Form.

- Schedule One day of your activities using Google Calendar.
- Store and Retrieve Date from cloud storage using Google Drive.
- Translate the English language sentence to Telugu sentence using Google Translate
- Organizing photo and editing photo using Google Photos.

7. Exploring Email

- Creation, Composing and Sending the E-mail.
- Use High Priority setting to categories the mail.
- Create a Folder in different Categories and move the received mail to Folder.
- Unsubscribing unwanted emails
- Enable settings for automatic reply

Add_on content:

- Networking Commands: ping, ssh, ifconfig, scp, ipconfig, traceroute, nslookup, getmac

Technical Stack: GNU Linux, Windows/ReactOS-Compression Utilities, PDF reader, Office Package.

Course Outcomes:

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

1. Attain complete knowledge of a computer hardware
2. Install Operating Systems and troubleshooting using Utility software.
3. Able to do document task through office productivity software.
4. Attain technically strong usage of Google Tools and Email handling.
5. Able to install basic computer engineering software.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

COMPUTER SCIENCE & ENGINEERING
(ARTIFICIAL INTELLIGENCE)
B. Tech II Year I Semester

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year I Semester

20MAT111 PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE

L	T	P	C
3	0	0	3

Pre-requisite **20MAT101**

Course Description:

This course provides an introduction to probability, distributions and statistics with applications. Topics include: Conditional probability, Random variables, Probability distributions, Joint densities, Bayesian inference, descriptive statistics, Correlation and Regression, Estimation, Confidence intervals, Hypothesis testing.

Course Objectives:

1. To extend and formalize knowledge of the theory of probability and random variables.
2. To solve real time problems in engineering and science by using discrete and continuous distributions
3. To analyze and interpret basic summary and modeling techniques for Multi-variate data
4. To analyze the data by using descriptive statistics for decision making
5. To apply the statistical inference involving confidence interval and hypothesis testing in data analysis.

UNIT I PROBABILITY 9 hours

Introduction to Probability, Sample space and events, axioms of probability, theorems on probability, conditional probability, multiplication theorem and independence of events, Baye's theorem.

Random variables (discrete and continuous), probability density functions, distribution function, mathematical expectation, properties. moment generating function.

UNIT II PROBABILITY DISTRIBUTIONS 9 hours

Discrete probability distributions - Binomial, Poisson, Geometric and their properties Continuous probability distributions - Uniform, Exponential, Gamma, Normal distributions and their properties, Chebychev's inequality.

UNIT III JOINT DISTRIBUTIONS 9 hours

Joint densities and Independence - Marginal distributions (discrete & continuous)- Expectation and Covariance, Correlation, Conditional densities and Regression, Curves of regression, Transformation of random variables.

UNIT IV STATISTICS FOR DATA ANALYSIS 9 hours

Data Visualization, Moments, skewness, kurtosis, correlation, correlation coefficient, rank correlation, principle of least squares, lines of regression, regression coefficients and their properties.

UNIT V STATISTICAL INFERENCE 9 hours

Population, sampling, formulation of null hypothesis, alternative hypothesis, level of significance, types of errors and power of the test. Large Sample Tests: Test for single mean, single proportion, difference of means, difference of proportions, Confidence interval for parameters in one sample and two sample problems, t test for single mean, difference of means, test for ratio of variances.

Course Outcomes:

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

1. Understand the probability concepts and their importance in engineering.
2. Apply discrete and continuous probability distributions to solve various engineering problems.
3. Get an idea about joint density functions, distribution functions to the random variables and analyse the multivariate problems in engineering
4. Apply the method of least squares to estimate the parameters of a regression model.
5. Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases.

Text BookS:

1 Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

2 Dr.B.S.Grewal, " Higher Engineering Mathematics", Khanna Publications, 42nd Edition.

Reference Books:

1 Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

2 Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2012

3 Dean G. Duffy., "Advanced Engineering Mathematics with MATLAB", CRC Press, Third Edition 2013.

E BOOKS

1 http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf

2 https://www.khanacademy.org

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year I Semester

20CAI103 COMPUTER SYSTEM ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course deals with basics of digital logic design and computer organization. It provides knowledge to design digital circuits for computer components with high performance. Computer arithmetic, Pipelining and Parallel processing are studied in this course. It also emphasises on CPU, Memory and I/O organization.

Course Objectives:

1. To provide knowledge for designing digital circuits.
2. To understand various data representation methods and arithmetic operations.
3. To learn about Processor, Memory and I/O organization.
4. To learn the basics of pipelined execution and parallel processing

UNIT I DIGITAL LOGIC CIRCUITS AND COMPONENTS 9 hours

Logic Gates – Boolean Algebra – Simplification of Boolean Expression using K – Map, Combinational Circuit - Binary Codes - Error Detection Codes. Encoders – Decoders – Multiplexers & Demultiplexers – Sequential Circuit - Flip Flops – Registers – Shift Registers.

UNIT II DATA REPRESENTATION AND COMPUTER ARITHMETIC 9 hours

Data Representation: Fixed Point, Floating point Representations –. **Computer Arithmetic**: Addition, Subtraction, Multiplication & Division Algorithms - Floating point Arithmetic Operations.

UNIT III CPU AND CONTROL UNIT 9 hours

Processor Structure and Function: - Processor Organization - Register Organization – Instruction Cycle – CISC – RISC Processors – x86 and ARM Addressing Modes – x86 and ARM Instruction Formats. **Control Unit Operation**:– Hardwired Control – Microprogrammed Control – Basic Concepts.

UNIT IV PIPELINE AND PARALLEL PROCESSING 9 hours

Instruction Pipelining: Pipelining Strategy – Pipeline performance – Pipeline Hazards – Dealing with branches – **Parallel processing**: Multi-Processor Organizations – Symmetric Multiprocessors – Multithreading and Chip Multiprocessors – Clusters.

UNIT V MEMORY AND I/O ORGANIZATIONS 9 hours

Memory Hierarchy: Main memory – ROM - RAM– Cache memory: Computer Memory System Overview – Cache memory principles – Elements of Cache design – **Data Transfer Schemes**: - Programmed I/O – Interrupt Driven I/O – Direct Memory Access – Redundant Array of Independent Disks.

Course Outcomes:

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

1. Design digital circuits for computer components.
2. Implement fixed-point and floating point arithmetic unit.
3. Understand the basics structure of computers, operations and instructions.
4. Understand pipelined execution and parallel processing architectures.
5. Analyze the various memory systems and I/O communication.

Text Books:

1. William Stallings, "Computer Organization and Architecture Designing for Performance", Tenth Edition, Pearson Publications.
2. M.Morris Mano, "Computer System Architecture", Third edition, Pearson Publications.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill Publications.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year I Semester

20CAI104 DATA STRUCTURES USING PYTHON

L	T	P	C
3	0	0	3

Pre-requisite 20CSE102

Course Description:

The typical data structures course, which introduces a collection of fundamental data structures. The basic concepts related to abstract data types, data structures, and algorithms. Arrays, Sets and Maps, Searching and Sorting, Linked Structures, Stacks, Queues, Advanced Linked Lists, Recursion, Hash Tables, Advanced Sorting, Binary Trees, Search Trees.

Course Objectives:

1. To develop skills to design and analyze linear and nonlinear data structures.
2. Develop algorithms for manipulating linked lists, stacks, queues, trees and graphs.
3. Develop recursive algorithms as they apply to trees and graphs.
4. To develop skill in advanced linked list.
5. To develop skill in advanced sorting.

UNIT I ABSTRACT DATA TYPES, ARRAYS, SETS AND MAPS 9 hours

Abstract Data Types: Introduction, The Date Abstract Data Type, Bags, Iterators. **Arrays:** The Array Structure, The Python List, Two-Dimensional Arrays, The Matrix Abstract Data Type. **Sets and Maps:** Sets, Maps, Multi-Dimensional Arrays.

UNIT II ALGORITHM ANALYSIS, SEARCHING AND SORTING 9 hours

Algorithm Analysis: Complexity Analysis, Evaluating the Python List, Amortized Cost, Evaluating the Set ADT. **Searching and Sorting:** Searching, Sorting, Working with Sorted Lists, The Set ADT Revisited.

UNIT III LINKED STRUCTURES, QUEUES 9 hours

Linked Structures: The Singly Linked List, The Bag ADT Revisited, The Sparse Matrix Revisited. **Stacks:** The Stack ADT, Implementing the Stack, Stack Applications. **Queues:** The Queue ADT, Implementing the Queue, Priority Queues.

UNIT IV ADVANCED LINKED LISTS, RECURSION, HASH TABLES 9 hours

Advanced Linked Lists: The Doubly Linked List, The Circular Linked List, Multi-Linked Lists, Complex Iterators. **Recursion:** Recursive Functions, Properties of Recursion, How Recursion Works, Recursive Applications. **Hash Tables:** Hashing, Separate Chaining, Hash Functions, The HashMap Abstract Data Type.

UNIT V ADVANCED SORTING, BINARY TREES, SEARCH TREES 9 hours

Advanced Sorting: Merge Sort**,** Quick Sort, Radix Sort, Sorting Linked Lists. **Binary Trees:** The Tree Structure, The Binary Tree, Expression Trees, Heaps, Heapsort. **Search Trees:** The Binary Search Tree, Search Tree Iterators, AVL Trees, The 2-3 Tree.

Course Outcomes:

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

1. Describes the Abstract Data Types, Arrays, Sets and Maps
2. Explains the Algorithm Analysis, Searching and Sorting
3. Understand the Linked Structures, Stacks, and Queues
4. Examine the Advanced Linked Lists, Recursion, and Hash Tables
5. Construct of Advanced Sorting, Binary Trees, and Search Trees

Text Books:

1. Data Structures and Algorithms Using Python, Rance D. Necaise

Reference Books:

1. Fundamentals of Data Structures, Ellis Horowitz, SartajSahni, Dinesh Mehta, Silicon Press, Second Edition. 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20CAI105 OBJECT ORIENTED PROGRAMMING – JAVA

L	T	P	C
2	1	0	3

Pre-requisite 20CSE102

Course Description:

This course is designed to provide basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java- classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:

1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes.
3. To introduce the implementation of packages and interfaces.
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

UNIT I INTRODUCTION TO OOPS CONCEPTS AND CLASSES 9 hours

Introduction to Object Oriented Programming, Java buzzwords, Java Programming Basics, Sample programs, Data types and operators, Control statements. **Classes:** Classes, Objects, Methods, Constructors, this and static keywords, Method and Constructor Overloading, Access modifiers, Polymorphism **Arrays**: One Dimensional and multi-dimensional arrays.

UNIT II STRINGS, INHERITANCE, INTERFACES, AND PACKAGES 9 hours

Strings: Strings, String Handling **Inheritance:** Basics, Usage of Super, Multi-level hierarchy, Method overriding, Abstract class and Final keyword. **Packages:** Defining, Finding and Importing packages, Member Access. **Interfaces:** Creating, Implementing, Using, Extending, and Nesting of interfaces.

UNIT III EXCEPTION HANDLING &MULTI-THREADING 9 hours

Exception Handling: Fundamentals, Types, Multiple catch clauses, Nested try blocks, Thrown Class, Using Finally and Throws, Built-in exceptions, User-defined exceptions.

Multi-threading: Thread Class, Runnable interface, creating multiple threads, life cycle of thread, thread properties, synchronization, thread communication, suspending, resuming and stopping threads.

UNIT IV I/O STREAMS AND COLLECTION FRAME WORK CLASSES 9 hours

I/O Streams: Byte Stream Classes and Character Stream Classes. **Collection Frame work :** Hierarchy of collection framework, Array List, Linked List, Vector, Stack, Queue, Priority Queue, Hash Set, Linked Hash Set, Tree Set.

UNIT V SWINGS **9 hours**

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, Event Handling- Handling mouse and keyboard events, Exploring Swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.

Course Outcomes:

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

1. Choose object-oriented programming concepts for problem solving.
2. Create and use packages and interfaces.
3. Develop multithreaded applications with synchronization.
4. Provide computed based solutions by using java collection framework and I/O classes
5. Design GUI based applications

Text Books:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.

2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.

3. "Thinking in Java", Bruce Eckel, Pearson Education.

4. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

5. A Programmers Guide to Java SCJP", Third Edition, Mughal, Rasmussen, Pearson.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20CAI106 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course is aimed to provide basic understanding of different intelligent agents in terms of Artificial Intelligence. This Course covers introduction to artificial intelligence, solving problems by various algorithms, Knowledge and Reasoning, Uncertain Knowledge and Reasoning.

Course Objectives:

1. To provide a broad understanding of the basic techniques for building intelligent computer systems and an understanding of how AI is applied to problems.
2. To Gain knowledge in problem formulation and building intelligent agents.
3. To understand the search technique procedures applied to real world problems.
4. To learn the types of logic and knowledge representation schemes.
5. To understand the applications of Al: namely Game Playing, Theorem Proving and Expert systems.

UNIT I FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE 9 hours

Introduction, A.I. Representation, Non-AI &AI Techniques, Representation of Knowledge, Knowledge Base Systems, State Space Search, Production Systems, Problem Characteristics, types of production systems, Intelligent Agents and Environments, concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.

UNIT II UNINFORMED SEARCH STRATEGIES 9 hours

Formulation of real world problems, Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search, Comparison of Uninformed search Strategies, Searching with partial information, Sensor-less problems, Contingency problems.

UNIT III INFORMED SEARCH STRATEGIES 9 hours

Generate & test, Hill Climbing, Best First Search, A* and AO* Algorithm, Constraint satisfaction, Game playing: Minimax Search, Alpha-Beta Cutoffs, Waiting for Quiescence.

UNIT IV KNOWLEDGE REPRESENTATION 9 hours

Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining.

UNIT V PLANNING AND UNCERTAINTY 9 hours

Planning: Planning problem, Planning with State Space Search, Partial Order Planning, Hierarchical Planning, Conditional Planning. Non Monotonic Reasoning, Logics for Non Monotonic Reasoning, Justification based Truth Maintenance Systems, Semantic Nets, Statistical Reasoning, Fuzzy logic: fuzzy set definition and types, membership function, designing a fuzzy set for a given application. Probability and Bayes' theorem, Bayesian Networks.

Course Outcomes:

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

1. Formulate a problem and build intelligent agents.
2. Apply appropriate searching techniques to solve a real world problem.
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
4. Analyze the problem and infer new knowledge using suitable knowledge representation schemes.
5. Formulate and solve given problem using Propositional and first order logic.
6. Apply reasoning for non-monotonic AI problems.

Text Books:

1. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

Reference Books:

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: An Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
4. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.
6. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 1999.
7. George F. Luger, Artificial Intelligence, Pearson Education, 2001.
8. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

B. Tech II Year I Semester

20CAI203 DATA STRUCTURES USING PYTHON LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20CSE201

Course Description:

The typical data structures course, which introduces a collection of fundamental data structures. The basic concepts related to abstract data types, data structures, and algorithms. Arrays, Sets and Maps, Searching and Sorting, Linked Structures, Stacks, Queues, Advanced Linked Lists, Recursion, Hash Tables, Advanced Sorting, Binary Trees, Search Trees.

Course Objectives:

1. To develop skills to design and analyze linear and nonlinear data structures.
2. To develop algorithms for manipulating linked lists, stacks, queues, trees and graphs.
3. To develop recursive algorithms as they apply to trees and graphs.
4. To develop skill in advanced linked list.
5. To develop skill in advanced sorting.

List of Programs:

1. Write a Python program that uses functions to perform the following:
   a) Create a singly linked list of integers.
   b) Delete a given integer from the above linked list.
   c) Display the contents of the above list after deletion.

2. Write a Python program that uses functions to perform the following:
   a) Create a doubly linked list of integers.
   b) Delete a given integer from the above doubly linked list.
   c) Display the contents of the above list after deletion.

3. Write a Python program that uses stack operations to convert a given infix expression into its postfix Equivalent, Implement the stack using an array.

4. Write Python programs to implement a double ended queue ADT using i) array and ii) doubly linked list respectively.

5. Write a Python program that uses functions to perform the following:
   a) Create a binary search tree of characters.
   b) Traverse the above Binary search tree recursively in Postorder.

6. Write a Python program that uses functions to perform the following:
   a) Create a binary search tree of integers.
   b) Traverse the above Binary search tree non recursively in inorder.

7. Write Python programs for implementing the following sorting methods to arrange alist of integers in ascending order:
   a) Insertion sort b) Merge sort

8. Write Python programs for implementing the following sorting methods to arrange alist of integers in ascending order:
   a) Quick sort b) Selection sort

9. i) Write a Python program to perform the following operation:
   A) Insertion into a B-tree
   ii) Write a Python program for implementing Heap sort algorithm for sorting a given list of integers in ascending order.
10. Write a Python program to implement all the functions of a dictionary (ADT) using hashing.

11. Write a Python program for implementing Knuth-Morris- Pratt pattern matching algorithm.

12. Write Python programs for implementing the following graph traversal algorithms:
    a)Depth first traversal b)Breadth first traversal

Course Outcomes:

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

1. Describes the Abstract Data Types, Arrays, Sets and Maps
2. Explains the Algorithm Analysis, Searching and Sorting
3. Understand the Linked Structures, Stacks, and Queues
4. Examine the Advanced Linked Lists, Recursion, and Hash Tables
5. Construct of Advanced Sorting, Binary Trees, and Search Trees

Text Books:

1. Data Structures and Algorithms Using Python, Rance D. Necaise

Reference Books

1. Fundamentals of Data Structures, Ellis Horowitz, SartajSahni, Dinesh Mehta, Silicon Press, Second Edition. 2007.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year I Semester

20CAI204 OBJECT ORIENTED PROGRAMMING - JAVA LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20CSE201

Course Description:

Basics of Object-Oriented Programming - objects, classes, polymorphism, inheritance, static and dynamic binding. Object Oriented Programming using Java-classes, interfaces, inheritance, polymorphism, method dispatch, features for encapsulation and modularity.

Course Objectives:

1. Understand object-oriented programming concepts, and apply them in solving problems.
2. Learn the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
3. To Introduce the implementation of packages and interfaces
4. Learn the concepts of exception handling and multithreading.
5. Learn the design of Graphical User Interface using applets and swing controls.

List of Programs:

1. .a) Write a Java program that prints all real solutions to the quadratic equation ax2 + bx + c =0. Read in a, b, c and use the quadratic formula. If the discriminant b2-4ac is negative, display a message stating that there are no real solutions.
   b) Write a Java program that find prime numbers between 1 to n.
   c) Write a Java Program that find the factorial of a number.
2. a) The Fibonacci sequence is defined by the following rule: The fist two values in the sequence are 1 and 1. Every subsequent value is the sum of the two values preceding it. Write a Java program that print the nth value in the Fibonacci sequence.
   b) Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a Palindrome.
   c) Write a Java program for sorting a given list of names in ascending order.
3. a) Write a java program to split a given text file into n parts. Name each part as the name of the original file followed by .part<n> where n is the sequence number of the part file
   b) Write a java program to convert an ArrayList to an Array.
   c) Write a Java program to make frequency count of vowels, consonants, special symbols, digits, words in a given text..
4. a) Write a Java program that reads a file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
   b) Write a Java program that reads a file and displays the file on the screen, with a line number before each line.
   c) Implement Stack using queues.
5. a) Write a java program to make rolling a pair of dice 10,000 times and counts the number of times doubles of are rolled for each different pair of doubles. Hint: Math.random()
   b) Write java program that inputs 5 numbers, each between 10 and 100 inclusive. As each number is read display it only if it‘s not a duplicate of any number already read display the complete set of unique values input after the user enters each new value.
   c) Write a java program to read the time intervals (HH:MM) and to compare system time if the system time between your time intervals print correct time and exit else try again to repute the same thing. By using StringToknizer class.

6. a) Write java program to create a super class called Figure that receives the dimensions of two dimensional objects. It also defines a method called area that computes the area of an object. The program derives two subclasses from Figure. The first is Rectangle and second is Triangle. Each of the sub class overridden area() so that it returns the area of a rectangle and a triangle respectively.
   b) Write a Java program that creates three threads. First thread displays ―Good Morning‖ every one second, the second thread displays ―Hello‖ every two seconds and the third thread displays ―Welcome‖ every three seconds

7. a) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
   b) Use inheritance to create an exception super class called EexceptionA and exception sub class ExceptionB and ExceptionC, where ExceptionB inherits from ExceptionA and ExceptionC inherits from ExceptionB. Write a java program to demonstrate that the catch block for type ExceptionA catches exception of type ExceptionB and ExceptionC
8. Write a Java Program to design login window using AWT components.
9. Develop an application for simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.
10. Design & Develop an application that creates a user interface to perform integer divisions. The user enters two numbers in the JtextFields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an ArithmeticException Display the exception in a message dialog box.
11. Design a GUI application that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be on at a time No light is on when the program starts.
12. Design a GUI application for Cafeteria bill generation.
    Project Based Learning : Design and Develop a mini project using OOPS concepts

Course Outcomes:

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

1. Solve real world problems using OOP techniques.
2. Implement string handling and file handling methods.
3. Design multithreaded applications with synchronization.
4. Develop web applications using AWT components.
5. Create GUI based applications

Text Books:

1. Java The Complete Reference, Herbert Schildt, MC GRAW HILL Education, 9th Edition, 2016.

Reference Books:

1. "Java Fundamentals - A Comprehensive Introduction", Herbert Schildt and Dale Skrien, Special Indian Edition, McGrawHill, 2013.
2. "Java – How to Program", Paul Deitel, Harvey Deitel, PHI.
3. "Thinking in Java", Bruce Eckel, Pearson Education.
4. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech II Year I Semester

20CAI205 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20CSE101**

Course Description:

The course aims at equipping students to be able to use python programming for solving Artificial Intelligence problems.

Course Objectives:

1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

List of Programs:

1. Study of Numpy and Pandas basic programs.
2. Write a program to implement Breadth First Search using Python.
3. Write a program to implement Depth First Search using Python.
4. Write a program to implement Tic-Tac-Toe game using Python.
5. Write a program to implement 8-Puzzle problem using Python.
6. Write a program to implement Water-Jug problem using Python.
7. Write a program to implement Travelling Salesman Problem using Python.
8. Write a program to implement Tower of Hanoi using Python.
9. Write a program to implement Monkey Banana Problem using Python.
10. Write a program to implement Missionaries-Cannibals Problems using Python.
11. Write a program to implement 8-Queens Problem using Python.

Course Outcomes:

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

1. Formulate a problem and build intelligent agents.
2. Apply appropriate searching techniques to solve a real world problem.
3. Evaluation of different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.

Text Books:

1. Kevin Knight, Elaine Rich, B. Nair, Artificial Intelligence, McGraw Hill, 2008.
2. Stuart Russell and Peter Norvig. Artificial Intelligence – A Modern Approach, Pearson

Reference Books:

1. George F. Luger, "AI-Structures and Strategies for Complex Problem Solving", 4/e, 2002, Pearson Education.
2. Robert J. Schalkolf, Artificial Intelligence: An Engineering approach, McGraw Hill, 1990.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson.
4. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.

5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert System, PHI.

6. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill, 1999.

7. George F. Luger, Artificial Intelligence, Pearson Education, 2001.

8. Nils J. Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kauffman, 2002.David E Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Pearson Education, 2013.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course

20CHE901 ENVIRONMENTAL SCIENCE

L	T	P	C
2	0	0	0

Pre-requisite Basic knowledge about sciences up to intermediate or equivalent level.

Course Description:
The course deals with basic concepts of environment, its impact on human, universe, consumption of energy sources, effects, controlling methods for pollution and the environmental ethics to be followed by human beings.

Course Objectives:
1. To make the students aware about the environment and its inter-disciplinary nature and to emphasize the importance of the renewable energy sources.
2. To familiarize the concept of Ecosystem and their importance.
3. To bring the awareness among students about the importance of biodiversity and the need for its conservation.
4. To make the students understand the adverse effects of environmental pollution, its causes and measures to control it.
5. To introduce the environmental ethics and emphasize the urgency of rain water harvesting along with water shed management.

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES — 6 hours

Definition, Scope and Importance – Need for Public Awareness. Renewable energy Resources: Solar energy - solar cells, wind energy, tidal energy. Non-renewable energy resources: LPG, water gas, producer gas. Overgrazing, effects of modern agriculture – fertilizer and pesticides.

UNIT II ECOSYSTEMS — 6 hours

Concept of an ecosystem. Structure – functions – Producers, Consumers and Decomposers – Ecological succession – Food chains, Food webs and Ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystems: Forest, Desert and Lake.

UNIT III BIODIVERSITY AND ITS CONSERVATION — 6 hours

Introduction, Definition: Value of biodiversity: consumptive use, productive use, social, ethical and aesthetic values. Biogeographical zones of India. Threats to biodiversity: habitat loss, poaching of wildlife, Endangered and Endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT IV ENVIRONMENTAL POLLUTION — 6 hours

Definition, Cause, effects and control measures of pollution – Air, Water, Soil and Noise. Solid Waste Management: Effects and control measures of urban and industrial wastes.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT 6 hours

Urban problems related to Water conservation, rain water harvesting and watershed management; Climate changes: global warming, acid rain, ozone layer depletion, nuclear accidents. Case Studies: Population growth, variation among nations and population explosion.

Course Outcomes:

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

1. Ability to understand the natural environment, its relationship with human activities and need of the day to realize the importance of the renewable energy sources.
2. The knowledge of various ecosystems and their importance along with the concepts of food chains, food webs and ecological pyramids.
3. Familiarity with biodiversity, its importance and the measures for the conservation of biodiversity.
4. The knowledge about the causes, effects and controlling methods for environmental pollution, along with disaster management and solid waste management.
5. Awareness about the sustainable development, environmental ethics, social issues arising due to the environmental disorders.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission, Universities Press, 2005.
2. Environmental Studies by R. J. Ranjith Daniels and Jagdish Krishnaswamy, (Wiley Re- print version 2014).
3. Chemistry for Environmental Engineering/C.N. Sawyer, P.L. McCarty, G.F. Parkin (TataMcGraw Hill, Fifth Edition, 2003).
4. Environmental Chemistry by B.K. Sharma, (Goel Publishing House, 2014).
5. Environmental Studies by Benny Joseph (TataMcGraw Hill, Second Edition, 2009).

Reference Books:

1. Environmental Science & Engineering by Dr. A. Ravikrishnan, Hitech Publishing Company Pvt. Ltd. 2013.
2 Perspectives in Environmental Studies, Second edition, Anubha Koushik and C.P. Koushik, New Age International (P) Limited, Publishers, 2004.
3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

COMPUTER SCIENCE & ENGINEERING
(ARTIFICIAL INTELLIGENCE)
B. Tech II Year II Semester

B. Tech II Year II Semester

20HUM101 ECONOMICS AND FINANCIAL ACCOUNTING FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The Engineering Economics and Financial Accounting aims to provide an insight into production, cost analysis, market structure, Accounting Basic concepts and financial Statement Analysis. The course is designed to give emphasis on the application of real life examples on various fundamental issues of economics and accounts. This course introduces the accounting system, principles, types of accounts, and financial statements etc. The ratio analysis and financial analysis are useful to know the positions of financial statements are explained to know the analysis of financial matters.

Course Objectives:

1. Describe the nature of engineering economics in dealing with the issues of scarcity;

2. Know the supply, demand, production and cost analysis to analyze the impact of economic events on markets;

3. Explain the performance of firms under different market structures and Price determination in various market conditions.

4. Explain the accounting principles, types of accounting and preparation of final accounts; and

5. Describe the financial statement analysis and investment evaluation through ratios and capital budgeting techniques.

UNIT I DEMAND ANALYSIS 9 hours

Scope and Significance of Economics- Understanding the problem of scarcity and choice - Elements of market Economy: Demand, Supply and Market Equilibrium- Theory of Demand, Elasticity of Demand, Supply and Law of Supply.

UNIT II PRODUCTION AND COST ANALYSIS 9 hours

Production Function – Short-run and long- run production – Cost Analysis: Cost concepts - Cost Structure of Firms and output decision- Break-Even Analysis (BEA) – Managerial significance and limitations of BEA - Determination of Break Even Point (Simple Problems).

UNIT III MARKET STRUCTURE AND PRICING 9 hours

Classification of Markets - General Equilibrium and efficiency of Perfect competition, Monopoly, Monopolistic, Oligopoly, Duopoly – Price determination under various market conditions- Pricing objectives- Methods.

UNIT IV BASICS OF ACCOUNTING 9 hours

Uses of Accounting - Book Keeping Vs Accounting - Double Entry System - Accounting Principles - Classification Of Accounts - Rules Of Debit & Credit- Accounting Cycle: Journal, Ledger, Trial Balance. Final Accounts: Trading Account - Profit & Loss Account - Balance Sheet with Adjustments, (Simple Problems).

UNIT V FINANCIAL RATIO ANALYSIS AND CAPITAL BUDGETING 9 hours

Ratio Analysis - Liquidity, Leverage, Solvency, Activity and Profitability Ratios - Capital Budgeting. (Simple Problems).

Course Outcomes:

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

1. Understand Engineering economics basic concepts,

2. Analyze the concepts of demand, elasticity, supply, Production, Cost Analysis and its essence in floating of an organization,

3. Compare different market structures and identify suitable market,

4. Demonstrate an understanding and analyzing the accounting statements, and

5. Exhibit the ability to apply knowledge of ratio analysis and capital budgeting techniques in financial statement analysis and investment evaluation respectively.

Text Books:

1. Case E. Karl & Ray C. Fair, "Principles of Economics", Pearson Education, 8th Edition, 2007

2. Financial Accounting, S. N. Maheshwari, Sultan Chand, 2009

3 Financial Statement Analysis, Khan and Jain, PHI, 2009

4 Financial Management, Prasanna Chandra, T.M.H, 2009

Reference Books:

1. Lipsey, R. G. & K. A. Chrystal , "Economics", Oxford University Press, 11th Edition, 2007

2 Samuelson P. A. & Nordhaus W. D. "Economics", Tata McGraw-Hill 18th Edition, 2007

3 Financial Management and Policy, Van Horne, James, C., Pearson, 2009.

4. Financial Management, I. M. Pandey, Vikas Publications

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20MAT112 DISCRETE MATHEMATICAL STRUCTURES

L	T	P	C
3	0	0	3

Pre-requisite 20MAT110

Course Description:

This course introduces the concepts of discrete mathematics and their applications in computer science. It covers algebraic structures, combinatory and finite state machines. It also provides insight into the concepts of graph theory and their applications.

Course Objectives:

1. To introduce the concepts of logic, rules of inference and predicates.
2. To discuss the concepts on combinatory.
3. To explain the concepts of algebraic structures.
4. To familiarize the principles of Lattices and Boolean algebra.
5. To illustrate the problems in graph theory.

UNIT I MATHEMATICAL LOGIC AND STATEMENT CALCULUS 9 hours

Introduction -Statements and Notation - Connectives – Tautologies – Two State Devices and Statement logic - Equivalence - Implications - The Theory of Inference for the Statement Calculus –- The Predicate Calculus - Inference Theory of the Predicate Calculus.

UNIT II COMBINATORY 9 hours

The Basics of Counting- The Pigeonhole Principle -Permutations and Combinations - Binomial Coefficients -Generalized Permutations and Combinations –Generating Permutations and Combinations.

UNIT III ALGEBRAIC STRUCTURES 9 hours

Semigroups and Monoids - Grammars and Languages –Types of Grammars and Languages – Groups – Subgroups – Lagrange's Theorem –Homomorphism: Introduction –Properties - Group Codes.

UNIT IV LATTICES AND BOOLEAN ALGEBRA 9 hours

Relations - Partially Ordered Relations - Hasse Diagram - Poset - Lattices - Boolean algebra - Boolean Functions - Representation and Minimization of Boolean Functions - Karnaugh map representation.

UNIT V GRAPH THEORY 9 hours

Basic Concepts of Graph Theory - Isomorphic graph - Matrix Representation of Graphs – Trees - Kruskal's and Dijkstra's algorithms - Storage Representation and Manipulation of Graphs - Introduction to Finite State Machines.

Course Outcomes:

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

1. Evaluate elementary mathematical arguments and identify fallacious reasoning (not just fallacious conclusions) for develop syntax of programming languages.
2. Apply the concepts inclusion/exclusion principle and the pigeonhole methodology in data structure and algorithm.
3. Learn elementary proofs and properties of modular arithmetical results; and explain their applications such as in coding theory and cryptography.
4. Apply proof techniques towards solving problems in Boolean algebra and computer circuit designing.
5. Apply graph theory models and finite state machines concepts to solve critical networking issues, shortest path problems, scheduling, etc.

Text Book(s)

1. J.P. Trembley and R.Manohar, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill – 13th reprint, 2012.
2. Kenneth H. Rosen, Discrete Mathematics and its applications, 6th Edition, Tata McGraw Hill, (2011)

Reference Books

1. Richard Johnsonbaugh, "Discrete Mathematics", 6th Edition, Pearson Education, 2011.
2. S. Lipschutz and M. Lipson, "Discrete Mathematics", Tata McGraw Hill, 3rd Edition, 2010.
3. B.Kolman, R.C.Busby and S.C.Ross, "Discrete Mathematical structures", 6th Ed, PHI, 2010.
4. C.L.Liu, "Elements of Discrete Mathematics", Tata McGraw Hill, 3rd Edition, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20CAI107 OPERATING SYSTEMS FUNDAMENTALS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To give introduction to shell programming.
3. To learn the mechanisms involved in memory management in contemporary OS
4. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
5. To know the components and management aspects of concurrency management

UNIT I INTRODUCTION 9 hours

Concept of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Case study on UNIX and WINDOWS Operating System. KORN SHELL PROGRAMMING: Basic Script Concepts, Expressions, Decisions: Making Selections, Repetition, Special Parameters and Variables, Changing Positional Parameters, Argument Validation, Debugging Scripts.

UNIT II PROCESS CONCEPTS 9 hours

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling.

UNIT III PROCESS SYNCHRONIZATION AND DEADLOCKS 9 hours

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT IV MEMORY MANAGEMENT STRATEGIES 9 hours

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT V FILE SYSTEM 9 hours

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Course Outcomes:

At the completion of the course the students will be able to:

1. Write shell scripts using korn shell.
2. Create processes & threads and implement the various process scheduling techniques.
3. Analyse the concurrent processing and deadlock situations.
4. Design algorithmic solutions to solve memory management problems.
5. Implement the different types of file management techniques.

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Reference Books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley.
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India,
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20CAI108 AI TOOLS, TECHNIQUES AND APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite **20CAI106**

Course Description:

To understand the importance of AI and its applications, Machine learning for regression, clustering and classification. Text and Image processing preliminaries.

Course Objectives:

1. Expose fundamental concepts in AI
2. Understand the strengths, weaknesses, and use cases of different clustering methods.
3. Explore supervised learning algorithms and its performance.
4. Introducing grammar and text processing.
5. Apply image processing for classification tasks

UNIT I FUNDAMENTALS OF AI 9 hours

What is AI? Historical background, Turing test, Definition of AI, Applications of AI, Knowledge representation and reasoning - Hypothesis testing, Null and alternate hypothesis, ANalysis Of VAriance (ANOVA) - Linear Regression – univariate and multivariate, Ridge regression - Machine Learning – What is Machine Learning? Supervised and Unsupervised Learning

UNIT II UNSUPERVISED LEARNING 9 hours

Unsupervised Learning – K-means clustering, K-means++, K-medoids, Fuzzy K-means, X-means, Competitive Learning, Self-Organizing Map (SOM), Outlier and Anomaly Detection, Semi-supervised Learning - Reinforcement Learning

UNIT III SUPERVISED LEARNING 9 hours

Supervised Learning – Single Layer Perceptron (SLP), Nearest Neighbor Classifier, k-Nearest Neighbor Classifier, Parzen window, Kernel method - Evaluation of Classifier Performance – Confusion matrix, FP, FN, F-score, ROC, Log loss, Cross entropy - Multi-Layer Perceptron (MLP) and Back-Propagation Training - Decision Tree, Random Forest, Support Vector Machine (SVM), Logistic Regression

UNIT IV NATURAL LANGUAGE PROCESSING 9 hours

What is Natural Language Processing (NLP), The challenges of NLP, Language and Grammar, Chomsky hierarchy, CFG for NLP with examples, Parse tree, ambiguit. - Text preprocessing - Stemming and Lemmatization, Term Frequency (TF), Inverse Document Frequency (IDF), tf-idf as term-feature of a document

UNIT V IMAGE PROCESSING 9 hours

Image processing - Noise Removal, Image Enhancement - Segmentation Object Classification and detection – Filters and Transforms for feature extraction, Convolution Neural Network (CNN), Introduction to Deep Neural Network (DNN) and its use for object detection

Course Outcomes:

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

1. To understand the basic concepts and applications of Artificial Intelligence
2. To learn various clustering algorithms and analyze their performances
3. To explore various classification algorithms and evaluate their performances
4. Understand the importance of grammar and text processing techniques
5. To apply image processing techniques for classification and detection

Text Books:

1. Tom Markiewicz & Josh Zheng, "Getting started with Artificial Intelligence," Published by O'Reilly Media,2017
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach."
3. J.E.Hopcroft, R.Motwani and J.D Ullman, ―Introduction to Automata Theory, Languages and Computations, Third Edition, Pearson Education, 2016.
4. Richard Szeliski, "Computer Vision: Algorithms and Applications," Springer 2010

Reference Books:

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. A classical approach to Artificial Intelligence, Munesh Chandra Trivedi, Khanna Publications
3. Artificial Intelligence and Machine Learning, Chandra S.S. & H.S. Anand, PHI Publications
4. Micheal Sipser, ―Introduction of the Theory and Computation, Thomson Brokecole, 3 rd Edition, 2013.
5. Machine Learning, Rajiv Chopra, Khanna Publishing House

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20CAI109 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
2	1	0	3

Pre-requisite **20CAI104**

Course Description:

This course emphasis on analysis of various types of algorithms. It provides idea to design the algorithm to solve the problems using divide and conquer, greedy method, dynamic programming, backtracking, branch and bound, approximation.

Course Objectives:

1. To introduce the concepts of Algorithm Analysis, Time Complexity, Space Complexity.
2. To discuss various Algorithm Design Strategies with proper illustrative examples.
3. To introduce Complexity Theory with NP and Approximation.

UNIT I INTRODUCTION & DIVIDE AND CONQUER 9 hours

Introduction: What is an algorithm?, Algorithm specification, Space Complexity, Time Complexity, Orders of Growth, Worst-Case, Best-Case, and Average-Case Efficiencies, Asymptotic notations.

Divide and Conquer: Master's Method, Substitution Method, Recursion Tree Method, Binary Search, Finding the maximum and minimum, Merge sort, Quick Sort, Strassen's matrix multiplication.

UNIT II GREEDY METHOD & DYNAMIC PROGRAMMING 9 hours

Greedy Method: General method, Fractional Knapsack problem, Huffman Code, Job Scheduling with Deadlines, Optimal merge pattern.

Dynamic Programming: General method, String Editing, Longest Common Subsequence, Matrix Chain Multiplication, 0/1 Knapsack problems, The traveling sales person problem.

UNIT III GRAPH ALGORITHMS 9 hours

BFT, DFT, Connected components, Biconnected Components, Spanning Trees, Minimum cost Spanning Trees, Kruskal's and Prim's algorithm, Topological sort, Shortest Path Algorithms: Dijkstra's Single Source Shortest Path Algorithm, Floyd-Warshall's All Pairs Shortest Path Algorithm.

UNIT IV BACK TRACKING & BRANCH AND BOUND 9 hours

Backtracking: General method, N-Queens Problem, Sum of subset problem, Graph Coloring Problem.

Branch and Bound: General method: FIFO, LIFO and LC, Travelling salesperson problem, 0/1 Knapsack problem.

UNIT V NP PROBLEMS &APPROXIMATION ALGORITHMS 9 hours

NP Problems: Complexity Class - P, NP, NP Complete, NP Hard. Reducibility, Cook's Theorem.

Approximation Algorithms: Introduction, Absolute Approximation, ϵ - Approximation, Polynomial time Approximation.

Course Outcomes:

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

1. Analyze the performance of different algorithms.
2. Identify optimal solution for different problems using greedy method and dynamic programming.
3. Implement various graph based algorithms.
4. Make use of backtracking and branch & Bound methods to solve real world problems.
5. Understand the complexity of NP problems and Approximation algorithms.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2008
2. Jon Kleinberg and Eva Tardos "Algorithm Design", Pearson Education, 2007

Reference Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012
2. Micheal T. Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis and Internet examples", Second Edition, Wiley Publication, 2006
3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, 2006

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20CAI206 OPERATING SYSTEMS FUNDAMENTALS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite NIL

Course Description:

This course will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems.

Course Objectives:

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management.

List of Programs:

1. To Study basic concepts in OS with the help of Linux commands.
2. a) Write a shell script that accepts two integers as its arguments and computers the value of first number raised to the power of the second number.
   b) Write a shell script that takes a command –line argument and reports on whether it is directory, a file, or something else.
3. a) Write a shell script that accepts one or more file name as arguments and converts all of them to uppercase, provided they exist in the current directory.
   b) Write a shell script that computes the gross salary of a employee according to the following rules:

   i)If basic salary is < 1500 then HRA =10% of the basic and DA =90% of the basic.

   ii)If basic salary is >=1500 then HRA =Rs500 and DA=98% of the basic

   The basic salary is entered interactively through the key board.
4. a) Write a shell script that displays a list of all the files in the current directory to which the user has read, write and execute permissions.
   b) Develop an interactive script that ask for a word and a file name and then tells how many times that word occurred in the file.
5. Simulate the following CPU scheduling algorithms
   a) Round Robin b) SJF c) FCFS d) Priority
6. Program on process creation and Execution
   a. To display Environment variables.
   b. To implement Different types of exec functions.
7. a)Write a program to create a chain of Processes.
   b) Demonstration of Zombie and Orphan process.
8. Write a program for Producer Consumer Problem.

9. Write a program to create pipes.

10. Write a Program to find whether a file is having read, write, execute permissions and also check whether a given name is file or directory.

11. Simulate MVT and MFT.

12. Simulate all page replacement algorithms

13. Simulate all file allocation strategies
    a) Sequential b) Indexed c) Linked

Course Outcomes:

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

1. Understand the use of Linux commands
2. Compare the performance of processor scheduling algorithms
3. Design algorithmic solutions for process synchronization problems
4. Analyze the performance of various file management schemes
5. Implement different page replacement algorithms.

Text Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India

References:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

B. Tech II Year II Semester

20CAI207 AI TOOLS, TECHNIQUES AND APPLICATIONS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite 20CAI205

Course Description:

Experiments and Data, Inference from Data, Data distribution, Clustering, Labeled data and Classification, Unsupervised learning, Supervised learning, Models for Classification and training them, Model evaluation, Text data analysis, Preprocessing of text data, Document Classification, Digital Image processing, Segmentation, Feature extraction, Object detection.

Course Objectives:

1. To understand labelled and unlabeled data
2. To understand data distribution, Clustering and Classification
3. To be able to evaluate performance of trained classifier models,
4. To learn methods for text pre-processing and analysis
5. To learn Image classification and object recognition

List of Programs:

1. Data of profit (dependent variable) and population (independent variable) of a city is available. Find correlation between independent and dependent variables. Implement simple linear regression to predict profits for a certain population.
2. Implement the simple logistic regression for the given dataset.
3. Implement the unsupervised learning algorithm using K-means clustering.
4. Implement ANOVA test and check the hypothesis for given data.
5. Write a python program to implement coding of first neuron and edge detection.
6. Write a python program to create a single layered neural network with two inputs.
7. Write a python program to create a multilayered layered neural network with two inputs.
8. Write a python program to create a single layered perceptron and multilayered layered perceptron with bias.
9. Write a python program to create a convolutional neural network on MNIST hand written digits datasets
10. Train a deep learning network model (VGG-16) for classifying images of two classes, dog and cat.

Course Outcomes:

Upon successful completion of the course, students will be able to fulfill course objectives.

1. will be able to differentiate between labeled and unlabeled data.
2. Gain knowledge about clustering techniques for grouping similar data points and classification methods for assigning labels.
3. Understand how to assess the performance of clustering and classification models and interpret evaluation results effectively.
4. Importance of text preprocessing and analysis.
5. Develop the ability to recognize objects in images and understand the applications of image classification in various domains

Text Books:

1. Tom Markiewicz& Josh Zheng,Getting started with Artificial Intelligence,Published by O'Reilly Media,2017
2. Programming collective Intelligence: Building Smart Web 2.0 Applications-Toby Segaran
3. Building Machine Learning systems with Python, WilliRichart Luis Pedro Coelho
4. Python Machine Learning by Example, Liu, Yuxi(Hayden),Packt Publishers
5. Stuart J. Russell and Peter Norvig,Artificial Intelligence A Modern Approach

Reference Books:

1. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts,Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. Machine Learning with Python, AbhishekVijayvargia, BPB publications
3. Python Machine Learning, Sebastian Raschka, packt publishers

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech II Year II Semester

20CAI208 DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite **20CAI203**

Course Description:

This course is aimed to provide hands on experience to analyse the time complexity of sorting, graph based, greedy, dynamic programming and backtracking algorithms.

Course Objectives:

1. To learn how to analyse a problem & design the solution for the problem.
2. To Strengthen the ability to identify and apply the suitable algorithm for the given real world problem.
3. To develop the optimal solution, i.e., time complexity & space complexity must be very low.

List of Programs:

1. Sort a given set of elements using the Quick sort method and determine the time required to sort the elements.
2. Implement Merge Sort algorithm to sort a given set of elements and determine the time required to sort the elements.
3. Implement Fractional Knapsack problem using Greedy Method
4. Implement Job Scheduling with Deadlines using Greedy Method
5. Implement 0/1 Knapsack problem using Dynamic Programming
6. Implement Traveling Salesperson problem to find the optimal tour using Dynamic Programming
7. Find Minimum Cost Spanning Tree of a given undirected graph using
   (a) Prim's algorithm.
   (b) Kruskal's algorithm
8. Implement the algorithm for Topological ordering of vertices in a DAG.
9. From a given vertex in a weighted connected graph, find shortest paths to all other vertices using Dijkstra's algorithm
10. Implement All-Pairs Shortest Paths Problem using Floyd-Warshall's algorithm
11. Find a subset of a given set $S = \{S_1, S_2, ...S_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example, if S= {2, 3, 5, 7, 8} and d = 10 there are three solutions {2,3,5}, {3,7}. and {2,8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
12. Implement N Queen's problem using Back Tracking

Course Outcomes:

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

1. Analyse the performance of different algorithms.
2. Apply various problem solving approaches
3. Identify optimal solution for different problems using greedy method and dynamic programming.
4. Implement various graph based algorithms.
5. Make use of backtracking method to solve real world problems.

Text Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Second Edition, Universities Press, 2008
2. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Third Edition, Pearson Education, 2012.

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.
3. Web reference: http://nptel.ac.in/

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course

20HUM901 INDIAN CONSTITUTION

L	T	P	C
2	0	0	0

Pre-requisite NIL

Course Description:

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state.

Course Objectives:

The course is intended to:

1. To know about Indian constitution;
2. To know about central and state government functionalities in India; and
3. To know about Indian society.

UNIT I INTRODUCTION **6 hours**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6 hours**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6 hours**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6 hours**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments –Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V INDIAN SOCIETY **6 hours**

Society: Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

Course Outcomes:

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

1. Understand the functions of the Indian government; and

2. Understand and abide the rules of the Indian constitution.

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi..
2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
3 Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
4 K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

Reference Books:

1. **S**harma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2 U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3 R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

COMPUTER SCIENCE & ENGINEERING

(Artificial Intelligence)

B. Tech III Year I Semester

B. Tech III Year I Semester

20CAI110 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The main emphasis of this course is to understand the basic concepts of Computer Networks, Introducing the layered approach for design of computer networks, introduce to computer communication, TCP/IP layers functionalities, and operations of network protocols in the TCP/IP suite, and elucidating the design issues for a computer network.

Course Objectives:

1. To study the evolution of computer networks, foundational principles, architectures, and techniques employed in computer networks.
2. To study the concepts of communication networks from layered perspective
3. To provide students with a theoretical and practical base in computer networks issues
4. Student will be able purse his study in advanced networking courses
5. To Prepare students for easy transfer from academia into future directions of research.

UNIT I INTRODUCTION 9 hours

NETWORK FUNDAMENTALS:

Introduction, Advantages and Applications, Network Types, Topologies, Internet History, Standards and Administration. Protocols and Standards Network Models: Protocol Layering, The ISO Model, Layers in the OSI Model, TCP/IP Protocol Suite, Cross-layering, Addressing.

THE PHYSICAL LAYER

Data and Signals, Transmission impairment, Data rate limits, Performance. Transmission media: Introduction, Guided Media, Unguided Media. switching: Structure of Circuit Switched Networks, Packet switched networks.

UNIT II THE DATA LINK LAYER 9 hours

Introduction, Link layer addressing. Error detection and Correction: Cyclic codes, Checksum, Forward error correction. Data link control: DLC Services, Data link layer protocols, Frames, Flow & Error Control, Protocols, HDLC, Point to Point Protocol. Media Access control: Random Access, Controlled Access, Channelization, and connecting devices.

UNIT III THE NETWORK LAYER 9 hours

Network layer design issues, Routing algorithms, (Optimal, Shortest path, Distance Vector routing, Link State routing, Hierarchical routing, Routing in adhoc networks), Congestion control algorithms, Quality of service, Internetworking, The network layer in the Internet: IP Classes, IPV4 and IPV6, IP Addressing, NAT, IP support protocols, OSPF, BGP, RIP, IGMP.

UNIT IV THE TRANSPORT LAYER 9 hours

The Transport Service, Elements of Transport Protocols, Flow control, Congestion Control, The internet transport protocols: UDP, TCP, SCTP. Performance problems in computer networks, Network performance measurement. Performance Issues.

UNIT V THE APPLICATION LAYER 9 hours

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP. DNS, TELNET, e-mail, File Transfer, WWW and HTTP, SNMP, Streaming Audio & Video, Content delivery.Case study- Computer Networks in health care.

Course Outcomes:

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

1. Understand and choose the transmission media and topologies depending on the requirements.
2. Apply error detection and error correction wherever required.
3. Analyze the concepts of routing, and congestion control
4. Evaluate the computer network logically, by enumerating the layers of the TCP/IP.
5. Create and make use of application-level protocols for file communication, and file transfer.

Text Book(s)

1. "Data communications and networking", Behrouz A. Forouzan, Mc Graw Hill Education,5th edition, 2012.
2. "Computer Networks", Andrew S. Tanenbaum, Wetherall, Pearson,6th edition, 2021.

Reference Books

1. "Internetworking with TCP/IP – Principles, protocols, and architecture", Volume 1, Douglas E. Comer, 5th edition, PHI
2. Peterson, Larry L., and Bruce S. Davie. Computer networks: a systems approach. Elsevier, 2007.
3. "Data communications & networking with TCP/IP protocol suite", Behrouz A. Forouzan, Mc Graw Hill Education, 2021.
4. Droms, R. (2001). Computer networks and internets: with internet applications. Prentice Hall.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year I Semester

20CAI111 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course is designed to provide a basic understanding of database systems and their design. The course material is further used for developing any web-based applications in which the database is back end. The course covers all basic and advanced queries of SQL, PL/SQL programs, Relational algebra and calculus, normal forms, low-level details such as representing data elements of the database and indexed structures, transaction management, and data recovery.

Course Objectives:

1. To understand the concept of DBMS and ER Modelling.
2. To comprehend the structure of SQL Queries and commands to manage data from the databases
3. To learn PL/SQL concepts that help in seamless processing of SQL
4. To explain the normalization, Query optimization, and relational algebra
5. To apply Transaction processing, concurrency control, recovery, security, and indexing for the real-time data
6. To gain knowledge on Database Attacks, Recovery, and Recent Trends

UNIT I INTRODUCTION 9 hours

Database Systems Concepts and Architecture: History and motivation for database systems-characteristics of database approach Advantages of using DBMS approach- Architectures for DBMS– Classification of database management systems. **Database Modelling**: Types of Attributes, Entities, Relationships, ER Model. **Introduction to Relational Model**: Introduction, Logical database design, Introduction to views

UNIT II RELATIONAL MODEL 9 hours

Relational Data Model: Concept of relations, schema-instance distinction, keys, referential integrity, foreign keys, relational algebra operators, SQL - Introduction, data definition in SQL, table, key, and foreign key definitions. Querying in SQL, notion of aggregation, Integrity constraints, aggregation functions group by and having clauses.

PL/SQL concepts: Embedded SQL, Dynamic SQL, triggers and active databases, Cursors, Introduction to JDBC, Stored Procedures.

Relational Algebra and Calculus: Preliminaries, Relational algebra- Selection and Projection, Set Operations, Renaming, Joins, Division. Relational Calculus

UNIT III DATABASE DESIGN & SCHEMA REFINEMENT 9 hours

Database Design: Dependencies and Normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FDs.

Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, and 5NF decompositions and desirable properties

UNIT IV TRANSACTION PROCESSING & INDEXING 9 hours

Transaction processing - Concepts of transaction processing, ACID properties, concurrency control, Time-stamp based and lock-based protocols for concurrency control. Serializability of scheduling Index Structures – Indexes on Sequential Files – Secondary Indexes – B-Trees – Hash Tables

UNIT V DATABASE ATTACKS, RECOVERY, AND RECENT TRENDS 9 hours

Database Attacks and Recovery: SQL Injection, Recovery based on deferred update – Recovery techniques based on immediate update - Shadow Paging

Recent Trends: Need of NoSQL, CAP Theorem, different NoSQL data models

Course Outcomes:

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

1. Apply design principles for database design, ER model
2. Demonstrate the basics of query evaluation and heuristic query optimization techniques
3. Access normalization relations of the relational model using normal forms
4. Implement transaction processing techniques in the database.
5. Design database security plan for database

Text Book(s)

1. Database Management Systems, Raghu RamaKrishnan, Johannes Gehrke, 3rd Edition, 2003,McGraw Hill.
2. Database Systems, The Complete Book, Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, 3rd impression, 2009, Pearson.

Reference Books

1. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 6th Edition 2010.
2. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015
3. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management,6th Edition,2012.
4. Pramod J. Sadalage and Marin Fowler, NoSQL Distilled: A brief guide to merging world of Polyglot persistence, Addison Wesley, 2012

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year I Semester

20CAI112 MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

This course aims to gives a basic knowledge on machine learning, classification and clustering techniques. It helps the students to explore supervised, unsupervised and ensembling techniques by using various algorithms. It enlightens the students with the knowledge of need for advanced techniques like transfer learning, federated learning, graph representation learning etc.

Course Objectives:

1. To understand the foundations of machine learning
2. To learn how to assess the performance of machine learning models
3. To study different supervised machine learning models.
4. To explore various Unsupervised learning techniques
5. To familiarize advancements in machine learning concepts with case studies.

UNIT I MACHINE LEARNING PRELIMINARIES 9 hours

Linear Algebra basics, Probability and Statistics basics, Machine learning and traditional AI – Examples of Machine Learning applications – Supervised Learning, Unsupervised Learning, Reinforcement Learning - Input representations, Hypothesis class, Version space, Vapnik-Chervonenkis (VC) Dimension

UNIT II MODEL EVALUATION AND GENERALIZATION 9 hours

Probably Approximately Learning (PAC), Noise, Learning Multiple classes, Model Selection and Generalization, Dimensionality reduction- Subset selection - Accuracy and Precision, Confusion matrix, ROC Curve

Generalization - Bias Variance dilemma, Regularization technique

UNIT III SUPERVISED LEARNING 9 hours

Classification- Cross validation and re-sampling methods- K- fold cross validation, Boot strapping, Regression

Bayes' theorem – a-prior and posterior, Naïve Bayes Classifier, Maximum Likelihood Estimation and Maximum A Posterior

Decision Trees- Entropy, Information Gain, ID3 and CART Algorithm, Issues in Decision Tree learning- Over-fitting and Under-fitting, Reduced Error Pruning

UNIT IV UNSUPERVISED LEARNING 9 hours

Clustering – Cluster numbers and clustering indices,

Clustering Methods - K-means, Expectation-Maximization Algorithm, Hierarchical Clustering Methods, Density based clustering, Cluster Analysis

Association Analysis - Dimensionality reduction techniques

UNIT V ADVANCED TOPICS IN MACHINE LEARNING 9 hours

Ensemble Learning Techniques - Bagging and boosting, ADA BOOST and Gradient Boost Algorithms

Transfer learning, Relational learning, graph representation learning, Federated Learning.

Case study: Machine learning-based financial market prediction, Machine learning based network congestion control and network privacy security

Course Outcomes:

1. To understand the principles and concepts of machine learning
2. To learn various evaluation and generalization strategies to measure the performance of machine learning models
3. To analyze different supervised machine learning models and their limitations
4. To explore various clustering methods and association analysis in Unsupervised learning
5. To learn advanced machine learning topics like federated learning, transfer learning, ensemble learning etc.

Text Book(s)

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Geron Aurelien
2. Machine Learning: A multistrategy approach, Tom M. Mitchell

Reference Books

1. Introduction to Machine Learning in the Cloud with Python, Pramod Gupta • Naresh K. Sehgal, Springer
2. E. Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice-Hall of India, 2010.
3. Simon Haykin, “Neural Networks and Learning Machines”, Pearson, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year I Semester

20CAI209 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite NIL

Course Description:

This course is designed to provide a basic understanding of database systems and their design. The course material is further used for developing any web-based applications in which the Database is back end. The course covers all basic and advanced queries of SQL, PL/SQL programs, low-level details such as representing data elements of Databases.

Course Objectives:

1. To understand the concept of DBMS and ER Modelling.
2. To understand the components of DBMS and to study database design.
3. To comprehend the structure of SQL Queries and commands to manage data from the databases
4. To comprehend the structure of SQL Queries to query, update, and manage a database.
5. To understand all constraints to develop a business application using cursors, triggers, and stored procedures

LIST OF PROGRAMS:

1. Analyze the below problem carefully and come up with the entities in it. Identify what data has to be persisted in the Database. This contains the entities, attributes, etc. Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys, if any. The student is required to submit a document by writing the Entities and keys.). Indicate the type of relationships (total/partial). Try to incorporate generalization, aggregation, specialization, etc. whenever required

A) Draw an ER diagram for Library Management System

B) Draw an ER diagram for Hospital Management System

2. Students should be allowed to choose appropriate DBMS software, install it, configure it and start working on it. Create sample tables, and insert the data into them, and perform the following using DDL and DML commands

a. Insert the data given above in employee, department, and project tables.
b. Retrieve all the employees' information for a particular department number
c. Get Employee name along with his SSN and Supervisor SSN.
d. Retrieve the employee names whose bdate is' 29-MAR-1959.'
e. Get salaries of the employees without duplications.
f. Retrieve the MgrSSN, MgrStartDate of the manager of 'Research' department.
g. Change the department number of an employee having fname as 'Joyce' to 3
h. Alter Table department add column ContactNo of NUMBER data type and insert values into this column only.
i. Change table department by modifying the size of field ContactNo.
j. Modify the field name ContactNo of departments table to MobileNo.
k. Change the name of Table Department to DEPT.

3. Perform following queries
    a. Retrieve all data from employee, jobs, and deposit.
    b. Give details of account no. and deposited rupees of customers having an accountopened between dates 01-01-06 and 25-07-06.

c. Display all jobs with a minimum salary is greater than 4000.
d. Display name and salary of the employee whose department no is 20. Give alias nameto name of the employee.
e. Display employee no, name, and department details of those employees whosedepartment lies in(10,20)

4. To study various options of LIKE predicate
   a. Display all employees whose name starts with 'V' and the third character is 'v.'
   b. Display name, number, and salary of those employees whose name is 5 characterslong and the first three characters are 'Vic.'
   c. Display the non-null values of employees and employee name second charactershould be 'n,' and the string should be 5 characters long.
   d. Display the null values of an employee, and also employee name's third charactershould be 'a'.
   e. What will be output if you are giving LIKE predicate as '%_%' ESCAPE '\'
5. To perform various data manipulation commands, aggregate functions, and sorting conceptson all created tables.
   a. List total deposit from the deposit.
   b. List total loan from karolbagh branch
   c. Give maximum loan from branch vice.
   d. Count the total number of customers
   e. Count total number of customer's cities.
   f. Create table supplier from the employee with all the columns.
   g. Create table sup1 from the employee with the first two columns.
   h. Create table sup2 from the employee with no data
   i. Insert the data into sup2 from an employee whose second character should be 'n' andstring should be 5 characters long in the employee's name field.
   j. Delete all the rows from sup1.
   k. Delete the detail of the supplier whose sup_no is 103.
   l. Rename the table sup2.
   m. Destroy table sup1 with all the data.
   n. Update the value dept_no to 10 where second character of emp. name is 'm'.
   o. Update the value of employee name, whose employee number is 103.
6. To know how the constraints are used to make a table contain valid data.
   Execute the following Queries on the Database to note the violations integrity constraints byany of the following operations
   a. Insert ('Robert', 'F', 'Scott', '987987987 ', '21-JUN-42', '2365 Newcastle Rd, Bellaire,TX', M, 58000, '888665555', 1) into EMPLOYEE.
   b. Insert ('Ramez', 'F', 'Scott', ' ', '21-JUN-42', '2365 Newcastle Rd, Bellaire, TX', M,58000, '888665555', 1) into EMPLOYEE.
   c. Insert ('677678989', null, '40.0') into WORKS_ON.
   d. Insert ('453453453', 'John', M, '12-DEC-60', 'SPOUSE') into DEPENDENT
   e. Insert ('343453453', 'Varun','', '12-DEC-60', 'SON') into DEPENDENT
   f. Delete WORKS_ON tuples with ESSN= '333445555'.
   g. Modify MGRSSN and MGRSTARTDATE of the DEPARTMENT tuple with DNUMBER=5 to '123456789' and '01-OCT-88', respectively.
7. To study Single-row functions.
   a. Write a query to display the current date.

b. For each employee, display the employee number, job, salary, and salary increased by15% and expressed as a whole number. Label the column New Salary
c. Modify your query no 2 to add a column that subtracts the old salary from the newsalary. Label the column Increase
d. Write a query that displays the employee's names with the first letter capitalized and all other letters lowercase, and the length of the names, for all employees whose namestarts with J, A, or M. Give each column an appropriate label. Sort the results by the employees' last names.
e. Write a query that produces the following for each employee: <employee last name>earns <salary> monthly
f. Write a query to calculate the annual compensation of all employees (sal+comm)

8. Displaying Data from Multiple Tables (join)
   a. Give details of customers Vivek
   b. Give the names of the customers who are borrowers and depositors and having living cityMadanapalle
   c. Give city as their city name of customers having the same living branch.
   d. Write a query to display the last name, department number, and department name for allemployees.
   e. Create a unique listing of all jobs that are in department 30. Include the location of thedepartment in the output
   f. Write a query to display the employee name, department number, and department namefor all employees who work in NEW YORK.
   g. Display the employee's last name and employee number along with their manager's lastname and manager number. Label the columns Employee, Emp#, Manager, and Mgr#, respectively.
   h. Create a query to display the name and hire date of any employee hired after employeeSCOTT.
9. To apply the concept of Aggregating Data using Group functions.
   a. List total deposit of customer having account date after 1-Jan-96.
   b. List total deposit of customers living in city Nagpur.
   c. List maximum deposit of customers living in Bombay.
   d. Display the highest, lowest, sum, and average salary of all employees. Label the columns Maximum, Minimum, Sum, and Average, respectively. Round your results to the nearest whole number.
   e. Write a query that displays the difference between the highest and lowest salaries. Label the column DIFFERENCE
   f. Create a query that will display the total number of employees and, of that total, thenumber of employees hired in 1995, 1996, 1997, and 1998
   g. Find the average salaries for each department without displaying the respectivedepartment numbers.
   h. Write a query to display the total salary being paid to each job title within eachdepartment.
   i. Find the average salaries > 2000 for each department without displaying the respectivedepartment numbers.
   j. Display the job and total salary for each job with a total salary exceeding 3000, whichexcludes the present and sorts the list by the total salary.

k. List the branches having the sum of deposit more than 5000 and located in city Bombay.

10. To solve queries using the concept of the subquery.
    a. Write a query to display the last name and hire date of any employee in the samedepartment as SCOTT. Exclude SCOTT
    b. Give the name of customers who are depositors having same branch city of Mr. Arul.
    c. Give deposit details and loan details of the customer in the same city where Pramod isliving.
    d. Create a query to display the employee numbers and last names of all employees whoearn more than the average salary. Sort the results in ascending order of salary.
    e. Give names of depositors having the same living city as Mr. Hari and having depositamount greater than 2000
    f. Display the last name and salary of every employee who reports to ford.
    g. Display the department number, name, and job for every employee in the accountingdepartment.
    h. List the name of the branch having the highest number of depositors.
    i. Give the name of cities wherein the maximum number of branches are located.
    j. Give the name of customers living in the same city where maximum depositors arelocated.

11. . Write a PL/SQL block to change the address of a particular employee by taking theiremployee number interactively.
    b. Write a cursor program to display manager details for each department

12. a. Create a trigger which checks whether an employee with Emp_no is present in theEmployee table before inserting it into EMP.
    b. Write a procedure to insert a record into the ORDER table by validating the qty limit ofthe item and also check whether that item exists

Project-Based Learning:

Design and implementation of Student Information System

Choose a Mini Project and apply the database concepts as given below.

- Draw ER Diagram
- Tables Creation
- Establish the relationship between relevant tables Apply Normalization (if necessary)
- Create GUI
- Establish Connection between front end and back end as Oracle
- Prepare Project Report

Course Outcomes:

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

1. Perform DDL and DML operations on database tables.
2. Design and implement complex queries to access the data using SQL join.
3. Implement stored procedures in PL/SQL.
4. Implement exceptions and triggers to solve real-time problems.
5. Design and develop a real-world application to access and render data.

Text Book(s)

1. A. Silberschatz, H. F. Korth S. Sudershan, Database System Concepts, McGraw Hill, 7th Edition 2021.
2. R. Elmasri S. B. Navathe, Fundamentals of Database Systems, Addison Wesley, 2015.

Reference Books

1. Raghu Ramakrishnan,Database Management Systems,Mcgraw-Hill,4th edition,2015.
2. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation and Management,6th Edition,2012

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year I Semester

20CAI210 MACHINE LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite

Course Description:
This course helps the students to learn various machine learning algorithms. It makes the students to explore the machine learning algorithms using various dataset. It also helps the students to analyse the data and find interesting patterns.

Course Objectives:

1. Make use of Data sets in implementing the machine learning algorithms
2. Implement the machine learning concepts and algorithms in Python
3. To apply various supervised learning methods to different problems
4. To apply various unsupervised learning methods to different problems
5. To evaluate the performance of the machine learning algorithms

List of Programs:

1. Foundational mathematical operations in Machine Learning
2. Exploratory Data Analysis
3. Evaluation measures – Precision, recall, ROC, Confusion Matrix
4. Bayes classification Algorithm
5. ID3 – Decision tree Classifier
6. CART based Pruning Techniques for Decision Tree
7. Kmeans ++ Clustering algorithm
8. Hierarachical Clustering Implementation
9. Density based clustering – Implementation and Cluster Analysis
10. Dimensionality reduction techniques
11. Implementation of Bagging techniques
12. ADA BOOST and Gradient Boost Algorithms
13. ML Based financial market prediction

Course Outcomes:

1. Practice various mathematical relationships within and across machine learning algorithms
2. Design and implement various machine learning algorithms in a range of real-world applications
3. Apply suitable machine learning techniques for data handling
4. Analyze the paradigms of supervised and un-supervised learning
5. Evaluate the performance of algorithms

Text Book(s)

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, Geron Aurelien
2. Machine Learning: A multi strategy approach, Tom M. Mitchell

Reference Books

1. E. Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice-Hall of India, 2010.
2. Simon Haykin, “Neural Networks and Learning Machines”, Pearson, 2008.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Mandatory Course

20CE901 DISASTER MANAGEMENT

L	T	P	C
2	0	0	0

Pre-requisite: None

Course Description:

The goal of this course is to expose the under graduate students regarding different types of disasters and preparedness needed to mitigate their effects. The course matrix will cover various natural, biological, chemical and emerging hazards and risks that may cause property, loss of lives, and livestock's. Thus, the future engineers will understand the social responsibility for the preparedness and mitigation of the damages caused by the disasters.

Course Objectives:

1. To make aware the students about disasters and their impact on living beings.
2. 2. To ensure the students for the understanding on vulnerability, disasters, disaster prevention
3. and risk reduction.
4. To gain a preliminary understanding of approaches for the Disaster Risk Reduction (DRR)
5. To enhance awareness of institutional processes available in the country for the disaster risk mitigation.

UNIT I INTRODUCTION **6 hours**

Introduction, Etymology of disaster, Concepts and definitions: disaster, hazard, vulnerability, risks, Resilience, prevention and mitigation.

UNIT II TYPES OF DISASTERS **6 hours**

Types of Disaster; natural disasters (earthquakes, volcanoes, forest fires and explosions, heat and cold waves, floods, draught, cyclones, tsunami, landslides, soil erosion); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.), hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT III DISASTER IMPACTS **6 hours**

Disaster Impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT IV DISASTER RISK MITIGATION MEASURES **6 hours**

Disaster Risk Reduction (DRR) - Disaster management- four phase approach; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications), DRR programmers in India and the activities of National Disaster Management Authority. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction.

UNIT V IMPACT OF DEVELOPMENTAL ACTIVITIES **6 hours**

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

The students after completing the course will be able to:

1. Explain various disaster concepts
2. Differentiate between categories of disasters
3. Analyze impact of various types of disasters
4. Select disaster risk mitigation measures
5. Identify the impact of development activities

Text Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

Data Books:

1. C P Kothandaraman & S Subramanyan, Heat and Mass Transfer data book, New Age International Publishers, Eight Edition.

Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
6. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mode of Evaluation: Assignments, Mid Term Tests

COMPUTER SCIENCE & ENGINEERING

(Artificial Intelligence)

B. Tech III Year II Semester

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year II Semester

20CAI113 BIG DATA ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite **NIL**

Course Description:

This course introduces the students the concept of big data, characteristics, and its importance. It helps the students to explore Hadoop, how to set up a Hadoop cluster, spark, and its applications. It also discusses the MapReduce functions and NoSQL database.

Course Objectives:

1. To understand the Big Data Platform and its Use cases
2. To Provide an overview of Apache Hadoop
3. To understand the various MapReduce functions
4. To Provide HDFS Concepts and Interfacing with HDFS
5. To understand NoSQL database

UNIT I INTRODUCTION **9 hours**

Introduction: Big Data - Characteristics of Big Data - Big data management architecture - Examining Big Data Types - Big Data Technology Components - Big data analytics - Big data analytics examples - Web Data Overview - Web Data in Action.

UNIT II HADOOP **9 hours**

Introduction: History of Hadoop - Hadoop Ecosystem - Analyzing data with Hadoop - Hadoop Distributed File System - Design - HDFS concepts - Hadoop filesystem - Data flow - Hadoop I / O - Data integrity - Serialization - Setting up a Hadoop cluster - Cluster specification - cluster setup and installation - YARN.

UNIT III MAPREDUCE **9 hours**

Introduction: Understanding MapReduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures - Shuffle and sort - MapReduce types and formats - features - counters - sorting - MapReduce Applications –Configuring and setting the environment - Unit test with MR unit - local test.

UNIT IV SPARK **9 hours**

Installing spark - Spark applications - Jobs - Stages and Tasks - Resilient Distributed databases - Anatomy of a Spark Job Run - Spark on YARN - SCALA: Introduction - Classes and objects - Basic types and operators - built-in control structures - functions and closures - inheritance.

UNIT V NoSQL DATABASE **9 hours**

Introduction to NoSQL - MongoDB: Introduction - Data types - Creating - Updating and deleing documents - Querying - Introduction to indexing - Capped collections - Hbase: Concepts - Hbase Vs RDBMS - Creating records - Accessing data - Updating and deleting data - Modifying data - exporting and importing data. USE CASES: Call detail log analysis - Credit fraud alert - Weather forecast.

Course Outcomes:

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

1. Understand the characteristics of big data and concepts of Hadoop ecosystem
2. Understand the concepts of Scala programming
3. Apply Mapreduce programming model to process big data
4. Analyze Spark and its uses for big data processing
5. Design programs for big data applications using Hadoop components

Text Book(s)

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley Publishers, 2015.
2. Simon Walkowiak, "Big Data Analytics with R", PackT Publishers, 2016.

Reference Books

1. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No SQL, and Graph", Morgan Kaufmann/Elsevier Publishers, 2013.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.
3. Kim H. Pries, Robert Dunnigan, "Big Data Analytics: A Practical Guide for Managers", CRC Press, 2015.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year II Semester

20CAI114 DEEP LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Probability and Statistics, Introduction to Machine Learning

Course Description:
This course is designed to present the core fundamentals behind the much talked about field of Deep Learning. We will delve into selected topics of Deep Learning, from discussing basics of neural networks, to understanding how CNN and NN works with common examples and publicly available datasets. Special highlight of the course is the lecture on Interpretability of Neural Networks which will help students to understand how to trust a neural network's recommendation.

Course Objectives:

To introduce the fundamentals of deep learning and the main research activities in this field.

To learn architectures and optimization methods for deep neural network training

UNIT 1 LINEAR ALGEBRA REVIEW AND OPTIMIZATION 9 hours

Brief review of concepts from Linear Algebra, Types of errors, bias-variance trade-off, overfitting-under fitting, brief review of concepts from Vector Calculus and optimization, variants of gradient descent, momentum.

UNIT 2 LOGISTIC REGRESSION 9 hours

Basic concepts of regression and classification problems, linear models addressing regression and classification, maximum likelihood, logistic regression classifiers.

UNIT 3 NEURAL NETWORKS 9 hours

Basic concepts of artificial neurons, single and multi-layer perceptron, perceptron learning algorithm, its convergence proof, different activation functions, SoftMax cross entropy loss function.

UNIT 4 CONVNETS 9 hours

Basic concepts of Convolutional Neural Networks starting from filtering. Convolution and pooling operation and arithmetic of these, Discussions on famous convent architectures - AlexNet, ZFNet, VGG, GoogLeNet, ResNet, MobileNet-v1

REGULARIZATION, BATCHNORM

Discussion on regularization, Dropout, Batchnorm, Discussion on detection as classification, region proposals, RCNN architectures

UNIT 5 RECURRENT NEURAL NETWORKS 9 hours

Basic concepts of Recurrent Neural Networks (RNNs), backpropagation through time, Long-Short Term Memory (LSTM) architectures, the problem of exploding and vanishing gradients, and basics of word embedding.

AUTOENCODERS

Autoencoders, Denoising autoencoders, sparse autoencoders, contractive Autoencoders

Course Outcomes:

After completion of course, students would be able to:

1. Understand the fundamentals of deep learning

2. Compare various deep neural network architectures

3. Apply various deep learning algorithms based on real-world applications.

Text Book(s)

1. Ian Goodfellow, YoshuaBengio, Aaron Courville. Deep Learning, the MIT press, 2016

2. Bengio, Yoshua. " Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now Publishers, 2009.

Reference Books

1. B. Vegnanarayana, Artificial Neural Networks, Prentice Hall of India, 2005.

2. Simon Haykin, Neural Networks a Comprehensive Foundations, PHI Edition, 2005.

3. Chao Pan, Deep Learning Fundamentals: An Introduction for Beginners, AI Sciences Publisher.

Online Resources:

1. https://www.coursera.org/learn/neural-networks-deep-learning

2. https://www.deeplearning.ai/program/deep-learning-specialization/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year II Semester

	L	T	P	C
20CAI115 DATA SCIENCE	**3**	**0**	**0**	**3**

Pre-requisite: Introduction to Python

Course Description:

This course is designed to provide strong foundation for data science and application area related to it and understand the underlying core concepts and emerging technologies in data science.

Course Objectives:

1. To describe the life cycle of Data Science and computational environments for data scientists using Python.
2. To describe the fundamentals for exploring and managing data with Python.
3. To examine the various data analytics techniques for labeled/columnar data using Python.
4. To demonstrate a flexible range of data visualizations techniques in Python.
5. To describe the various Machine learning algorithms for data modeling with Python.

UNIT I INTRODUCTION TO DATA SCIENCE 9 hours

Introduction to Data Science and its importance - Data Science and Big data-, The life cycle of Data Science- The Art of Data Science - Work with data – data Cleaning, data Managing, data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter.

UNIT-II VISUALIZING DATA 9 hours

Visualizing Data: matplotlib, Bar Charts, Line Charts, Scatterplots. Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation.

UNIT-III GETTING DATA 9 hours

Getting Data: stdin and stdout, Reading Files, Scraping the Web, Using APIs. Working with Data: Exploring Your DataUsing NamedTuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction. Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

UNIT-IV MACHINE LEARNING 9 hours

Machine Learning: Modeling, Overfitting and Underfitting, Correctness, The Bias-Variance. Categories of Machine Learning algorithms, Dimensionality reduction-Introducing ScikitApplication: Exploring Hand-written Digits. Feature Engineering, Naive Bayes Classification - Linear Regression - kMeans Clustering

UNIT-V CLUSTERING **9 hours**

Clustering: The Idea, The Model, Choosing k, Bottom-Up Hierarchical Clustering. Recommender Systems: Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization Data Ethics, Building Bad Data Products, Trading Off Accuracy and Fairness, Collaboration

Course Outcomes:

Upon successful completion of the course, students will be able to
1. Identify phases involved in the life cycle of Data Science.
2. Pre-process and manage the data for efficient storage and manipulation in Python.
3. Realize the various data analytics techniques for labeled / columnar Data using Python Pandas.
4. Explore a flexible range of data visualizations approaches in Python.
5. Analyze various Machine learning algorithms for data modeling with Python.

Text Books

1. Joel Grus, "Data Science From Scratch", OReilly. 2) Allen B.Downey, "Think Stats", OReilly.
2. Doing Data Science: Straight Talk From The Frontline, 1st Edition, Cathy O'Neil and Rachel Schutt, O'Reilly, 2013

Reference Books

1. Mining of Massive Datasets, 2nd Edition, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press, 2014
2. "The Art of Data Science", 1st Edition, Roger D. Peng and Elizabeth matsui, Lean Publications, 2015
3. "Algorithms for Data Science", 1st Edition, Steele, Brian, Chandler, John, Reddy, Swarna, springers Publications, 2016

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year II Semester

20CAI211 BIG DATA ANALYTICS LABORATORY

L T P C

0 0 3 1.5

Pre-requisite: Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Course Description:
This course is designed an in-depth understanding of terminologies and the core concepts behind big data problems, applications, systems and the techniques that underlie today's big data computing technologies. It provides an introduction to some of the most common frameworks such as Apache Spark, Hadoop, MapReduce, Large scale data storage technologies such as in-memory key/value storage systems, NoSQL distributed databases

Course Objectives:

1. Optimize business decisions and create competitive advantage with Big Data analytics
2. Imparting the architectural concepts of Hadoop and introducing map reduce paradigm
3. Introducing Java concepts required for developing map reduce programs
4. Derive business benefit from unstructured data
5. Introduce programming tools PIG & HIVE in Hadoop echo system.

List of Programs:

1. (i)Perform Setting Up And Installing Hadoop In Its Two Operating Modes:

Pseudo Distributed, And Fully Distributed.

(ii) Use Web Based Tools To Monitor Your Hadoop Setup.

2. (i) Implement the following file management tasks in Hadoop:

    1. Adding files and directories
    2. Retrieving files
    3. Deleting files

ii) Benchmark and stress test an Apache Hadoop cluster

3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

    1. Find the number of occurrence of each word appearing in the input file(s)
    2. Performing a MapReduce Job for word search count (look for specific keywords in a file)

4. Stop word elimination problem:

a. Input:

    i. A large textual file containing one sentence per line

    ii. A small file containing a set of stop words (One stop word per line)

b. Output:

i. A textual file containing the same sentences of the large input file without thewords appearing in the small file.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: https://github.com/tomwhite/hadoop- book/tree/master/input/ncdc/all.

1. Find average, max and min temperature for each year in NCDC data set?

2. Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

6. Purchases.txt Dataset

a. Instead of breaking the sales down by store, give us a sales breakdown by product category across all of our stores

i. What is the value of total sales for the following categories?

1. Toys
2. Consumer Electronics

b. Find the monetary value for the highest individual sale for each separate store

7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8. Write a Pig Latin scripts for finding TF-IDF value for book dataset (A corpus of eBooks available at: Project Gutenberg)

9. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes

10. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.

Course Outcomes:

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

1. Preparing for data summarization, query, and analysis.
2. Applying data modelling techniques to large data sets
3. Creating applications for Big Data analytics
4. Building a complete business data analytic solution

Text Book(s)

1. Arshdeep Bahga, Vijay Madisetti, “Big Data Science & Analytics: A Hands-On Approach “,VPT, 2016
2. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge DataStreams with Advanced Analytics”, John Wiley& sons, 2012

Reference Books

1. Paul Zikopoulos, Dirkde Roos, Krishnan Parasuraman, Thomas Deutsch, James Giles , David Corrigan, “Harness the Power of Big Data The IBM Big Data Platform”, Tata McGraw Hill Publications, 2012
2. Bart Baesens “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)”, John Wiley & Sons,2014

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

B. Tech III Year II Semester

20CAI212 DEEP LEARNING LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: Machine Learning Lab

Course Description

This course is designed to provide a basic understanding of working principle of perceptron model. Expert knowledge in solving real world problems using state of art deep learning architectures. This covers TensorFlow frame work and Keras library to solve real world problems by using neural network and deep learning techniques.

Course Objectives

1. Understand various image processing operations using OpenCV library
2. Learn different activation functions and optimization techniques used in neural networks.
3. Apply deep learning models for binary and multiclass classification.
4. Understand the architectures of CNN, VGG-16, RNN and LSTM.
5. Explore OpenCV to detect faces and objects.

List of Programs:

1. Basic OpenCV operations: Reading Images, Displaying Images, Resizing the Image
2. Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
3. Artificial Neural Network:
   a) Implement coding our first neurons
   b) Implement Single Layered Neural Network
   c) Implement Multi Layered Neural Network
4. Implement all Activation Functions in Building Neural Network and analyse their usage
5. Implement Backpropagation Neural Network using Python
6. Build an ANN model using TensorFlow and Keras Libraries for classification of IRIS Flower dataset
7. Build an ANN model for classify the House Prize Prediction using TensorFlow and Keras Libraries
8. Create a CNN model and train it on MNIST handwritten image dataset for classification
9. Create a CNN model to analyse CIFAR10 dataset and classify the given image into one of the 10 classes of images
10. Build an image classification model using VGG-16 for Dog Vs Cat
11. Create a RNN model and do sentiment analysis of movie reviews on IMDB dataset
12. Create a LSTM model and analyse the Google Stock prize data and find out increasing or decreasing the trend of stock prizes and predict the stock prize of next day
13. Design a Deep Learning Model to classify the movie reviews as Positive or Negative based on the text content of reviews using IMDB dataset.

14. Implement a program using OpenCV to detect faces in a given image or photo
15. Design a Deep Learning framework for Object Detection using YOLO algorithm on COCO dataset

COURSE OUTCOMES:

1. Illustrate image processing operations using OpenCV library.
2. Design single and multi-layer neural networks with Back propagation algorithm and evaluate the performance of various optimization techniques.
3. Build Deep Learning models for binary and multiclass classification problems.
4. Compare the various Deep learning architectures like CNN, VGG-16, RNN, LSTM
5. Use OpenCV library for object detection applications.

TEXTBOOKS:

1. Deep Learning with Python, Francois Chollet, Manning Publications Co.
2. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms with contributions by Nikhil Buduma , O'Reilly publications
3. Francois Chollet, "Deep learning with Python" – Manning Publications.

REFERENCE BOOKS:

1. Deep Learning, Ian Good fellow,Yoshua Bengio and Aaron Courville, MIT Press, London, England
2. Deep Learning: A Practitioner's Approach by Josh Patterson, Adam Gibs, O'Reilly publications

Mode of Evaluation: Continuous Internal Evaluation of the Lab Experiments, Record, Viva-voce, and External Lab Examination

B. Tech III Year II Semester

20CAI213 DATA SCIENCE LABORATORY

L	T	P	C
0	0	3	1.5

Pre-requisite: 20CSE101, Basic Programming Knowledge

Course Description:

This course is designed to equipping students to be able to use python programming for solving real-time data science problems.

Course Objectives:

1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation

List of Programs:

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random Functions.
2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
3. Computation on NumPy arrays using Universal Functions and Mathematical methods.
4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
5. Load an image file and do crop and flip operation using NumPy Indexing.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Create Pandas Series and Data Frame from various inputs.
8. Import any CSV file to Pandas Data Frame and perform the following:
    (a) Visualize the first and last 10 records
    (b) Get the shape, index and column details.
    (c) Select/Delete the records(rows)/columns based on conditions.
    (d) Perform ranking and sorting operations.
    (e) Do required statistical operations on the given columns.
    (f) Find the count and uniqueness of the given categorical values.
    (g) Rename single/multiple columns.
9. Import any CSV file to Pandas DataFrame and perform the following:

(a) Handle missing data by detecting and dropping/ filling missing values.

(b) Transform data using apply() and map() method.

(c) Detect and filter outliers.

(d) Perform Vectorized String operations on Pandas Series.

(e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

10. Write a program to demonstrate Linear Regression analysis with residual plots on a given data set
11. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
12. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Python ML library classes.
13. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Course Outcomes:

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

1. Illustrate the use of various data structures.
2. Analyze and manipulate Data using Numpy and Pandas.
3. Creating static, animated, and interactive visualizations using Matplotlib.
4. Understand the implementation procedures for the machine learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Book(s)

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.

2. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017.

Reference Books

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.

2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.

3. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, “How to Think Like a Computer Scientist: Learning with Python 3”, 3rd edition, Available at https://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
4. Paul Barry, “Head First Python a Brain Friendly Guide” 2nd Edition, O’Reilly, 2016 4.
Dainel Y.Chen “Pandas for Everyone Python Data Analysis” Pearson Education, 2019

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Mandatory Course

20HUM902[**] /20HUM102[#] UNIVERSAL HUMAN VALUES

L	T	P	C
2[**]/3[#]	0	0	0[**]/3[#]

Pre-requisite None.

Course Description:

This course discusses students' role in their family and briefly touches issues related to their role in the society and the nature.

Course Objectives:

This course enables students to

1. Understand Happiness and Prosperity correctly and basic Human Aspirations
2. Able to self-verify the Harmony in the Human Being
3. Visualize a universal harmonious order in society which leads to Undivided Society at Universal Order- from family to world family.
4. Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
5. Implicate the UHV in professional ethics.

UNIT I The Process for Value Education - Basic Human Aspirations 8 hours

L1: Purpose and motivation for the course, recapitulation from Universal Human Values-I

L2: Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

L3: Continuous Happiness and Prosperity- A look at basic Human Aspirations

L4: Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

L5: Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

L6: Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

T1 & T2: Discussion on natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II Understanding Harmony in the Human Being - Harmony in Myself! 8 hours

L7: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

L8: Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

L9: Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

L10: Understanding the characteristics and activities of 'I' and harmony in 'I'

L11: Understanding the harmony of I with the Body: Self-regulation and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

L12: Programs to ensure Self-regulation and Health.

T3 & T4: Discussion on the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT III Understanding Harmony in the Family and Society 7 hours

L13: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

L14: Understanding the meaning of Trust; Difference between intention and competence
L15: Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
L16: Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
L17: Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
T5 & T6: Reflection on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT IV Understanding Harmony in the Nature and Existence 6 hours

L18: Understanding the harmony in the Nature
L19: Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
L20: Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
L21: Holistic perception of harmony at all levels of existence.
T7 & T8: Discussion on human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V Implications of Holistic Understanding of Harmony on Professional Ethics 11 hours

L22: Natural acceptance of human values
L23: Definitiveness of Ethical Human Conduct
L24: Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
L25; Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
L26: Case studies of typical holistic technologies, management models and production systems
L27: Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
L28: Sum up.
T9-T14: Exercises and Case Studies For e.g. Individual discussion on the conduct as an engineer or scientist etc.

Course Outcomes:

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

1. Understood the natural acceptance in human being as the innate acceptance,
2. More aware of themselves,
3. Maintain harmony with family and society by recognizing Harmony in Human-Human Relationship,
4. Try to get Harmony in the Nature and Existence by realizing existence as Coexistence
5. More responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind with better critical ability.

Text Book(s)

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

Mode of Evaluation: Assignment / Quiz, Classroom participation, Mini project / Report, Internal Mid Examination and external semester end examination.

Open Elective - II

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - II

20MAT301 ADVANCED NUMERICAL METHODS

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT107, 20MAT110

Course Description:

This course reviews and continues the study of computational techniques for evaluating interpolations, derivatives and integrals; solving system of algebraic equations, transcendental equations, ordinary differential equations and partial differential equations. The course emphasizes on numerical and mathematical methods of solutions with appropriate error analysis. The students use MATLAB as the computer language to obtain solutions to a few assigned problems.

Course Objectives:

1. To introduce computation methods of solving algebraic and transcendental equations.
2. To avail the basics of numerical techniques for solving the system of linear equations
3. To familiarize the knowledge of interpolation and numerical calculus.
4. To use numerical calculus for solving ordinary differential equations.
5. To introduce the computational techniques for solving partial differential equations.

UNIT I SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS — 9 hours

Introduction to MATLAB, errors, sources of errors, floating point arithmetic, significant digits, relative error, propagation of errors, how to avoid loss of significant digits, evaluation of polynomial - Bisection method, False-position method, Secant method, Fixed-point iteration method, Newton's method – single and multiple roots, Order of convergence of the methods.

Exercises of Bisection method and Newton's method through MATLAB

UNIT II SOLUTIONS OF SYSTEM OF ALGEBRAIC EQUATIONS — 9 hours

Gaussian Elimination, LU decomposition, Thomas algorithm for the tridiagonal systems, Norms-Euclidean, mini-maxi, Frobenius and 1-,2- and ∞-norms, Condition numbers and errors in computed solutions. Jacobi's method, Gauss-Seidel method, Power method for obtaining eigenvalues and eigenvectors of matrices.Exercises of Gaussian Elimination and Gauss-Seidel method through MATLAB

UNIT III INTERPOLATION & NUMERICAL CALCULUS — 9 hours

Existence and Uniqueness of interpolating polynomial, Lagrange polynomials, Divided differences, Evenly spaced points, Error of interpolation, cubic spline, Inverse interpolation, Derivatives from difference table, Higher order derivatives, Trapezoidal rule, Simpsons rule, a composite formula, Gaussian Quadrature - Exercises of Divided differences and Simpson's rule through MATLAB

UNIT IV NUMERICAL SOLUTIONS TO ORDINARY DIFFERENTIAL EQUATIONS — 9 hours

Taylor series method, Euler and Modified Euler's method, Runge-Kutta methods for initial value problems, Shooting method, Finite difference method for boundary value problems.

Exercises of Runge-Kutta method and Shooting method through MATLAB.

UNIT V NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS — 9 hours

Finite difference methods for one-dimensional Wave and Heat equations; Laplace and Poisson equations (five-point formula) - Exercises of Finite difference method (forward, central and backward differentiation) and Crank-Nicolson method through MATLAB

Course Outcomes:

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

1. Solve the system of algebraic and transcendental equations.
2. Apply the numerical techniques to find the solution to system of equations.
3. Calculate and analyze the rate of variations and numerical sum of such changes using numerical calculus relevant to the field of Engineering.
4. Find the accurate numerical solutions to ordinary differential equations representing some Engineering problems.
5. Compute the solutions for engineering problems represented by partial differential equations.

Text Books:

1. Curtis F. Gerald, Patrich O. Wheatley, Applied Numerical Analysis, Pearson Education, 7th Edition, 2003.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.
2. Burden and Faires, Numerical Analysis 7th ed., Thomson Learning, 2001.
3. Advanced Engineering Mathematics by E. Kreyszig, 10th ed., Wiley, 2010.
4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven C. Chapra, 3rd ed., Mc Graw Hill, 2012.
5. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering, New Age International Ltd., 5th Edition, 2010.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Computer Science & Engineering (Artificial Intelligence)

Open Elective - II

20MAT302 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

Pre-requisite: 20MAT101, 20MAT106, 20MAT104, 20MAT108, 20MAT109, 20MAT110.

Course Description:
Unconstrained and constrained optimization, Linear programming problem, transportation and assignment problems, dynamic programming problem, project management and queuing models.

Course Objectives:
1. Understand the optimization techniques for solving engineering problems.
2. Formulate and solve linear programming problem.
3. Obtain the optimal solution for transportation and assignment problems.
4. Avail knowledge to solve dynamic programming problem using recursive relations.
5. Analyze the techniques of project management and queuing models.

UNIT I CLASSICAL OPTIMIZATION 9 hours

Introduction to optimization, unconstrained optimization with single variable and multi variable. Constrained multivariable optimization with equality constraints- Lagrange multipliers method, constrained multivariable optimization with inequality constraints - Kuhn-Tucker conditions.

UNIT II LINEAR PROGRAMMING PROBLEM 9 hours

Linear Programming Problem (LPP), Mathematical formulation, graphical solution, simplex method. Artificial variable technique - Big M-method and two phase simplex method. Duality, dual Simplex method.

UNIT III TRANSPORTATION PROBLEM AND ASSIGNMENT PROBLEM 9 hours

Transportation problem: definition and algorithm, transshipment problem. Assignment problem, travelling salesman problem.

UNIT IV DYNAMIC PROGRAMMING 9 hours

Introduction, developing optimal decision policy, Dynamic Programming Problem (DPP) under certainty, DPP approach for solving LPP.

UNIT V PROJECT MANAGEMENT AND QUEUING MODELS 9 hours

Network analysis: Network representation, Critical Path Method (CPM) and Project Evolutionary and Review Technique (PERT). Introduction to queuing system, single server queuing models (M/M/1) :(∞/FCFS), (M/M/1): (N/FCFS).

Course Outcomes:
At the end of the course, students will be able to:
1. Understood the importance of unconstrained and constrained optimization to solve engineering problems.
2. Get an idea about the linear programming techniques.
3. Solve transportation and assignment problems in engineering situations.
4. Apply the Bellman principle of optimality to solve dynamic programming problem.
5. Analyze the problems of network analysis for project management and Queuing systems engineering & industry.

Text Books:

1. J K Sharma, Operations Research: Theory and Practice, Macmillan Publishers India Ltd, 5th edition,2013.
2. B.S. Grewal, Higher Engineering Mathematics, 43rd edition (2014), Khanna publishers.

Reference Books

1. Hamdy A Taha, Operations Research: An Introduction, Pearson Education, 9/E, 2011.
2. FS Hillier and GJ Lieberman, Introduction to Operations Research, TMH, 8/E, 2006.
3. JC Pant, Introduction to Optimization: Operations Research, Jain Brothers, New, 6/E, 2004.
4. A Ravindran, DT Philips and JJ Solberg, Operations Research: Principles and Practice, John Wiley& Sons, Singapore, 2nd edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - II

20PHY301 OPTICAL PHYSICS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course will cover Geometrical optics, Aberrations, Physical Optics, Diffraction and Optical fibers.

Course Objectives:
Students will

1. Knowledge of basic principles and concepts in optics and the techniques used to deal with them.
2. Explain the limitations associated with spherical and chromatic aberration
3. Describe optical systems such as microscopes and telescopes with reference to parameters such as angular magnification and depth of field
4. Provide students with a working knowledge of optical physics, including interference, diffraction and physical optics.
5. Introduce construction and concepts of basic fiber optic communication system and to make the students learn about its important applications for societal needs.

UNIT I INTRODUCTION 9 hours

Corpuscular and wave theory, Fermat's principle, Matrices for translation, refraction and reflection, Unit and nodal planes, Eigenvalues and Eigenvectors.

UNIT II ABERRATIONS AND OPTICAL INSTRUMENTS 9 hours

Types of aberrations, Chromatic and monochromatic aberrations. Different types of monochromatic aberrations. Simple and Compound microscopes, Astronomical and Terrestrial telescopes. Ramsden's and Huygens' eye pieces.

UNIT III WAVE OPTICS & INTERFERENCE 9 hours

Huygens's principle, Superposition of waves, Fourier transforms, representation of slits and apertures, Two beam interference by Division of wave front. Applications of Interference, Nonlinear interaction of light with matter (self-study).

UNIT IV DIFFRACTION & POLARISATION 9 hours

Fraunhoffer diffraction, Diffraction from single slit, double slit & multiple slits, Fresnel half-period zones, Zone plate, Applications of diffraction, Polarization, Malus' law, double refraction. Applications of polarization.

UNIT V FIBER OPTICS 9 hours

Construction and working principle of optical fibers, Numerical aperture and acceptance angle, Types of optical fibers. Attenuation and losses in optical fibers, Analog and Digital optical fiber communication system. Applications of optical fibers in communications, sensors and medicine.

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

1. Recollect the fundamental characteristics of light and their mathematical principles.
2. Learn the principles of superposition, Interference and Diffraction
3. Understand nonlinear optics and photonics phenomena.
4. Be exposed to the application of optical techniques in cutting edge research areas.
5. Describe the basic laser physics, working of lasers and principle of propagation of light in optical fibers.

Text Books:

1. Optics by Ghatak, 4th Edition, Tata McGraw Hill (2011).

Reference Books

1. Optics by Lipson, Lipson & Lipson, 4th Edition, Cambridge Univ Press (2010).

2. Optics by Hecht, 4th Edition, Addison-Wesley (2002).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20PHY302 LASER PHYSICS AND ADVANCED LASER TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Basic knowledge of atomic structure at intermediate (10+2) level is sufficient

Course Description:

Laser usage is rampant in various technological applications. Several fields gaining attention in the usage of lasers. This course covers the introduction to the theory and mechanism of laser action, various types of lasers and their applications and future use.

Course Objectives:

1. Make the student to understand the detailed principles of various lasers.
2. Profound understanding of different variety of lasers will provide them to think of superior selection and usage of lasers in practical technological applications.
3. Students are aware of latest developments in certain areas of Laser technology which have important applications for societal needs.
4. Explain how material processing is accomplished with lasers. Estimate laser operation parameters for material processing.
5. Exposure about Lasers applications in engineering, communications, spectroscopy and material process etc.

UNIT I INTRODUCTION TO LASER TECHNOLOGY 9 hours

Laser characteristics, The Einstein Coefficients, Absorption and Emission Cross Sections, Spontaneous and Stimulated emission of radiation, Population inversion, Methods of Population Inversion, Laser Rate Equations, stable two minor optical resonators, Mode selection, Gain in the regenerative laser cavity.

UNIT II GASES AND LIQUIDS LASING MEDIUM 9 hours

Energy levels & Radiative properties of Atoms and molecules; Atomic lasers: He-Ne laser, Argon Ion laser; Molecular Lasers: Carbon dioxide laser, Liquid energy levels and their radiative properties, Organic Dye laser.

UNIT III SOLID STATE LASERS 9 hours

Energy Levels in solids-dielectric medium, Solid-state lasing materials, Narrow line width laser materials, broad band line width laser materials, solid state lasers: Nd:YAG, Nd:YLF; Ti:Sapphire (introduction only)

Energy Levels in solids-semiconductor medium, direct and indirect band gap semiconductors, Semiconductor diode laser, Quantum dot lasers (Introduction only);

UNIT IV PULSED OPERATION OF LASERS 9 hours

Nanosecond: Q-Switching, Techniques of Q-Switching: electro-optic, Acousto-Optic.

Femtosecond: Relationship between pulse duration and Spectral Width, Passive mode-locking, Active mode locking, Kerr lens mode locking, Amplification of femtosecond pulses.

UNIT V LASER APPLICATIONS 9 hours

Laser processing of materials: laser cutting, laser drilling, welding; Lasers in metrology- Accurate measurement of length, light wave communications; Laser spectroscopy: Laser fluorescence and Raman scattering.

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Course Outcomes:

Upon completion of this course the students shall be able to:

1. Understand the principle of phenomenon of laser and identify the operating principle involved in various type of lasers.
2. Estimate stability requirements in producing laser light by different types of sources
3. Differentiate or list the various types of lasers and their means of excitation.
4. Assess (Identify) which laser would best meet the need for a particular industrial or research task.
5. Student can knowledge of latest technological developments in laser technology. Femtosecond laser etc.

Text Books:

1. Laser Fundamentals: William T Silfvast. Cambridge Publication.
2. Laser Theory and Applications: A.K. Ghatak and K. Thyagarajan, Springer
3. Femtosecond Laser Pulses Principles and Experiments: Claude Rulli`ere, Springer
4. Principles of Laser: O. Svelto
5. Laser Physics: Peter W Miloni, Joseph H Eberly.

Reference Books

1. Solid State Laser Engineering: Walter Koechner. Springer series in optical sciences.
2. Ultrafast Optics, Andrew M. Weiner
3. Laser spectroscopy: Demtroder
4. Laser Applications: Monte Ross

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - II

20CHE301 INTRODUCTION TO PETROLEUM INDUSTRY

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:
It deals with basic principles of petroleum engineering and the processes involved in petroleum industry.

Course Objectives:
Students will

1. To understand the basic concepts of crude oil, distillation process, internals, petroleum products and their properties, Instruments used for fuel testing.
2. To understand the type of chemicals and their application in petroleum industry.
3. To introduce the basic principles of hydroprocessing and fluid catalytic cracking and familiarize the processes involved there.
4. To familiarize the basic concepts of catalysis, bioprocesses in the refinery.
5. Health, environment, process safety and management in petroleum companies.

UNIT I BASIC PROCESSES IN PETROLEUM REFINING AND FUEL TESTING — 9 hours

Source of Crude oils and types, Overview of refinery process, Atmospheric Distillation, Vacuum distillation, Desalter, Desulphurization, Cracking, catalysis, Effluent treatment plant. Density, viscosity, pour point, flashpoint, octane number, cetane number, Fire point, Chromatography, Ductility, Water content, Sulphur analysis, MCRT, SARA, HFRR, calorific value etc.

UNIT II CHEMICALS AND THEIR IMPORTANCE IN PETROLEUM INDUSTRY — 9 hours

Types of products in the refinery and their structural properties, Netralizing amines, Corrosion inhibitors, Multifunctional additives, viscosity improvers, drag reducing agents, antioxidants, Lubricity improvers, Antifoam additives, Oil spill absorbers, Dispersants and their applications, Types of Catalysts used in the refinery, Chemicals for ETP plant.

UNIT III ROLE OF HYDROPROCESSING AND FLUID CATALYTIC CRACKING IN PETROLEUM INDUSTRY — 9 hours

Objectives, Hydrocracking Reactions, Hydrocracking feedstocks, Modes of Hydrocracking, Effects of process variables, Hydro treating process and catalysts Resid hydro processing, FCC Cracking, Catalyst coking and regeneration, Design concepts, New Designs for Fluidized-Bed Catalytic Cracking Units

UNIT IV ROLE OF CATALYSTS, BIOPROCESSES IN PETROLEUM INDUSTRY — 9 hours

Types of catalyst and their importance, Design of catalyst, selection of catalyst, Catalytic processes. Introduction to biotechnology, oil recovery from reservoirs, refining of petroleum using biodesulphurisation, Bioremediation, commercial processes for bioethanol, propanol.

UNIT V HEALTH, ENVIRONMENT, PROCESS SAFETY AND MANAGEMENT IN PETROLEUM INDUSTRY — 9 hours

Safety policy, Personal protective equipment, Different type of extinguishers, Types of gloves and their application, Hydrants and their role, Safety indicators, Safety contact, Environmental pollution, precaution and first aid, precautions safety, Occupational safety and management, different elements and their role.

Course Outcomes:

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

1. Be able to understand the overview of petroleum industry
2. Be able to understand the concepts of crude oil, types of crude oils, properties of fuels such as octane number, cetane number, viscosity, density etc. Instruments.
3. Be familiarized with importance and their use of chemicals involved in the petroleum industry.
4. Be familiarized with the processes involved in hydroprocessing and fluid catalytic cracking.
5. Be familiarized the types of catalysts and bioprocesses in the petroleum industry.
6. Understanding the PPE, different types of extinguishers, First aid, process safety and management in the petroleum industry.

Text Books:

1. Mohamed A. Fahim, Taher A. Al-Sahhaf, Amal Elkilani, Fundamentals of Petroleum Refining, Elsevier,2009
2. David T Day, Handbook of the Petroleum Industry, Volume 1, ISBN: 137595962X, CHIZINE PUBN, 2017
3. S. P. Srivastava Jenő Hancsók, *Fuels and fuel additives*, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
4. Robert O. Anderson, *Fundamentals of the Petroleum Industry*–University of Oklahoma Pres, 1987.
5. James G.Speight, *Handbook of Petroleum Product Analysis*, John Wiley & Sons, Inc, 2015
6. Physical Chemistry by G.W. Castellan (Addison Wesley Publishing Company)

Reference Books

1. Sankara Papavinasam, Corrosion Control in the Oil and Gas Industry, Elsevier, 2013
2. Petroleum Engineering Handbook (Vol. 1 through VIII). Editor in Chief: Larry W. Lake, Society of Petroleum Engineers.
3. Srinivasan Chandrasekaran. Health, safety and Environmental Management for offshore and Petroleum Engineers, John Wiley and Sons, U.K., ISBN: 978-11-192-2184-5, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20CHE302 GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT

L	T	P	C
3	0	0	3

Pre-requisite: Basic Chemistry at Intermediate or equivalent level.

Course Description:

This course aims to introduce the interdisciplinary concept for engineering's to enhance their knowledge that they need to contribute with relevance and confidence in developing green technologies. This course covers feedstocks, green metrics and the design of safer, more efficient processes, as well as the role catalysts and solvents and green processes for Nanoscience.

Course Objectives:

Students will

1. Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry
2. Sensitize the students in redesigning of chemicals, industrial processes and products by means of catalysis.
3. Understand the use of alternatives assessments in using environmentally benign solvents.
4. Emphasize current emerging greener technologies and the need of alternative energies.
5. Learn to adopt green chemistry principles in practicing Nanoscience.

UNIT I PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY 9 hours

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation.

UNIT II CATALYSIS AND GREEN CHEMISTRY 9 hours

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites: Catalytic cracking, ZSM-5 catalyst and high silica zeolites, TS1 Oxidation catalyst, Catalytic Converters, Homogeneous catalysis: Hydrogenation of alkenes using wilkinson's catalyst, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide.

UNIT III ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS 9 hours

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT IV EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES 9 hours

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Fuel Cells(Hydrogen—oxygen fuel cell), Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions(caprolactum), Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry.

UNIT V GREEN PROCESSES FOR GREEN NANOSCIENCE 9 hours

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

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Course Outcomes:

Upon completion of this course the students should:

1. Recognize green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.
2. Understand and apply catalysis for developing eco-friendly processes.
3. Be in a position to use environmental benign solvents where ever possible.
4. Have knowledge of current trends in alternative energy sources.
5. Apply green chemistry principles in practicing green Nanoscience.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.

2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books

1. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20CE301 GROUND IMPROVEMENT TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Identification of problematic soils; ground improvement techniques; densification in granular soils; densification in cohesive soils; soil stabilization; confinement; reinforced earth; geo-synthetics; improvement of expansive soils.

Course Objectives:
Students will
1. To introduce engineering properties of soft, weak and compressible deposits, principles of treatment for granular and cohesive soils and various stabilization techniques.
2. To bring out concepts of reinforced earth.
3. Applications of geotextiles in various civil engineering projects.

UNIT I DEWATERING & GROUTINHG 9 hours

Introduction- Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique.
Methods of de-watering- sumps and interceptor ditches- wells- drains- Electro- osmosis. Objectives of grouting- grouts and their properties-grouting methods.

UNIT II DENSIFICATION 9 hours

In - situ densification methods in cohesionless Soils: - Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth. In - situ densification methods in cohesive soils: - preloading or dewatering, Vertical drains - Sand Drains- Sand wick geo-drains
- Stone and lime columns - thermal methods.

UNIT III STABILIZATION 9 hours

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride- sodium silicate and gypsum.

UNIT IV REINFORCED EARTH & GEOSYNTHETICS 9 hours

Principles - Components of reinforced earth - factors governing design of reinforced earth walls design principles of reinforced earth walls. Geotextiles- Types, Functions and applications - geo- grids and geo-membranes - functions and applications.

UNIT V EXPANSIVE SOILS 9 hours

Problems of expansive soils - tests for identification - methods of determination of swell pressure. Improvement of expansive soils - Foundation techniques in expansive soils - under reamedpiles.

Course Outcomes:
After successful completion of the course, student will be able to
1. Evaluate basic deficiencies of various soil deposits and able to decide various dewatering methods to improve the soil.
2. Implement different techniques of soil densification.
3. Choose the best method for stabilizing the soil for a given soil condition.
4. Choose-the best geosynthetic materials in different engineering applications.
5. Assessing various types of foundation techniques and methods to control swelling of soil

Text Books:

1. Dr. Purushotham Raj, P., Ground Improvement Techniques, Laxmi Publications, New Delhi.

2. Dr. Sivakumar Babu, GL, An Introduction to Soil Reinforcement & Geosynthetics, Universities Press

Reference Books

1. Hausmann M.R., Engineering Principles of Ground Modification, McGraw-Hill International Edition, 1990.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20CE302 ENVIRONMENTAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course will focus on Basic concept of Environmental Impact Assessment (EIA), EIA Methodologies, Impact of Developmental Activities and Land use in soil, water, and vegetation, Environmental Audit, Post Audit activities, The Environmental pollution Acts.

Course Objectives:
Students will
1. To impart knowledge on Environmental management and Environmental Impact Assessment.
2. To give the student the brief knowledge about various legislations and audit protocols.
3. To give student knowledge about the framing of environmental audit through case studies.

UNIT I CONCEPTS AND METHODOLOGIES IN EIA 9 hours

Introduction - Elements of EIA - Factor affecting EIA -Impact evaluation and analysis - Preparation of Environmental Base map - Classification of environmental parameters. Criteria for the selection of EIA Methodology - EIA methods: Ad-hoc methods - matrix methods - Network method - Environmental Media Quality Index Method -overlay methods - cost/benefit Analysis.

UNIT II IMPACT OF DEVELOPMENTAL ACTIVITIES 9 hours

Introduction and Methodology for the assessment of soil and ground water - Delineation of study area - Identification of actives. Procurement of relevant soil quality - Impact prediction - Assessment of Impact significance -Identification and Incorporation of mitigation measures. EIA in surface water - Air and Biological environment.

UNIT III IMPACT ON VEGETATION AND WILD LIFE 9 hours

Assessment of Impact of development Activities on Vegetation and wildlife - environmental Impact of Deforestation - Causes and effects of deforestation.

UNIT IV ENVIRONMENTAL AUDIT 9 hours

Environmental Audit & Environmental legislation objectives of Environmental Audit - Types of environmental Audit - Audit protocol - stages of Environmental Audit - onsite activities - evaluation of audit data and preparation of audit report - Post Audit activities.

UNIT V ENVIRONMENTAL POLLUTION ACTS 9 hours

The water Act-1974 - The Air Act-1981 (Prevention & Control of pollution Act.) - Wild life Act- 1972 - Indian Forest Conservation Act-1980 -National Green Tribunal Act –2010 - Biological Diversity Act-2002.

Course Outcomes:
The students after completing the course will be able to:
1. Apply the various methods used in predicting environmental impacts.
2. Apply site information to interpret impacts on land and groundwater.
3. Evaluate environmental impacts of various development activities on existing ecosystem.
4. Apply the procedures and various protocols involved in preparation of environmental audit report.
5. Apply the implications of environmental prevention and protection acts in relation to environmental impact assessment.

Text Books:

1. Anjaneyulu, Y., Environmental Impact Assessment Methodologies, B.S. Publication, Sultan Bazar, Kakinada.

Reference Books

1. Glynn, J. and Gary W. Hein Ke., Environmental Science and Engineering, Prentice Hall Publishers

2. Suresh K. Dhaneja Environmental Science and Engineering, S.K., Katania& Sons Publication, New Delhi.

3. Dr. Bhatia, H.S., Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20CE303 WATERSHED MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
Topic covers basic concepts of watershed, sustainable watershed management approached and practices, integrated watershed management and modelling, social aspect in watershed management, quantification of water quality and quantity at the catchment outlet using modern techniques, drought, flood and storm management at catchment scale.

Course Objectives:
1. To discuss various aspects of water resources development and management on watershed basis.
2. To proliferate the sustainable use and development of natural resources.
3. To enrich the students for change in the hydrological fluxes due altered physiographic condition (land use or elevation) on a watershed scale.
4. To improve the quantitative problem solving skills of the students for natural resources management.

UNIT I CONCEPT OF WATERSHED 9 hours

Concept of watershed - classification of watershed - introduction to watershed management - objective of watershed development - Hydrological cycle - water balance equation - different stakeholders and their relative importance - watershed management policies and decision making. Factor Affecting Watershed Development**:** Morphological characteristics: linear - Arial and Relief aspect - land use - vegetation - soil and geological characteristics - Hydrology and geology and socio-economic characteristics.

UNIT II WATERSHED MODELING 9 hours

Watershed delineation - modelling of rainfall - runoff process - Concept of integrated watershed management conjunctive use of water resources - Integrated water resources management. PRA - Private sector participation - Institutional issues - Socio- economy issues - Integrated development - Water legislation and implementations - Tools and emerging technologies for watershed management and planning.

UNIT III EROSION AND SEDIMENTATION 9 hours

Types of erosion - factor affecting erosion - effect of erosion on land fertility and capacity - estimation of soil loss due to erosion: universal soil loss equation - Prevention And Control To Erosion: contour techniques - ploughing - furrowing- trenching - bunding - terracing - gully control - rockfill dams - check dams - brushwood dam - Gabion structure.

UNIT IV WATER HARVESTING 9 hours

Rain water harvesting - catchment harvesting - harvesting structures - soil moisture conservation - check dams - artificial recharge from pond - percolation tanks - Flood And Drought Management: Definition of flood - Flood frequency analysis: Weibul - Gumbel - and log Pearson methods - Definition and classification of drought - drought analysis techniques - drought mitigation planning - Management Of Water Quality: Water quality and pollution - types and Sources of pollution - water quality modelling-environmental guidelines for water quality.

UNIT V COVER MANAGEMENT 9 hours

Land use land cover change estimation through satellite imageries - land capability classification - management of forest - agricultural - grassland and wild land - Reclamation of saline and alkaline soil. Classification of columns based on slenderness ratio - reinforcement & loading - Design of rectangular and circular columns subjected to axial load - (axial load + uni-axial bending) and (axial load + bi-axial

bending). Different Types of Footings - Design of isolated - square - rectangular and circular footings. Integrated Cropping System For Watersheds: Intercropping - mix cropping strip and terrace cropping - sustainable agriculture - cover cropping (biomass conservation) - horticulture - dryland agriculture and afforestation.

Course Outcomes:

The students after completing the course will be able to:

1. Classify watershed and Identify factors to consider for watershed Development.
2. Apply the concepts of watershed development and planning
3. Evaluate the erosion rate and total amount of soil loss from a watershed
4. Select the flood and drought mitigation measures
5. Quantify the change in land use land/cover and its impact on hydrological processes.

Text Books:

1. Kenneth N. Brooks Peter F. Ffolliott Joseph A. Magner. Hydrology and the Management of Watersheds. A John Wiley & Sons, Inc., Publication (4th Edition)
2. VVN, Murthy. Land and Water Management- Kalyani Pblication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective – II

20ME301 MATERIAL SCIENCE FOR ENGINEERS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

1. To understand the relation between structure and properties of metallic materials.
2. To understand the strengthening mechanism of metals
3. To comprehend the various electrical and electronic properties of materials.
4. To understand origins and various types of magnetism and its applications.
5. To comprehend the transmission of light in various solids and study of photonic behavior.

UNIT I STRUCTURE OF MATERIALS 9 hours

Introduction: Historical prospective - importance of materials - Classification of Materials and its Properties. Bonding in solids: bonding forces and energies - primary and secondary bonding. Crystallography and Metallic structures: Unit cell - Crystallographic directions and planes, FCC, BCC, HCP, SC and other structure – miller indices, Linear and planar densities - close- packed crystal structures. Packing of atoms in solids. Packing factor

UNIT II CRYSTAL IMPERFECTIONS AND DIFFUSION 9 hours

Crystal Imperfections: Types, Vacancies and interstitials, Dislocations, and grain boundaries. Diffusion: Fick's Law of diffusion – Diffusion mechanism – Steady state and non-steady state, factors affecting diffusion.

UNIT III ELECTRICAL PROPERTIES OF MATERIALS 9 hours

Introduction and Electrical Conduction: Ohm's Law, Electrical Conductivity, Electronic and Ionic Conduction - Energy Band Structures in Solids, Electron Mobility - Electrical Resistivity of Metals Semi conductivity: Intrinsic and Extrinsic Semiconduction - Temperature Dependence of Carrier Concentration, Factors that Affect Carrier Mobility, The Hall Effect, Semiconductor Devices. Conduction in Ionic Materials, Electrical Properties of Polymers. Dielectric Materials: Capacitance, Ferroelectric Materials, Piezoelectric Materials.

UNIT IV MAGNETIC PROPERTIES OF MATERIALS 9 hours

Introduction and Basic Concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Anti ferromagnetism, Ferrimagnetism, Influence of Temperature on Magnetic Behavior, Domains and Hysteresis, Magnetic Anisotropy, Soft and Hard Magnetic Materials, Magnetic Storage, Superconductivity.

UNIT V PHOTONIC MATERIALS 9 hours

Introduction, Electronic Radiation in Vacuum; Reflection, Refraction, and absorption in materials; Absorption and Chemical Bonding: Color, X-Ray absorption, Photon absorption Devices - Photon Emission: X-Ray Emission, Emission of electromagnetic radiation and devices: LED's, OLEDs and LASERs. Optical Fibers in communication

Course Outcomes:

At the end of the course students will be able:

1. To develop deep knowledge of crystal structure and effect of structure on the properties of the materials
2. To demonstrate knowledge of various imperfections in crystal, and diffusion mechanism in materials
3. To explain the origins of various electronic and electrical properties in the materials
4. To understand the concept of magnetism, its origin and types, while choosing the right material for the given application
5. To summarize various optical properties of the material and light's transmission behavior

Text Books:

1. W. Callister, "Materials Science and Engineering", Wiley, 7th Edition, 2007.
2. Charles M. Gilmore, "Materials Science and Engineering Properties", Cengage Learning, SI Edition, 2016

Reference Books

1. Donald R. Askeland, Pradeep P. Phule, "The Science and Engineering of Materials", Cengage Learning, 5th Edition, 2006.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20ME302 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Objectives:

Students belonging to all branches of Engineering are made to learn following fundamental topics related to mechanical engineering:

1. To teach students the basic concepts of Thermodynamics.
2. To teach students the basic Classification and working principles of boilers and turbines.
3. To teach students about IC engines, Refrigeration, and Air-Conditioning systems.
4. To teach students about engineering materials and casting manufacturing processes.
5. To teach students and machines tools and manufacturing systems.

UNIT I THERMODYNAMICS 9 hours

Basic concepts of Thermodynamics: Introduction, Important terminologies used in thermodynamics, Specific heat capacity, First law of thermodynamics, Second law of thermodynamics, Reversible and irreversible processes, the Carnot cycle and the Clausius inequality.

UNIT II BOILERS, TURBINES AND PUMPS 9 hours

Boilers: Introduction to boilers, Classification of boilers, requirements of a good boiler, Cochran, Babcock, Locomotive, and Lancashire boilers.

Turbines: Hydraulic Turbines-Classification and specification, Principles, and operation of Pelton wheel turbine, Francis turbine, and Kaplan turbine (elementary treatment only).

Hydraulic Pumps: Introduction, Classification, and specification of pumps, reciprocating pump, and centrifugal pump.

UNIT III IC ENGINES AND REFRIGERATION SYSTEMS 9 hours

Internal Combustion Engines: Classification, I.C. Engines parts, 2 and 4 stroke petrol and 4-stroke diesel engines, Working principle of IC engines, Valve timing diagrams, Otto cycle, Diesel cycle, and Dual cycle. Refrigeration and Air conditioning Refrigeration – Introduction, Refrigerator, and Heat pump, Components of refrigeration system, Types of refrigeration system, and Type of refrigerants.

UNIT IV MATERIALS, CASTING AND TRANSMISSION 9 hours

Engineering Materials: Introduction, mechanical properties of engineering materials, mechanical testing of engineering materials, Impact test, and Classification of engineering materials.

Casting: Introduction to casting processes, Classification of casting processes, Sand casting, and special casting methods.

Power Transmission Devices: Introduction, belt drive, rope drive, Chain drive, Gear drive, Classification of gears.

UNIT V TOOLS AND MANUFACTURING SYSTEMS 9 hours

Machine Tools: Introduction, Mechanism of metal cutting, Geometry of single point cutting tool, Orthogonal and oblique metal cutting, Lathe, and Milling machines.

Manufacturing Systems Introduction, Computer Integrated Manufacturing, CAD/CAM, Numerical Control (NC), Computer Numerical Control, and Dynamics Numerical Control.

Course Outcomes:

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

1. State first, second and third law of thermodynamics.
2. Sketch components of boilers and turbines.
3. State working principle of IC engines and R& AC systems.
4. Fair understanding of application and usage of various engineering materials, Casting process, and different types of drives with applications.
5. Explain the role of Computers in manufacturing systems.

Text Books:

1. "Basic Mechanical Engineering" by Pravin Kumar, Pearson Edition ISBN: 9789332505759, 9789332505759.

Reference Books

1. George E Dieter, "Mechanical Metallurgy", 3rd Edition, McGraw Hill, 2017
2. S. Kalpakjian and S. R. Schmid, "Manufacturing Engg, and Technology", 7th Edition, Pearson, 2018
3. P K Nag, "Engineering Thermodynamics", 6th Edition, McGraw Hill, 2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

220EEE301 INDUSTRIAL ELECTRICAL SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course deals with basics of electrical wiring systems for residential, commercial and industrial consumers, and its representation with standard symbols and drawings, various components of industrial electrical systems and its sizing and control aspects of industrial electrical system using PLC and SCADA.

Course Objectives:
1. To understand the electrical wiring systems for residential, commercial and industrial consumers.
2. To learn the representation of systems with standard symbols and drawings.
3. To understand the various components of industrial electrical systems.
4. To analyze and select the proper size of several electrical system components.
5. To study the control aspects of industrial electrical system using PLC and SCADA

UNIT I ELECTRICAL SYSTEM COMPONENTS 9 hours

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices.

UNIT II RESIDENTIAL AND COMMERCIAL ELECTRICAL SYSTEMS 9 hours

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

UNIT III ILLUMINATION SYSTEMS 9 hours

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

UNIT IV INDUSTRIAL SUBSTATION SYSTEMS 9 hours

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

UNIT V INDUSTRIAL SYSTEM AUTOMATION 9 hours

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Course Outcomes:

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

1. Discuss the various component representation involved in the design of electrical wiring for Low Tension.
2. Understand the guidelines for wiring of household and commercial buildings.
3. Understand the various components of illumination in industrial electrical systems.
4. Select the proper size of various electrical system components required for designing different electrical wiring systems.
5. Understand the control aspects of industrial electrical system using PLC and SCADA.

Text Books:

1. S. L. Uppal and G. C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008
2. K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

Reference Books

1. S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.
2. H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.
3. https://www.bis.gov.in/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20EEE302 INTRODUCTION TO MEMS

L	T	P	C
3	0	0	3

Pre-requisite: 20EEE101

Course Description:
This course describes about manufacturing, modeling and applications of MEMS.

Course Objectives:

1. To know the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. To know various MEMS microfabrication technologies.
3. To provide various MEMS technology for mechanical, optical, and chemical sensors and actuator

UNIT I INTRODUCTION 9 hours

Overview – History and industry perspectives – Working principles – Mechanics and dynamics — Scaling law

UNIT II MICRO SENSORS & ACTUATORS 9 hours

Micro sensors: Pressure sensors, accelerometers, gyroscopes-Micro actuators: comb drive actuators – Micro-electromechanical systems.

UNIT III MICRO MANUFACTURING 9 hours

Materials for MEMS and Microsystems- Micro fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation, Chemical Vapour Deposition- Physical Vapour Deposition, Micro manufacturing: Bulk micromachining, surface micromachining, LIGA Process- Packaging.

UNIT IV MODELING IN MEMS 9 hours

Micro system design: Finite Element Methods-– Modeling of simulation – piezoelectric, Gyroscope

UNIT V MEMS APPLICATIONS 9 hours

Micro fluids-sensors for turbulence measurement and control, micro-actuators for flow control, RFMEMS- filters, Oscillators and phase shifters, Optical MEMS, micro robotics – Case studies

Course Outcomes:

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

1. Explain the fundamentals of MEMS materials, their physical properties and Principles of operation of MEMS devices.
2. Analyze the Micro sensors and actuators and its fabrication.
3. Explain the materials for MEMS and Microsystems.
4. Design MEMS using microfabrication techniques.
5. Explain the advantages of MEMS technology for mechanical, optical, and chemical sensors and actuator

Text Books:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2006

2. G.K. Ananthsuresh et al ,’Micro and Smart Systems’, Wiley, India, 2010

Reference Books

1. NadimMaluf, "An introduction to Micro electro mechanical system design", ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2000.
3. James J.Allen, micro electro mechanical system design, CRC Press published in 2005
4. Stephen D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20ECE301 BIO-MEDICAL ELECTRONICS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course provides the fundamental knowledge on applications of electronics in bio-medical signal measurements and processing, bio-medical instrumentation and imaging techniques.

Course Objectives:
This course enables students to

1. Acquire the basic knowledge on human physiology and biological transducers.
2. Learn about bio-electrodes and bio-amplifiers used in bio-signal acquisition.
3. Understand the working principle of bio-medical measuring instruments.
4. Study various types of imaging techniques used in medicine.
5. Learn the applications of medical instrumentation in designing artificial medical aids

UNIT I HUMAN PHYSIOLOGY AND BIOMEDICAL TRANSDUCERS 9 hours

Introduction to human physiology - Biomedical transducers for measuring displacement, velocity, force, acceleration, potential, dissolved ions and gases.

UNIT II BIO-ELECTRODES AND AMPLIFIERS 9 hours

Introduction to bio-potential, Bio-electrodes, Typical waveforms and characteristics of ECG, EMG and EEG, Bio-potential amplifiers for ECG, EMG and EEG – Lead systems and recording methods.

UNIT III BIOMEDICAL MEASURING INSTRUMENTS 9 hours

Measurement of blood pressure and temperature, Blood flow meter, Cardiac output measurement, Respiratory measurement, Blood cell counter, Impedance plethysmography.

UNIT IV MEDICAL IMAGING 9 hours

X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Nuclear imaging, Ultrasonic Imaging.

UNIT V PROSTHESES AND AIDS 9 hours

Pacemakers, Defibrillators, Heart-lung machine, Artificial kidney, Aids for the handicapped, Safety aspects

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

1. Understand the applications of biological transducers in medical field.
2. Analyze the design of bio-electrodes and bio-amplifiers.
3. Apply suitable measuring instruments to measure various medical parameters.
4. Understand and test various imaging techniques used in bio-medical diagnosis.
5. Analyze the applications of artificial medical aids.

Text Books:

1. W.F. Ganong, Review of Medical Physiology, 26th Edition, Tata McGraw-Hill, New Delhi, 2019.

2. J.G. Websster, ed., Medical Instrumentation, 3rd Edition, Wiley India Pvt. Ltd. 2009

Reference Books

1. A.M. Cook and J.G. Webster, eds., Medical Devices and Human Engineering, Taylor & Francis, 2014
2. R.S.Khandpur,"Handbook of Biomedical Instrumentation", 2nd edition, Tata McGraw - Hill, New Delhi, 2005
3. LeslieCromwell,"BiomedicalInstrumentationandMeasurement",Prentice-Hall, New Delhi, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20ECE302 VLSI DESIGN

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course describes about various VLSI design methodologies, fundamentals of CMOS technology. It incorporates basics of MOSFET models, CMOS design rules, Design of VLSI Systems, combinational logic design, sequential logic design, logic families and VLSI Design flow.

Course Objectives:
This course enables students to

1. Study the fundamentals of CMOS circuits and its characteristics
2. Learn the design and realization of combinational digital circuits.
3. Learn the design and realization of sequential digital circuits.
4. Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed
5. Learn the different FPGA architectures and testability of VLSI circuits.

UNIT I INTRODUCTION TO MOS TRANSISTOR 9 hours

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9 hours

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.
Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9 hours

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.
Timing Issues: Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9 hours

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.
Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9 hours

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan

Course Outcomes:

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

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies
3. Design and construct Sequential Circuits and Timing systems.
4. Design arithmetic building blocks and memory subsystems.
5. Apply and implement FPGA design flow and testing.

Text Books:

1. Neil H.E. Weste, David Money Harris "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits:A Design perspective", Second Edition , Pearson , 2016.

Reference Books

1. Operating Systems - Internals and Design Principles. Stallings, 6th Edition2009. Pearson education.
2. William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Prentice Hall, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

Open Elective - IV

20PHY303 THIN FILM TECHNOLOGY AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Nucleation, crystallization, surface energy, various thin film coating processes including both physical vapour deposition such as evaporation, sputtering, pulsed laser deposition and chemical vapour deposition, spray coating, and other methods such as spin-coating, plasma polymerization, Langmuir Blodgett, transport phenomena in thin films, various properties of thin films, techniques and method to characterize thin films, current application of thin film, introduction to fabrication of thin film devices

Course Objectives:

1. To provide students with a comprehensive overview on the fundamentals of thin film preparation and characterization.
2. To enable the students to develop a thorough understanding of how core physics can be used to understand thin film deposition processes.
3. To establish the correlation between processing variables and materials characteristics and performance within the framework of key modern technologies.
4. To realize thin film applications to science and technology

UNIT I PHYSICS OF THIN FILMS 8 hours

Introduction - Role of thin films in devices - Thin film definition - Crystalline and amorphous films - Crystal defects - Nucleation and growth - film formation.

UNIT II THIN FILM DEPOSITION TECHNIQUES 10 hours

Physical methods of films deposition-evaporation, e-beam, sputter deposition, pulsed laser, molecular beam epitaxy. Chemical methods of film deposition -Deposition of Inorganic films from Solutions-Chemical vapour deposition - Electrolysis, Anodization, Spray pyrolysis, Other techniques: Langmuir Blodgett and Spin Coating.

UNIT III PROPERTIES OF THIN FILMS 8 hours

Structural-Optical-Electrical-Magnetic-Mechanical and Thermal properties of thin films.

UNIT IV CHARACTERIZATION OF THIN FILMS 10 hours

Imaging Techniques (SEM, AFM, TEM) - Structural Techniques (XRD, Raman)-Optical Techniques (UV-Vis-NIR, PL)-Electrical Techniques (Hall Effect, IV, CV)-Magnetic Techniques (EPR, H-V curve)-Mechanical Techniques (Hardness testing)-Thickness measurement (profilometer, ellipsometry).

UNIT V APPLICATIONS OF THIN FILMS 9 hours

Transparent conducting coating - Optical coating – Solar cells – Photocatalytic – Sensors - Superconductivity- Superhard coatings – Thin film transistors.

Course Outcomes:

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

1. Discuss the differences and similarities between different vacuum based deposition techniques, evaluate and use models for nucleating and growth of thin films.
2. Asses the relation between deposition technique, film structure, and film properties.
3. Know the typical thin film applications.
4. Motivate selection of deposition techniques for various applications.

Text Books:

1. Thin Film Deposition: Principles and Practice, Donald L. Smith, McGraw Hill, Singapore, 2001.
2. Maissel, L.I and Glang. R, "Handbook of thin film technology", McGraw Hill, 1970.

Reference Books:

1. Thin film phenomena / Kasturi L. Chopra, New York: McGraw-Hill, c1969.
2. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
3. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications" Imperial College Press, 2004.
4. Thin film processes, John L Vossen, Werner Kehn editors, Academic Press, New York, 1978.
5. Thin film physics / O.S. Heavens, London: Methuen, c1970.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CHE303 INTRODUCTION TO NANO SCIENCE AND TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This is primarily a lecture course which brings together relevant knowledge from the disciplines of physics and chemistry to give students a fundamental understanding of the integrated multidisciplinary nature of Nanotechnology.

Course Objectives:

1. To understand the emergence of nanoscience and technology through history.
2. The various process techniques available for nanostructured materials.
3. The role of nanotechnology in electronics how basic nano-systems work
4. To use physical reasoning to develop simple nanoscale models to interpret the behaviour of such physical systems

UNIT I MOLECULE TO MATERIALS: BASICS OF NANOTECHNOLOGY **8 hours**

History & emergence (Feynman to present) of Nanoscience and Nanotechnology, Challenges in Nanotechnology. Atomic Structures: Rutherford and Bohr's model of atom. Bohr's model to Quantum: Wave function, Uncertainty principle, Orbital quantum numbers, Shape of the orbitals. Types of simple crystal structures, defects in crystals.

UNIT II TYPES AND SYNTHESIS OF NANOSTRUCTURES **10 hours**

Definition of a Nano system - Zero Dimensional (OD), One Dimensional (1D) - Two Dimensional (2D) - Three Dimensional (3D) nanostructured materials. Nanoscale building blocks, Top-down and Bottom-up approaches. Synthesis of Nanomaterials – Physical & Chemical methods: Chemical Vapour Deposition (CVD), Atomic Layer Deposition (ALD), Chemical Reduction, Co-precipitation, Emulsion Polymerization (Polymer and Organic NPs), Sol-Gel, Green synthesis of Nanoparticle (NP).

UNIT III PROPERTIES OF NANOMATERIAL **8 hours**

Thermal, Mechanical, Optical, Electrical and Magnetic properties of nanomaterials (Metal oxides, Ceramics, Nanocomposites, Semiconductors). Carbon age materials: CNTs, and other Carbon-based materials). Effect of size and shape on the properties of nanomaterials.

UNIT IV CHARACTERIZATION OF NANOMATERIALS **10 hours**

Structure: Powder XRD (SAXS); Composition: XPS; Thermal: TG-DTA; Optical & Electron microscopes: Atomic force microscopes (AFM), Scanning electron microscope (SEM), Transmission electron microscope (TEM); Magnetic characterization (SQUID).

UNIT V APPLICATIONS OF NANOMATERIALS **9 hours**

Molecular electronics and nano-electronics – LED applications, Quantum electronic devices - CNT based transistor and Field Emission Display – Biological (anti-bacterial, anti-fungal, anti-microbial) applications - Biochemical sensor - Membrane based water purification, Target based drug delivery system.

Course Outcomes:

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

1. Understand the correlation between atomic, molecular structures and nanomaterials
2. Classify the types and synthesis the nanomaterials based on the needs of the society and environment.
3. Infer and interpret the properties of nanomaterials
4. Apply the knowledge of characterization tools towards making the sustainable engineering products.
5. Illustrate the application of various nanomaterials in daily life, industry towards the sustainable development.

Text Books:

1. M. Wilson, K. Kannangara, G. Smith, M. Simmons, and B. Raguse, Nanotechnology: Basic science and Emerging technologies, Overseas Press India Pvt Ltd, New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, and A. K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh & Co, Weinheim, 2004.
3. Kenneth J. Klabunde (Eds), Nanoscale Materials Science, John Wiley & Sons, InC, 2001.
4. C. S. S. R. Kumar, J. Hormes, and C. Leuschner, Nanofabrication towards biomedical applications, Wiley - VCH Verlag GmbH & Co, Weinheim, 2004.
5. T. Pradeep, Nano: The Essentials, Understanding Nanoscience and Nanotechnology, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2007.

Reference Books

1. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
2. K. E. Drexler, Nano systems, Wiley, 1992.
3. G. Cao, Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperical College Press, 2004.
4. P. Yang, Chemistry of Nanostructured Materials, World Scientific Publishers, 2005.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Open Elective - IV

20CHE304 COMPUTATIONAL METHODS IN MATERIALS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Exposure to Introductory engineering mathematics, introductory materials science and introductory programming courses is preferred.

Course Description:

This course deals with various computational approach and mathematical methods to understanding and apply different concepts in materials science and engineering.

Course Objectives:

1. To get exposed to the basic concepts in Materials Science and Engineering.
2. To understand the basic concepts of Programming and Graphical plotting.
3. To introduce the basic concepts of Data types and handling of various data.
4. To familiarize the basic concepts of modelling and simulation.
5. To acquire and apply the current knowledge and trends in the field of Computational Materials Science.

UNIT I INTRODUCTION TO COMPUTATIONAL MATERIALS SCIENCE AND ENGINEERING **9 hours**

Concepts in materials science and engineering; use of computers and freely available open source software to: data handling; understand concepts and solve problems of engineering interest.

UNIT II PROGRAMMING AND PLOTTING **9 hours**

Introductions to the advanced concept C programming language; open source software for numerical computations and visualization (gnuplot, GNU Octave, Scilab); introduction to the LaTeX software for report preparation along with other miscellaneous software and programs.

UNIT III DATA TYPES AND HANDLING TECHNIQUES **9 hours**

Classification, and understanding of data properties, data handling - plotting, fitting, functional forms, interpolation, and integration.

UNIT IV COMPUTATIONAL MODELING AND SIMULATIONS **9 hours**

Understanding the materials properties; atomistic and electronic modelling of materials; concepts in molecular dynamics and its application using Quantum ESPRESSO.

UNIT V CURRENT TRENDS IN COMPUTATIONAL MATERIALS SCIENCE **9 hours**

Applied materials for various engineering field; research literature exploration; real-time application of computational methods in materials science and engineering, mini-project.

Course Outcomes:

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

1. Understand the importance and applications of computational methods in Materials Science and Engineering.
2. Be familiarized with the tools of the trade, namely programming and graphical plotting.
3. Be able to understand and access the various types of data sets and appropriately handle it to productively work with it.
4. Get the knowledge about handling various open source computational tools and their effective usage to do computational modeling and simulations.
5. Be familiarized with up to date trends in computational materials science by taking up real time research problems and provide solutions.

Text Books:

1. Computational Materials Science: An Introduction, Second Edition 2nd Edition, by June Gunn Lee, 2014
2. Materials science and engineering: an introduction, William D Callister, Sixth edition, John Wiley & Sons, 2013.
3. The C programming language, Brian W Kernighan and Dennis M Ritchie, Second edition, PHI Learning Private Limited, 2010.
4. Materials science and engineering: a first course, V Raghavan, Fifth edition, PHI Private Limited, 2008.
5. Physical metallurgy principles, Robert E. Reed-Hill, Second edition, Affiliated East-West Press Pvt. Limited, 2008.
6. An introduction to materials science and engineering, Kenneth M Ralls, Thomas H Courtney, and John Wulff, Wiley India Pvt. Ltd., 2011.

Reference Books

1. Materials Science and Engineering,V Raghavan,Prentice-Hall India, 2004
2. Advanced Engineering Mathematics, E Kreyzig, Wiley-India,1999.
3. A Review of Computational Methods in Materials Science, International Journal of Molecular Sciences 10(12):5135-216

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - IV

20CE304 GREEN BUILDINGS AND ENERGY CONSERVATION

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
The course covers various aspects of bioclimatic architecture like climate sensitive design, passive solar architecture, Water management, green building materials and construction techniques.

Course Objectives:

1. The course introduces concepts of sustainability and bioclimatic design in planning, construction and life of buildings.
2. This course intends to equip students with technical knowledge of energy-efficient green buildings
3. This course guide students, through projects, to apply concepts and ideas for the design of a green building by introducing them to green initiatives and ratings.
4. This course also initiates students in basics of functional design and drawing of the various buildings using the above concepts.

UNIT I GREEN BUILDING CONCEPTS 9 hours

Introduction to bioclimatic architecture - Sustainability in building science and Functional planning - Orientation - Elements of building design and drawing - Building regulations and bylaws - Traditional and VernacularArchitecture - Climate zones - Design Charts - sun path diagram - Solar angles - Indices of thermal comfort - Vernacular buildings in different climate zones.

UNIT II CLIMATE RESPONSIVE SCIENTIFIC PROCESS OF DESIGN 9 hours

Introduction - various steps in Site planning - Plan form Building envelope Land form -Topography - vegetation - water bodies; Orientation - S/V ratio - P/A ratio - Walls, Fenestration - Roof and floors - Active and passive solar strategies - Passive solar architecture.

UNIT III THERMAL FLOW IN BUILDINGS 9 hours

Calculation of thermal conductance - Heat flow through different building elements - Ventilation and day lighting- Design and placement of openings- Water management in buildings- Techniques to recycle, reuse and harvest water.

UNIT IV GREEN BUILDING MATERIALS AND CONSTRUCTION 9 hours

Material properties - Energy efficiency using various materials - emerging new materials Construction techniques- Techniques for roof, wall and foundations.

UNIT V ECONOMY OF GREEN BUILDING 9 hours

Cost of building - operation and maintenance - Green building rating system - Evaluation criteria of LEED - TERI GRIHA case studies - Case studies in different climate zones.

Course Outcomes:

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

1. Use various regulations and by laws for green building construction0.
2. Do site planning for Green Building.
3. Compute thermal flow through different building elements
4. Identify energy efficient building materials
5. Compute cost of building/operation and maintenance

Text Books:

1. Krishnan, A., Baker, N., Yannas, S., & Szokolay, S. (Eds.). (2001). Climate responsive architecture, a design handbook for energy efficient buildings. New Delhi: Tata McGraw- Hill Publishing Company.
2. TERI & ICAEN (InstitutCatalad'Energia). (2004). Sustainable building design manual (Vol. II). New Delhi: The Energy and Resources Institute(TERI) Press.

Reference Books

1. Bureau of Indian Standards. (1995). SP:41, Handbook on functional requirements of buildings (other than industrial buildings) (First reprint ed.). New Delhi: Bureau of Indian Standards.
2. Indian Green Building Council, LEED-India. (2011). LEED 2011 for India- Green building rating system, abridged reference guide for new construction and major renovations (LEED India NC). Hyderabad: Indian Green Building Council.
3. Koenigsberger, O., ingersoll, T. G., Mayhew, A., & Skozolay, S. V. (2011). Manual of Tropical Housing and Building. Hyderabad: Universities Press.
4. Prabhu, Balagopal T S, K Vincent Paul, and C Vijayan. Building Design and Drawing. Calicut: Spades Publishers, 2008.
5. Szokolay, S. V. (2008). Introduction to Architectural Science - The Basis of sustainable Design (Second ed.). Architectural Press/Elsevier.
6. The Energy and Resources Institute (TERI). (2011). Green Rating for Integrated Habitat Assessment (GRIHA) manual. New Delhi: TERI press.
7. Journals: Energy and Buildings, Building and Environment, Other relevant publications.
8. National Building Code, Bureau of Indian Standards: New Delhi. 2005; Building Bye laws and building rules of selected Indian urban and rural areas
9. Swamy, N. K., & Rao, A. K. (2013). Building planning and Drawing,New Delhi, CharotharPublishing House

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - IV

20CE305 ENVIRONMENTAL ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

The course covers demand, quality and treatment of water along with characterization, water and wastewater treatment plant units and design , low cost treatment of wastewater and household drainage. Similarly, air pollution, noise pollution and solid waste management are also included. Further the course also covers basic laboratory

Course Objectives:

1. To explain different sources of water, water quality standards, water demands, distribution of water, population forecast, characteristics of water.
2. To analyze various water treatment plant units and their design considerations, advanced water treatment systems.
3. To explain the generation and collection of wastewater; wastewater treatment plant design, various wastewater treatment units and sludge treatment.
4. To explain various impacts of air and noise pollution and various methods to control them air and noise pollution
5. To describe about solid waste generation, characterization, impacts and various management techniques

UNIT I WATER SUPPLY ENGINEERING 9 hours

Water- Sources of Water, Water quality standards, Quantity of water: water demands, percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and distribution of water; Quality of water: Physical, chemical, and biological characteristics of water and significance, necessity of treatment, water quality standards for various water uses.

UNIT II WATER TREATMENT 9 hours

Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection; Methods of treatment: Removal of color, tastes and odor control, removal of iron and manganese, fluoridation and defluorination. Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only.

UNIT III WASTEWATER TREATMENT 9 hours

Generation and collection of wastewaters- sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system. Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation. Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended growth systems, Attached growth systems, Secondary clarification, Disinfections of effluents; Sludge treatment and disposal: Sludge characteristics, thickening, disposal.

UNIT IV AIR AND NOISE POLLUTION 9 hours

Air - Composition and properties of air, urban air pollution, Air quality standards, Measures and major equipment for air pollution control, Noise - Basic concept, measurement, and various noise control methods.

UNIT V SOLID WASTE MANAGEMENT 9 hours

Solid waste management-Municipal solid waste, Composition, and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment, and disposal of MSW. Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle, Disposal methods.

Course Outcomes:

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

1. Estimate water demand and population forecasting and characteristics of water
2. Estimate water generation and perform basic design of the unit operations that are used in water treatment plants.
3. Explain various wastewater generation sources and different units of wastewater treatment and sludge treatment techniques
4. Describe the impacts of air and noise pollution and review various air and noise pollution control methods
5. Discuss about the impacts of solid waste and various solid waste management techniques

Text Books:

1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers.
2. Rao M and Rao H. V. N. Air Pollution, McGraw Hill Education, 2017.
3. Jagbir Singh and Ramanathan A. L., Solid Waste Management: Present and Future Challenges, I K International Publishing House Pvt. Ltd., 2009
4. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

Reference Books

1. Birdie, G.S, Birdie, J.S., Water supply and sanitary Engineering, Including Environmental Engineering, Water and Air Pollution Laws and Ecology, Dhanpat Rai Publications, 1996.
2. Punmia, B.C, Ashok Kr Jain, Arun Kr Jain., Waste Water Engineering, Laxmi Publications, 1998.
3. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
4. Metcalf & Eddy, Wastewater Engineering Treatment and Dispose, McGraw Hill Publication

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - IV

20ME303 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

Total quality management (TQM) is a philosophy, methodology and system of tools aimed to create and maintain mechanism of organization's continuous improvement. It involves all departments and employees for the improvement of processes and products. TQM encompasses various principles, techniques, and tools for identifying and solving problems, fostering a culture of quality, promoting teamwork, and striving for excellence in all areas of the organization. The goal of TQM is to achieve sustainable and long-term success by consistently delivering high-quality products and services that meet or exceed customer expectations while improving overall organizational performance.

Course Objectives:

Students will

1. Study comprehensive knowledge about the principles, practices, tools and techniques of total quality management.
2. Gain knowledge on leadership, customer satisfaction, addressing customer complaints, team work, employee involvement, related to customer and supplier partnership.
3. Gather information on various tools and techniques, concept on Six Sigma, bench marking and Failure Mode Effective Analysis (FMEA).
4. Know the importance of Quality circle, Quality Function Deployment, Taguchi design and case studies related to TQM.
5. Facilitate the understanding of standards of quality.

UNIT I INTRODUCTION **9 hours**

Introduction - Evolution of Quality - Historical Perspective, Basic Concepts of Quality – Quality control, Quality management and Quality Assurance - Definition of TQM – Basic concepts of TQM - TQM Framework - Contributions by Deming, Juran, Crosby and Feigenbaum – Dimensions of product and service quality

UNIT II TQM PRINCIPLES **9 hours**

TQM principles - Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Role of Leadership and Commitment in Quality Deployment, Team Building, Motivation and Rewards, Total Employee Empowerment, Performance appraisal - Continuous process improvement – Supplier partnership – Partnering, Supplier selection,

UNIT III TOOLS OF TQM **9 hours**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – KAIZEN, 5S, JIT, Documentation – Failure mode and Effect Analysis (FMEA)

UNIT IV TQM TECHNIQUES **9 hours**

Quality circles – Quality Function Deployment (QFD) – House of Quality – Design of Experiments – Taguchi quality engineering – Orthogonal Arrays – Signal to Noise Ratio – TPM – Concepts, improvement needs – Cost of Quality – Performance measures

UNIT V IMPELMENTATION OF TQM **9 hours**

Introduction – Benefits of ISO Registration – ISO 9000 Series of Standards –Implementation – Environmental Management System: Introduction – ISO 14000 Series Standards – Concepts of ISO 14001 – Requirements of ISO 14001, Case studies on TQM principles followed by Indian Industries.

Course Outcomes:

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

1. Understand the various principles and practices of TQM to achieve quality.
2. Identify the various statistical approaches for Total Quality Control.
3. Demonstrate the TQM tools for continuous process improvement.
4. Adopt the importance of ISO and Quality systems.
5. Make use of the concepts of TQM to solve case studies

Text Books:

1. Dale H. Besterfield, et al., Total Quality Management, Pearson Education Asia, Third Edition, Indian Reprint (2003).

Reference Books

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition (2003).
3. Suganthi,L and Anand Samuel, Total Quality Management, Prentice Hall (India) Pvt. Ltd. (2006) Model.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – II

20ME304 ENTREPRENEURSHIP

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:
This course is designed to ignite the entrepreneurship idea into the young minds of engineers. This course gives the complete details to setup an enterprise which includes the generating business ideas, writing business plan and executing the plan successfully.

Course Objectives:
1. Understand the requirements of entrepreneurship as a profession.
2. Understand and develop the business plan.
3. Identify the various financial terms and conditions of new business venture.
4. Selection of plant location and choosing layout.
5. Analyse the market research for new ventures and small businesses.

UNIT I INTRODUCTION 9 hours

Introduction to Entrepreneurship, history of entrepreneurship development, social Entrepreneurship, Intrapreneurship, Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs. Manager, Entrepreneur vs Intrapreneur. The Entrepreneurial decision processes. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. Realities & Case studies about successful Entrepreneur

UNIT II CREATING AND STARTING THE VENTURE 9 hours

Sources of new Ideas, Methods of generating ideas. The Business Plan Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, implementation of business plans. Case studies of successful business plan, Marketing plan, financial plan, and organizational plan, Launching formalities. Developing business plan and evaluation with team.

UNIT III FINANCING AND MANAGING THE NEW VENTURE 9 hours

Sources of capital, venture capital, angel investment, Record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. Ecommerce and Entrepreneurship, Internet advertising. New venture Expansion Strategies and Issues, Features and evaluation of joint ventures, acquisitions, merges, franchising. Case studies about entrepreneur who success or failure in their business based on the financial control

UNIT IV PLANT LAYOUT 9 hours

Definition of plant layout and its types, Issues related to Selection of layout. Production and Marketing Management, Selection of production Techniques, plant utilization and maintenance. Case study about selection of site and plant layout for new business venture.

UNIT V MARKET ANALYSIS AND PROJECT MANAGEMENT 9 hours

Inventory control, material handling and quality control. Marketing functions, market segmentation, market research and channels of distribution, Sales promotion and product pricing. Case studies on market analysis on entrepreneur perspective. Project Organization- Project Planning, Monitoring, Control and Learning. Detailed life cycle and post-mortem analysis, Resource allocation, Risk and uncertainty, Budget constraints, Project feasibility.

Course Outcomes:

Upon completion of this course the students shall be able to:

1. Describe the sources of new business ideas, methods to develop new ideas and use the problem-solving techniques.
2. Write a business plan which includes financial plan, organizational plan and marketing plan.
3. Identify the financial sources for new business ventures.
4. Select a plant layout and draw a plant layout.
5. Design a workplace and analyse the market research for new business.

Text Books:

1. Entrepreneurship, Robert Hisrich, & Michael Peters, 5/e TMH.
2. Entrepreneurship, Dollinger, Pearson, 4/e, 2004.

Reference Books

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publ. House, 2004.
2. Harvard Business Review on Entrepreneurship. HBR Paper Back, 1999.
3. Entrepreneurial Management, Robert J.Calvin, TMH, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – IV

20EEE303 ROBOTICS

L	T	P	C
3	0	0	3

Pre-requisite Nil 20EEE108

Course Description:

Robotics is an interdisciplinary area ranging from mechanical & electrical component design to advanced sensor technology, incorporating computer systems and Artificial Intelligence (AI). With advances in AI-techniques & computational power in recent years, it has become one of the most interesting areas for multidisciplinary research, with lots of commercial applications already in market.

Course Objectives:

This course enables students to

1. To know the fundamentals of Robotics & its applications.
2. To know about sensors and make them to handle the selection of sensors for robot design.
3. To know about kinetic and Jacobian modelling.
4. To know about robot programming and implementation.

UNIT I INTRODUCTION, TRANSFORMATION AND MAPPING 9 hours

Evolution of Robots and Robotics, Laws of Robotics, Advancement in Robots, Robot Anatomy, Human Arm Characteristics, Design and Control Issues, Manipulation and Control, Sensors and Vision, Robotic Programming and Future Prospects.

Coordinate Frames, Object Description in Space, Transformation of Vectors, Inverting a homogenous transform, Fundamental Rotation Matrices.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 9 hours

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers.

Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III SENSORS AND MACHINE VISION 9 hours

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors, binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV ROBOT KINEMATICS 9 hours

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems

UNIT V ROBOT PROGRAMMING, IMPLEMENTATION AND ECONOMICS **9 hours**

Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs. RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand the fundamentals of Robotics.
2. Analyze the robot drive system.
3. Understand the various sensors and actuators.
4. Analyze the mechanical structure and notations kinematic model.
5. Implement the basic commands for robots.

Text Book(s)

1. Mittal, R. K. and Nagrath, I.J., Robotic and Control, Tata McGraw Hill, New Delhi, 2003.
2. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approach, Universities Press, 2015. ISBN: 978-8173719547

Reference Books

1. Fu, K.S., Gonzalez, R.C., and Lee, C.S.G., Robotics Control, Sensing, Vision and Intelligence, McGraw Hill, 1988.
2. Craig, J.J., Introduction to Robotics: Mechanism & Control. Addison Wesley, 1986.
3. Paul, R.P., Robot Manipulator: Mathematics Programming & Control. MIT Press, 1981.
4. Pugh, A., Robot Sensors, Vision Vol.-I. Springer Verlag, 1986.
5. Groover, M.P., Industrial Robotics Technology, programming & Application, McGraw Hill,

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – IV

20EEE304 ELECTRICAL SAFETY

L	T	P	C
3	0	0	3

Pre-requisite Nil 20EEE101

Course Description:

To provide a comprehensive exposure to electrical hazards, various grounding techniques, safety procedures and various electrical maintenance techniques.

Course Objectives:

This course enables students to

1. To impart knowledge on electrical hazards and safety equipment.
2. To analyze and apply various grounding and bonding techniques.
3. To select appropriate safety method for low, medium and high voltage equipment.
4. To understand how to participate in a safety team.
5. To carry out proper maintenance of electrical equipment by understanding various standards.

UNIT I ELECTRICAL HAZARDS 9 hours

Primary and secondary hazards- arc, blast, shocks-causes and effects-safety equipment- flash and thermal protection, head and eye protection-rubber insulating equipment, hot sticks, insulated tools, barriers and signs, safety tags, Classification of insulating materials, locking devices- voltage measuring instruments- proximity and contact testers-safety electrical one-line diagram-electrician's safety kit.

UNIT II GROUNDING AND BONDING 9 hours

General requirements for grounding and bonding- definitions- grounding of electrical equipment-bonding of electrically conducting materials and other equipment- connection of grounding and bonding equipment- system grounding- purpose of system grounding- grounding electrode system-grounding conductor connection to electrodes-use of grounded circuit conductor for grounding equipment- grounding of low voltage and high voltage systems Ground resistance measurement using megger.

UNIT III SAFETY METHODS 9 hours

The six step safety methods- pre job briefings- hot -work decision tree-safe switching of power system- lockout-tag out- flash hazard calculation and approach distances- calculating the required level of arc protection-safety equipment, procedure for low, medium and high voltage systems- the one minute safety audit.

UNIT IV SAFETY TEAM 9 hours

Electrical safety programme structure, development- company safety team- safety policy-programme implementation- employee electrical safety teams- safety meetings- safety audit-accident prevention-first aid- rescue techniques-accident investigation.

UNIT V MAINTENANCE OF ELECTRICAL EQUIPMENT 9 hours

Safety related case for electrical maintenance- reliability centred maintenance (RCM) - eight-step maintenance programme- frequency of maintenance- maintenance requirement for specific equipment and location- regulatory bodies- national electrical safety code- Indian standard for electrical safety in work place- occupational safety and health administration standards.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Analyze and apply various grounding and bonding techniques.
3. Select appropriate safety method for low, medium and high voltage equipment.
4. Participate in a safety team.
5. Carry out proper maintenance of electrical equipment by understanding various standards**.**

Text Book(s)

1. Dennis Neitzel, Al Winfield, 'Electrical Safety Handbook', McGraw-Hill Education, 4th Edition,2012.

Reference Books

1. John Cadick, 'Electrical Safety Handbook', McGraw-Hill School Education Group, 1994.

2. The Institution of Electric Engineers, 1994.

3. Ray A. Jones, Jane G. Jones, 'Electrical safety in the workplace', Jones & Bartlett Learning, 2000.

4. Tareev, 'Electrical Engineering Materials', Verlag Technik, Berlin

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – IV

20ECE303 EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite None

Course Description:
The course will provide strong foundation on embedded system design. The course covers theory and logic to develop programming expertise. Student will understand application of embedded microcontrollers ARM.

Course Objectives:
This course enables students to

1. To provide knowledge on the basics, building blocks of Embedded System.
2. To provide basic of operating system and Real time programming languages
3. To teach automation using scheduling algorithms and Real time operating system.
4. To understand firmware design and Architectural Support for Operating Systems for various applications
5. To discuss on different Phases & Modeling of a new embedded product.

UNIT I THE CONCEPT OF EMBEDDED SYSTEMS 9 hours

Embedded System Design, Introduction to Embedded Hardware Elements, Sensors and Actuators, Embedded Processors, Memory Architectures. Embedded System vs. General Purpose computing systems, Examples of embedded systems, Embedded memories, Embedded microcontroller cores

UNIT II SOFTWARE ASPECTS OF EMBEDDED SYSTEMS – I 9 hours

Operating System Basics, types of Operating Systems, Task and Task States, Semaphores and shared Data, RTOS services and design using RTOS, Tasks, Process and Threads, Multiprocessing and Multitasking, Real time programming languages.

UNIT III SOFTWARE ASPECTS OF EMBEDDED SYSTEMS- II 9 hours

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication Synchronization Issues, Task Synchronization Techniques, Device Drivers, how to Choose an RTOS, Integrated Development Environment (IDE).

UNIT IV FIRMWARE AND ARCHITECTURAL SUPPORT FOR OPERATING SYSTEMS 9 hours

Firmware and Bootloader, an introduction to operating systems, The ARM system control coprocessor Embedded ARM Applications, CP15 protection unit registers, CP15 MMU registers, ARM MMU architecture, Synchronization, Context switching, Input/Output, Example and exercises, The ARM7500 and ARM7500FE.

UNIT V MODELLING WITH HARDWARE/SOFTWARE DESIGN APPROACHES 9 hours

Modelling embedded systems- embedded software development approach -Overview of UML modelling with UML, UML Diagrams-Hardware/Software Partitioning, Co-Design Approaches for System Specification and modelling- Co-Synthesis- features comparing Single-processor Architectures & Multi-Processor Architectures-design approach on parallelism in uniprocessors & Multiprocessors.

Course Outcomes:

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

1. To understand the functionalities of processor internal blocks, with their requirement
2. Understand the basics of operating systems and then to learn the programming language used for real time operating system.
3. systems and related terms.
4. Understand the role and features of RT operating system, that makes multitask execution possible by processors.
5. Understand that using multiple CPU based on either hard-core or softcore helps data overhead management with processing.

Text Book(s)

1. M.A. Mazdi & J.G. Mazdi, The 8051 Microcontroller and Embedded System, Pearson Education India , 2013
2. Andrew N. Sloss & Dominic Symes, ARM System Developer's Guide Designing and Optimizing System Software, Morgan Kaufmann Publisher, 2004.

Reference Books

1. Steve Furber, Arm System-On-Chip Architecture, 2000.
2. J.K. Peckol, Embedded Systems A contemporary Design Tool, Wiley Student Edition , 2008
3. K J Ayala, The 8051 Microcontroller Architecture, Programming and Application, Penram International Publishing (India)
4. S. Heath, Embedded Systems Design, Elsevier, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective – IV

20ECE304 DSP ARCHITECTURE

L	T	P	C
3	0	0	3

Pre-requisite 20ECE110

Course Description:

The course will provide an insight into the architectures of DSP processors for handling the bottlenecks in executing DSP algorithms. On the application side the students can develop FPGA based DSP Systems and can understand the concept of multicore DSP as HPC infrastructure

Course Objectives:

This course enables students to

1. Understand the programmable digital signal processing hardware.
2. study the architecture of TMS320CX processor and block diagram
3. Know syntax and write the assembly language programming for digital signal processors.
4. Study the architecture of FPGA based DSP for various applications.
5. Study about High-Performance Computing using P-DSP.

UNIT I PROGRAMMABLE DSP HARDWARE 9 hours

Introduction: Digital signal-processing system, discrete Fourier Transform (DFT) and fast Fourier transform (FFT), differences between DSP and other microprocessor architectures. Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating-Point Computations, Special Architectures, Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

UNIT II STRUCTURAL AND ARCHITECTURAL CONSIDERATIONS 9 hours

Parallelism in DSP processing, Commercial digital Signal-processing Devices, Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, Data Addressing Modes of TMS32OC54xx., TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

UNIT III VLIW ARCHITECTURE 9 hours

Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Optimizations, Heuristics. Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple application developments as an embedded environment.

UNIT IV FPGA BASED DSP SYSTEMS 9 hours

Limitations of P-DSPs, FPGA based signal processing design-case study of a complete design of DSP processor.

UNIT V HIGH PERFORMANCE COMPUTING USING P-DSP 9 hours

Modified bus structures and memory access in PDSPs, special addressing modes in PDSPs, Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

Course Outcomes:

After completing this Unit, students will be able to
1. Identify and formalize architectural level characterization of DSP hardware.
2. Design and test various digital signal processors.
3. Write assembly language programming for various digital signal processors.
4. Utilize FPGA based DSP hardware for Control, Audio and Video Signal processing applications.
5. Understand the High-Performance Computing using P-DSP.

Text Book(s)

1. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Applications", Tata McGraw-Hill Education Private Limited, 2011.

2. Phil Lapsley; Jeff Bier; Amit Shoham; Edward A. Lee, "DSP Processor Fundamentals: Architectures and Features", Wiley-IEEE Press, 1997.

Reference Books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing: A practical approach", Pearson-Education, PHI, 2002.

2. Sen M. Kuo, Woon-Seng S. Gan, "Digital Signal Processors: Architectures, Implementations, And Applications", Pearson/Prentice Hall, 2005.

3. Peter Pirsch, "Architectures for Digital Signal Processing", John Wiley & Sons, 2009

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - V

20HUM301 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The course provides students with a practical and concrete explanation of management concepts and techniques they will need to manage today's and tomorrow's organizations. The course will follow the "planning, organizing, leading, controlling" format of managerial functions while putting together many small pictures presented by individual modules into one bigger meaningful picture in which managerial knowledge would apply. At the end of the course students are expected to understand role of components of bigger picture and interactions between and among components.

Course Objectives:

The course is intended to:

1. Describe the concepts of Management theories, approaches and their application with organizations around us;

2. Know the concepts of planning and management;

3. Explain the basic concepts of organization, types and structure of organization;

4. Make the students know leading, good communication, theories of motivation; and

5. Explain controlling, operations management, value chain management and management audit.

UNIT I INTRODUCTION 9 hours

Introduction to Management and Organizations- Management definition, skills, roles, goals and functions of a manager, organization, value of studying management - Managing in a Global Environment- Global Perspective, Understanding global environment, - Social Responsibility and Managerial Ethics.

UNIT II PLANNING 9 hours

Decision-making process, Types of decisions and decision making conditions, styles, biases and errors, Planning: Meaning of planning, establishing goals and developing plans, contemporary issues in planning - Strategic Management-Importance of strategic management, strategic management process, types of organizational strategies, current issues in strategic management.

UNIT III ORGANIZING 9 hours

Organizational structures - HRM process, Contemporary issues in HRM – Departmentation – decentralization – delegation of Authority - Managing Change and Innovations.

UNIT IV COMMUNICATION, MOTIVATION AND LEADING 9 hours

Functions of communication, Inter-personal communication, Barriers of Communication – Understanding Information Technology- Motivation**:** Theories of motivation and current issues in motivation. Leading: Leaders and Leadership, Leadership theories - Leadership issues in twenty first century

UNIT V CONTROLLING 9 hours

Process of Control – Problems of Control Process-Types of Control – Techniques of Control-Essential conditions for effective control- Contemporary issues in control – Strategic role of Operations Management - Value Chain Management.

Management Audit: Objectives-Importance-Activities of Management Auditor.

Course Outcomes:

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

1. Understand the various concepts, approaches and theories of management in the real situation,

2. Analyze the concept of planning and apply on the decisions in strategic management,

3. Compare organization structure designs and chart diligently with theoretical learning concepts,

4. Apply communication and theories of motivation in an organization, and

5. Understand various tools for controlling organizational performance, management audit and apply to achieve the corporate objectives.

Text Book(s)

1. Stephen P. Robbins, Mary Coulter "Management", Pearson Education, 2010, 10th edition.

2. P. Subba Rao "Management and Organizational Behavior", Himalaya Publishing House.

Reference Books

1. Gary Dessler, "Management", Prentice Hall, Inc., 1998, 1st edition.

2 Daft Richard L. 'Management' Thomson South Western, 5th edition.

3 Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. ed., 2004, 6th edition.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - V

20HUM302 HUMAN RESOURCE DEVELOPMENT

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

The course content includes: Introduction to HRM, strategic human resource challenges, work flows, job analysis, managing diversity, concepts, goals, mechanism and system of HRD, recruitment and selection, downsizing and outplacement, appraising and managing employee performance, training, career development, managing compensation, rewarding performance, designing benefit plans, employee relation and employee discipline, and workplace safety and health.

Course Objectives:

The course is intended to:

1. Explain the nature and scope of HRM, its functions, policies and strategies;
2. Describe the human resource planning, work analysis and importance in designing jobs;
3. Know the recruitment, selection and the process of performance appraisal;
4. Make the student to learn about training and development, compensation management and
5. Explain the trade unions, industrial relations and grievance.

UNIT I INTRODUCTION 9 hours

Understanding the nature and scope of Human Resource Management- Definition, Evolution of HRD, Functions - objectives, organization of department. Human Resource Management v/s Personnel Management, Role and responsibility of HRM.

UNIT II HUMAN RESOURCE PLANNING 9 hours

Human Resource Planning- Factors affecting HRP, the planning process, managerial succession planning. Job Analysis, Methods of collecting job data, Competency based Job Analysis, Job design approach, contemporary issues in Job Description.

UNIT III RECRUITMENT, SELECTION AND PERFORMANCE APPRAISAL 9 hours

Recruiting and selecting employees-, Selection process, Barriers, selection in India. Performance Management, Process of Performance Appraisal, Methods of Performance Appraisal - Errors in Performance Appraisal.

UNIT IV TRAINING AND DEVELOPMENT 9 hours

Meaning – importance and benefits of Training and Development, Training v/s Development – Training Methods - challenges in training - Career development: Definition-objectives—importance of career development – Reward Management – Compensation Management: Nature-Objectives-Components of Compensation- Theories of Compensation-Factors influencing employee compensation.

UNIT V INDUSTRIAL RELATIONS, TRADE UNIONS 9 hours

Trade Unions: Importance-Objectives- Functions and Structure of the Trade Unions- Trade Union movement in India- Industrial Relations: Nature--Importance- Approaches-essential conditions for sound IR. Industrial Disputes: Meaning – Types- Causes-Industrial disputes settlement machinery. Grievance: Sources and Process of Redressal,

Course Outcomes:

At the end of the course, students will be able to:
1. Understand the concept of HRM, its nature, scope, functions, policies and strategies;
2. Analyse human resource planning and apply in designing jobs;
3. Evaluate the recruitment, selection and the process of performance appraisal;
4. Understand the importance of training and development activities, compensation management
5. Examine the trade unions, industrial relations and grievance.

Text Book(s)

1. Aswathappa K., Human Resource Management- Text and Cases, Tata McGraw Hill, 6th Edition, 2010
2. Gomez-Mejia, L.R., Balkin, D.B., & Cardy, R.L. Managing Human Resource Management 6th edition, Pearson Edu. 2007.
3 VSP Rao, Human Resource Management-Text & Cases, Excel Books.

Reference Books

1. Garry Dessler, BijuVarkkey , Human Resource Management ,11th Edition, Pearson Education, 2009.
2 R. Wayne Mondy, Human Resource Management, 10th Edition, 2010
Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Open Elective - V

20HUM303 SOFT SKILLS

L	T	P	C
3	0	0	3

Pre-requisite NIL

Course Description:

Soft skills are the personal attributes that make a student a valuable employee and a wholesome personality. They include aspects like communication, teamwork, problem-solving, and time management. Employers are increasingly looking for employees with strong soft skills, as they are essential for success in the workplace. This course will help students analyze themselves and build soft skills needed for their personal and career success.

Course Objectives:

The course is intended to:

1. Analyze their strengths and skills, and build confidence in presenting themselves
2. Work seamlessly as a team and negotiate for solutions
3. Think laterally and critically to evaluate a situation and present it with clarity
4. Write business emails effectively
5. Prepare holistically for a job interview

UNIT I SELF ANALYSIS AND DEVELOPMENT 10 hours

Personal ethics (politeness, empathy, and honesty); self-motivation / building confidence and assertiveness; identifying one's unique selling points (USPs) through skills introspection and recognizing strengths and weaknesses; nurturing strengths and fixing weaknesses; self-introduction.

UNIT II TEAM WORKING AND DYNAMICS 12 hours

Brainstorming techniques, team building, collaboration, and negotiation skills; team role plays (involving negotiation and decision making); group discussion etiquette (greetings and body language), idea generation, and common GD phrases; group discussion practice

UNIT III THINKING AND REASONING SKILLS 6 hours

Lateral thinking, critical thinking and logical reasoning through texts, images, and videos; Speaking activities (e.g. JAM) involving lateral thinking and reasoning through thought-provoking pictures, videos, cartoons, comic strips or articles.

UNIT IV PRESENTATION SKILLS 7 hours

Presentation etiquette; slides design; and presentation practice.

UNIT V INTERVIEW SKILLS 10 hours

Preparing resume and cover letter for job interviews; interview etiquette: dress code, body language, tone, and greeting; HR interviews: answering common interview questions, practice for HR interviews.

Course Outcomes:

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

1. Understand and express themselves with confidence
2. Work as an active team member
3. Think and express their views logically and speak on varied topics without hesitations.
4. Prepare business presentations and emails effectively
5. Attend job interviews with confidence

Text Book(s)

1. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.

2. Archana Ram, PlaceMentor, 2018, Oxford University Press

Reference Books

1. Karen Kindrachuk, Introspection, 2010, 1st Edition

2 Karen Hough, The Improvisation Edge: Secrets to Building Trust and Radical Collaboration at work, 2011, Berrett-Koehler Publishers

3. Colin Swatridge, Oxford Guide to Effective Argument and Critical Thinking 1st Edition, Oxford University Press

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Open Elective - V

20HUM304 NATIONAL CADET CORPS

L	T	P	C
3	0	0	3

Pre-requisite: NCC B-Certificate

Course Description:
The main aim of this course is to mould the youth into responsible citizens of the nation. It helps to improve character and leadership qualities towards nation building. This course also motivates the youth to offer Selfless service to the society and nation. The course comprises Common subjects, Service subjects of NCC, societal aspects and basic organization of Indian Armed Forces.

Course Objectives:
This course enables the student to –

1. Get aware of NCC organization and general structure of Defence Forces.
2. Learn leadership and national integration.
3. Motivate towards to maintain Health and hygiene, personality development.
4. Learn elementary characteristics of disaster management, Field craft and Battle craft.
5. Acknowledge the Social activities, Communication and Military History.

UNIT I **10 hours**

INTRODUCTION TO NCC
Introduction, History of NCC , NCC Motto, NCC Flag, Aims of NCC, Cardinal points of NCC, Organization of defence forces in general, Organizational structure of Indian Army(Armed forces), Organizational structure of NCC, NCC Song, Incentives of NCC, Ranks in Army, Navy and Air Force, current representatives – Certificate Examination in NCC– Honours and Awards.

FOOT DRILL BASICS
Aims of Drill, Word of Commands, Attention, Stand at Ease, Turning Left, Right and Inclining at the Halt. Sizing, Forming up in three Ranks and Numbering, Open and Close March Order, Dressing the Squad, Saluting at the Halt, Getting on Parade, Falling Out and Dismissing, Marching, Guard of Honour.

UNIT II **10 hours**

LEADERSHIP
Meaning, Leadership Traits, Types of Leadership, Discipline & Duty of an Indian Citizen, Motivation, Code of Ethics, Perception, Communication, Customs of Services, Importance of Team Work, leaders(swami Vivekananda).

NATIONAL INTEGRATION
Meaning and Importance, Unity in Diversity, Indian History and Culture, Religion and Customs of India, India and its Neighbours, Contribution of Youth in Nation Building, Contribution of leaders in nation unification .

UNIT III **12 hours**

HEALTH AND HYGIENE
Structure and Function of Human Body, Hygiene and Sanitation, Preventable Diseases, First Aid, Yoga: Introduction and Exercises, Physical and Mental Health, Fractures: Types and Treatment.

PERSONALITY DEVELOPMENT
Introduction to personality development, Physical and social factors influencing / shaping personality, psychological and philosophical factors influencing / shaping personality, Self-awareness, SWOT analysis, mind set, interpersonal relationship and communication, effective communication, barriers of communication.

ENVIRONMENT AND ECOLOGY

Environment: Meaning, Global Warming, Acid Rain, Depletion of Ozone Layer, Conservation of Environment. Ecology: Introduction, Component of Ecological System, Forest Ecology, Wild Life, Pollution Control.

UNIT IV **10 hours**

DEFENCE AND DISASTER MANAGEMENT

Civil Defence: Meaning, Organization and its Duties, Civil Defence Services, Fire Fighting : Meaning, Mode of Fire, Fire Fighting Parties, Fire Fighting Equipment. Introduction, Classification of Disaster: Natural Disaster & Man Made Disaster, Disaster Management During Flood, Cyclone and Earth Quake, Assistance in Removal of Debris, Collection and Distribution of Aid Material, Message Services.

SOCIAL SERVICE ACTIVITIES (Social Service And Community Development)

Basics of Social Service, Weaker Sections in the Society and its Identification, Contribution of Youth towards Social Welfare, NGOs and their Role and Contribution , Social Evils, Drug Abuse, Family Planning, Corruption, Counter Terrorism, Eradication of Illiteracy – Aids Awareness programme – Cancer Awareness Programme.

UNIT V **10 hours**

COMMUNICATION

Types of communication, characteristics of wireless technology, Walkie/talkie, Basic RT procedure, Latest trends and development(Multimedia, video conferencing, IT)

MILITARY HISTORY

Biography of Indian Historical Leaders: Chatrapati Shivaji, Maharana Pratap, Akbar Famous Battles / Wars of India: Indo – Pak War 1971(all wars), Kargil War.(Categorise: before/ After independence)
Biography of Successful Leaders: General Patton, General Mac. Arthur, Field Marshal Sam Maneksha.

Course Outcomes:

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

6. Analyse the NCC structure and different ranks in Indian Armed Forces along with foot drill.
7. Notify the leadership traits and the need of national integrity towards nation building.
8. Instill respect and responsibility towards personal health and hygiene, develop dynamic personality with adequate qualities.
9. Identify different disasters and judging measurements on the ground.
10. Recognise various communication devices, analyse the Military Organization.

Text Books:

1. HAND BOOK OF NCC – "SANJAY KUMAR MISHRA, MAJOR RC MISHRA", published by Kanti prakashan-2020.
2. NCC HAND BOOK - "SHASHI RANJAN & ASHISH KUMAR", published by Goodwin Publications-2021.

Reference Books:

1. NCC Hand book – "R.Gupta's", Ramesh Publishing House-2021.
2 NCC (ARMY WING)- "R.Guptas's",RPH Editorial Board-2021
3 Hand Book Of N.C.C. – "Ashok Pandey", Kanti Publications-2017

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Professional Elective – I

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective I

20CAI401 DISTRIBUTED SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:
This course helps the students to understand the importance of distributed systems, various procedures and methods used for communication in distributed systems and how the transaction takes place in distributed systems.

Course Objectives:

1. To understand fundamentals of Distributed Systems
2. To explore the issues in communications in distributed systems
3. To understand the various issues in process and thread management
4. To understand CORBA architecture and processes in the distributed file system
5. To recognize the Distributed System and shared memory architecture

UNIT I INTRODUCTION 9 hours

Characteristics - Design Goals -Types of Distributed Systems-Case Study: The World Wide Web. Distributed system models, Design issues in DS.

UNIT II COMMUNICATION IN DISTRIBUTED SYSTEM 9 hours

Inter process communication: Message passing model, Remote procedure call and implementation issues, Point to point and Group communication , Client Server model & its implementation, Socket programming, Case Studies: SUN RPC, DEC RPC

UNIT III SYNCHRONIZATION IN DISTRIBUTED SYSTEMS 9 hours

Introduction, Temporal ordering of events, Clock synchronization, mutual exclusion, Deadlock in distributed systems, Election algorithms. **Remote Method Invocation** -Introduction, Java RMI Architecture, API for Java RMI, Client Call-back, Stub downloading

UNIT IV COMMON OBJECT REQUEST BROKER ARCHITECTURE 9 hours

Introduction, Interface, Inter-ORB Protocol, Object server and object client, Naming service, Object service. **Processes and processors in distributed systems.** Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues.

UNIT V DISTRIBUTED FILE SYSTEMS 9 hours

Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study- HDFS. Distributed Shared Memory-general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing.

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

1. Explore the fundamentals of Distributed Systems
2. Get insight the issues in communications in distributed systems
3. Get awareness on various issues in process and thread management
4. Understand CORBA architecture and processes in the distributed file system
5. Recognize the Distributed System and shared memory architecture

Text Book(s)

1. Andrew S. Tanenbaum, Maartenvan Steen, "Distributed Systems Principles and Paradigms", 2nd ed., Pearson Education, 2006.
2. George Coulouris, Jean Dollimore, and Tim Kindberg, " Distributed Systems Concepts and Design", 5th ed., Pearson Education, 2011

Reference Books

1. Nancy A. Lynch, "Distributed Algorithms", Hardcourt Asia Pvt. Ltd., Morgan Kaufmann, 2000.
2. Kshemkalyani, Ajay D., Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press, 2011.
3. Singhal, Shivaratri, "Advanced Concepts in Operating Systems", TMH.
4. P K Sinha, "Distibuted Operating System", PHI, IEEE Press.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective I

20CAI402 SOFTWARE ENGINEERING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. To Describe and compare various software development methods.
2. To understand the requirements and to develop various design models.
3. To describe the processes and metrics involving in a software product.
4. To recognize various testing strategies in software development process
5. To identify the risk involved and to maintain the quality product.

UNIT I AN OVERVIEW OF SOFTWARE ENGINEERING 9 hours

Nature of Software, Software Engineering, Software Process, Software Engineering Practice, Software Process Models: Linear, RAD, Incremental, Spiral Component-based development, Fourth Gen Techniques.

UNIT II MODELING (REQUIREMENTS AND DESIGN) 9 hours

Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements. Design within the context of Software Engineering, Design Process, Design Concepts, Design Model-Software Architecture.

UNIT III PROCESS & PRODUCT METRICS 9 hours

Product Metrics, Metrics for the Requirements Model, Metrics for the Design Model - Architectural Design Metrics, Object-Oriented Design, Software Measurement, Metrics for Software Quality.

UNIT IV SOFTWARE TESTING 9 hours

Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Software Testing Fundamentals, Black box Testing, White box testing.

UNIT V RISK MANAGEMENT AND SOFTWARE MAINTENANCE 9 hours

Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Monitoring and Management, RMMM Plan, Software Maintenance, Software Supportability, Reengineering.

Course Outcomes:

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

1. Describe and compare various software development methods.
2. Understand the requirements and to develop various design models.
3. Describe the processes and metrics involving in a software product.
4. Recognize various testing strategies in software development process
5. Identify the risk involved and to maintain the quality product.

Text Book(s)

1. Roger Pressman, Software Engineering: A Practitioner's Approach, 7th Edition, McGrawHill, 2010.

Reference Books

1. Ian Sommerville, Software Engineering, 9th Edition, Addison-Wesley, 2010
2. Pankaj Jalote, A Concise Introduction to Software Engineering, Springer,2008
3. William E. Lewis , ―Software Testing and Continuous Quality Improvement‖, Third Edition, Auerbach Publications, 2008.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective I

20CAI403 WEB TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course will expose students to the techniques used in programming web pages for interactive content. The course begins by reviewing basic web technologies (HTML5, CSS3 style sheets) and exploring the use of event-driven programming in JavaScript to add interactive elements such as buttons and text fields to web pages. Next, students will use AJAX tools to build web pages that connect to servers like Google to dynamically access data (maps, search results, videos, images, etc.). Finally, the course will show students how to write their own xml code to provide access to a custom database.

Course Objectives:

1. To introduce Markup Languages for client side scripting
2. To introduce JavaScript and DOM and Java Servlets with Java
3. To introduce XML and processing of XML Data with Java
4. To introduce Server side programming with Java Servlets and JSP
5. To introduce various java web services and SOAP

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 — 9 hours

Web Essentials: Clients, Servers, and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio – Video controls - CSS3 – Inline, Embedded, and External style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT-SIDE PROGRAMMING — 9 hours

Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects, - Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL.

UNIT III SERVER-SIDE PROGRAMMING — 9 hours

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example — JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP and XML — 9 hours

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions — File handling — Cookies — Connecting to Database. XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation, News Feed (RSS and ATOM).

UNIT V INTRODUCTION TO AJAX and WEB SERVICES 9 hours

AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics — Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.

Course Outcomes:

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

1. Gain knowledge of client-side scripting, validation of forms and AJAX programming
2. Understand server-side scripting with JSP language
3. Understand what XML is and how to parse and use XML Data with Java
4. To introduce Server-side programming with Java Servlets and JSP
5. Design and implement the various Web services concepts of JAX-RPC

Text Book(s)

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

Reference Books

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, PearsonEducation,2011 .
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Fouth Edition,Pearson Education, 2008.
3. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II,Pearson Education, 2001.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective I

20CAI404 DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides the fundamental knowledge on processing images and their application areas. In this course, different image processing operations such as enhancement, filtering, coding and segmentation are presented.

Course Objectives:

1. Acquire the basic knowledge on fundamentals of digital images.
2. Learn about image enhancement in spatial domain, image filtering and color image processing.
3. Understand various image segmentation and image coding schemes.
4. Learn image transform to analyze and modify image.
5. Learn concepts of degradation function and restoration techniques.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9 hours

Image Processing Fundamentals -- Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures

UNIT II IMAGE ENHANCEMENT, FILTERING AND COLOR IMAGE PROCESSING 9 hours

Image Enhancements and Filtering - Gray level transformations, histogram equalization, smoothing filters – sharpening filters – two dimensional DFT and its inverse - frequency domain filters – low pass and high pass - Color Image Processing - Color models–RGB, YUV, HIS - color complements, color slicing, tone and color corrections – Color image smoothing and sharpening - Color Segmentation.

UNIT III IMAGE CODING AND SEGMENTATION 9 hours

Image Coding : Fundamentals of image compression, image data redundancies, Image Compression Model, Huffman Coding, Arithmetic Coding, Run Length Coding, Bit Plane Coding, Block Transform Coding, JPEG compression standard – DCT based image compression
Image Segmentation: Detection of discontinuities, edge linking and boundary detection – global and adaptive thresholding, region-based segmentation.

UNIT IV IMAGE TRANSFORMS 9 hours

A) Coding, inter pixel and image redundancy, 2-D Discrete Fourier Transform and frequency domain filters, Discrete Cosine Transform – its application in Baseline JPEG, Walsh Hadamard Transform, Fast Walsh Transform, Introduction to Gabor Transform. B) Hough Transform

UNIT V IMAGE RESTORATION 9 hours

Image Restoration – degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering - Inverse Filtering -Wiener filtering.

Course Outcomes:

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

1. Apply mathematics to represent the connectivity and neighborhood relationship between pixels and frames.
2. Understand application-based image enhancement and color image processing.
3. Develop algorithms for image segmentation and coding in image processing.
4. Use various image transforms to analyze and modify image.
5. Understand the restoration concepts and filtering techniques.

Text Book(s)

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Pearson, 4th edition, 2018
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 2nd edition, 2004.
3. Digital Image Processing, Gonzalez, Woods, PHI , 2nd edition
4. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Third Edition, 2010

Reference Books

1. Murat Tekalp, Digital Video Processing, Prentice Hall, 2ndedition, 2015
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective I

20CAI405 MULTIMEDIA TECHNOLOGIES

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course aims to introduce the students to Multimedia technologies and their usage in real world applications. This course covers introduction to multimedia, different image, video and audio formats, image coding and compression techniques, I/O technologies, Multimedia network and Multimedia Security and Forensics.

Course Objectives:

1. To provide the foundation knowledge of multimedia computing.
2. To provide the knowledge about media characteristics, compression standards, multimedia representation, data formats, multimedia technology development.
3. To understand Multimedia security and forensics.
4. To understand multimedia components efficiently
5. To develop integrated, collaborative multimedia systems

UNIT I INTRODUCTION 9 hours

Introduction to Multimedia: Multimedia Elements – Multimedia applications – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases, Multimedia Architecture – Multimedia Documents

UNIT II COMPRESSION, ANIMATION , FILE FORMATS 9 hours

Compression , Decompression, Binary Image Compression Schemes, Types of Compression, Image Compression , Video Compression , Audio Compression. principles of animation,2D, 3D animation. file formats: Rich Text Format – TIFF File Format – Resource Interface File Format – MIDI File Format - JPEG DIB File Format – AVI Indeo File Format .

UNIT III MULTIMEDIA TECHNOLOGIES 9 hours

Multimedia I/O Technologies: Image Scanners – Digital Voice and Audio – Digital Camera – Video Images – Full Motion Video -Video Motion Analysis.

UNIT IV MULTIMEDIA PROTOCOLS 9 hours

Protocol - QOS Issues - RTP, RTCP, RTSP, SIP - Media on demand –ITV - STB Broadcast Schemes for VoD Buffer Management- Multimedia over wireless networks.

UNIT V SECURITY ATTACKS 9 hours

Multimedia encryption - Digital Watermarking. Security Attacks- Digital Forensics taxonomy, goals/requirements - Forensic Data Acquisition -Forensics Analysis and Validation.

Course Outcomes:

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

1. Understand the characteristics of different media and the representations of different multimedia data formats.
2. Understand the characteristics of Image, Audio and Video systems and takes into considerations in multimedia techniques design and implementation.
3. Describe different coding and compression principles and compare different compression techniques.
4. Design multimedia components efficiently
5. Develop integrated, collaborative multimedia system

Text Book(s)

1. Li, Ze-Nian and Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall of India, 2004.

2. Steinmetz Ralf and K. Nahrstedt "Multimedia: Computing, Communications & Applications",Pearson Education, 1995.

Reference Books

1. Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2009
2. Chun-Shien Lu, "Multimedia Security : Steganography and Digital Watermarking techniques for Protection of Intellectual Property", Springer Inc 2007

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective III

Dept. of Computer Science & Engineering (Artificial Intelligence)

Professional Elective III

20CAI406 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

Pre-requisite: **Probability and statistics for computer science, C Programming and Data Structures**

Course Description:

This course is designed to introduce students to the fundamental concepts and ideas in natural language processing (NLP). It develops an in-depth understanding of both the algorithms available for the processing of linguistic information and the underlying computational properties of natural languages. Word level, syntactic, and semantic processing from both a linguistic and an algorithmic perspective are considered. The focus is on modern quantitative techniques in NLP: using large corpora, statistical models for acquisition, disambiguation, and parsing. Also, it examines and constructs representative systems.

Course Objectives:

1. `zTo understand the fundamental concepts of NLP and Language modelling.
2. To learn the word level analysis and syntactic analysis.
3. To have knowledge about the semantic analysis and discourse processing.
4. To learn about natural language generation, chat bots and dialogue systems.
5. To apply NLP techniques in real time problems such as machine translation.

UNIT I INTRODUCTION & LANGUAGE MODELLING 9 hours

Introduction: What is Natural Language Processing (NLP), Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Some Successful Early NLP Systems.

Language Modelling: Introduction, Various Grammar-based Language Models, Statistical Language Model.

UNIT II WORD LEVEL ANALYSIS & SYNTACTIC ANALYSIS 9 hours

Word Level Analysis: Introduction, Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging.

Syntactic Analysis: Introduction, Context-Free Grammar, Constituency, Parsing, Probabilistic Parsing, Indian Languages.

UNIT III SEMANTIC ANALYSIS & DISCOURSE PROCESSING 9 hours

Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.

Discourse Processing: Introduction, Cohesion, Reference Resolution, Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGE GENERATION, CHATBOTS & DIALOGUE SYSTEMS **9 hours**

Natural Language Generation: Introduction, Architectures of NLG Systems, Generation Tasks and Representations, Applications of NLI.

Chatbots & Dialogue Systems: Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design

UNIT V MACHINE TRANSLATION **9 hours**

Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule-based Machine Translation, Corpus-based Machine Translation, Semantic or Knowledge-based MT systems, Translation involving Indian Languages

Course Outcomes:

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

1. To Apply the principles and Process of Human Languages such as English and other Indian Languages using computers.
2. To understand the techniques word level analysis and syntactic analysis.
3. To understand the role of semantic analysis and discourse processing.
4. To Learn the architectures of NLG systems such as chatbots and dialogue systems.
5. To apply the natural language generation in the applications like machine translation.

Text Book(s)

1. Tanveer Siddiqui, U.S. Tiwary, ―Natural Language Processing and Information Retrieval, Oxford University Press, 2008.
2. Daniel Jurafsky, James H. Martin―Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

Reference Books

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Manning C. D. and Schutze H., "Foundations of Statistical Natural Language processing", First Edition, MIT Press, 1999

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective III

20CAI407 COMPUTER VISION FOR AI

L	T	P	C
3	0	0	3

Pre-requisite: Programming for Problem Solving (Python), Data Structures using Python

Course Description:

This course provides an introduction to computer vision including fundamentals of image formation, camera imaging geometry, feature detection and matching, stereo, motion estimation and tracking, image classification and scene understanding.

Course Objectives:

1. To understand the fundamental concepts related to Image formation and processing
2. To learn feature detection, matching and detection
3. To become familiar with feature based alignment and motion estimation
4. To develop skills on 3D reconstruction
5. To evaluate image based rendering and recognition patterns

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING **9 hours**

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION **9 hours**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION **9 hours**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion.

UNIT IV 3D RECONSTRUCTION **9 hours**

Shape from X - Active range finding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION **9 hours**

View interpolation Layered depth images - Light fields and Lumi graphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

Course Outcomes:

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

1. To understand basic knowledge, theories and methods in image processing and computer vision.
2. To implement basic and some advanced image processing techniques in OpenCV.
3. To apply 2D a feature-based based image alignment, segmentation and motion estimations.
4. To analyze 3D image reconstruction techniques
5. To design and develop innovative image processing and computer vision applications.

Text Book(s)

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

Reference Books

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006.
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of Computer Science & Engineering (Artificial Intelligence)

Professional Elective III

20CAI408 AI FOR CYBER SECURITY

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course is to systematically introduce the theories, principles, and techniques of internet security. The course covers concepts such as fundamentals of computer security, software security, and network security. After completing the course, students should explain the essential components of information security and the risks faced by computer systems, identify, and analyze security problems in systems, explain how security mechanisms work in computer systems. Finally, apply conceptual and practical knowledge of cyber security and tools and technologies to avoid, identify, counter, and recover from cyber threats.

Course Objectives:

1. To learn the need of AI for Cyber Security and detection of DDOS using AI techniques.
2. To gather the knowledge of intrusion detection using Neural Networks.
3. To understand the knowledge of CAPTCHA and scan detection and malicious detection.
4. To be trained the various applications of AI to detect cyber-attacks.
5. To be taught about the mail server.

UNIT I FUNDAMENTALS OF AI, DDoS **9 hours**

Introduction – Problems that AI Solves – Why AI in Cyber security – Current Cyber Security Solutions - Structured data, Unstructured data – Supervised learning – Unsupervised learning – Reinforcement learning – classification problem - clustering problems – SVM – ANNs.
Time series – Types of Time series – Time Series analysis in Cyber Security – Detecting DDOS with Time Series – Predicting DDOS attacks – Ensemble Techniques for Cyber security – Types of Ensemble – Types of Ensemble Algorithms – Bagging, Boosting, Stacking, Bayesian Model - Ensemble Method to detect Cyber-attack.

UNIT II DETECTION OF MALICIOUS WEB PAGES, URLS **9 hours**

URL Blacklisting – Drive by download URL- Command and Control URLs – Phishing URLs – Using Heuristics to detect Malicious Pages – Data for the analysis – Feature Extraction – Lexical Features – Web Content based Features – Host based features – site Popularity features.

UNIT III CAPTCHA AND SCAN DETECTION, CONTEXT BASED MALICIOUS EVENT DETECTION **9 hours**

Using AI to crack CAPTCHA – Types of CAPTCHA – ReCAPTCHA – Breaking a CAPTCHA – Solving CAPTCHA with neural network - Machine Learning in Scan Detection - Machine-Learning Applications in Scan Detection, Context based Malicious event detection – Adware – Bots –Bugs – Ransomeware – Rootkit – Spyware – Trojan horses – Viruses – Worms – Malicious Injections in Wireless networks.

UNIT IV AI and IDS **9 hours**

Architecture of IDS based on Neural networks – Intelligent flow-based IDS - Multi-Agent IDS – AI based Ensemble IDS – Machine Learning in Hybrid Intrusion Detection Systems – Machine Learning Applications in Hybrid Intrusion Detection: Anomaly - Misuse Sequence Detection System - Parallel Detection System.

UNIT V AI AND MAIL SERVER 9 hours

Types of Mail Server – Data Collection from mail server – Naive Bayes theorem to detect spam – Laplace smoothing – Featurization Techniques to covert text-based emails to numeric values – Logistic regression to spam filters - Anomaly detection techniques for SMTP and HTTP.

Course Outcomes:

After completing this Unit, students will be able to

1. Understand the AI for Cyber Security and detection of DDOS using AI techniques.
2. Implements the intrusion detection using Neural Networks
3. Learn about CAPTCHA and scan detection and malicious detection
4. Imply the various applications of AI to detect cyber-attacks.
5. Apply knowledge in mail server.

Text Book(s)

1. Hands-On Machine Learning for Cyber Security: Safeguard your system by making your machine intelligence using the python ecosystem, Soma Harder, Sinan Ozdemir, Packt Publishing Ltd, 2018.
2. The state of the Art in Intrusion Detection System, AI-Sakib Khan Pathan, CRC Press, Taylor & Francis Group, 2014.
3. Data Mining and Machine Learning in Cyber Security, Sumeet Dua and Xian Du, CRC Press, 2011.

Reference Books

1. Cybersecurity for Dummies, Brian Underdahl, Wiley, 2011
2. Cryptography and Network security, Behrouz A. Forouzan , Debdeep Mukhopadhyay, Mcgraw Hill Education, 2nd Edition, 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - III

20CAI409 INTELLIGENT AGENT SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course covers the concepts, applications, and theories of operations of Intelligent Agent Technology. An Intelligent Agent is a software program that uses communication protocols to exchange information for automatic problem solving. Students will perform an in-depth analysis of an Intelligent Agent for a specific application and construct a prototype of it.

Course Objectives:

1. Students can understand the concept of agents, intelligent agent systems and design architectures.
2. Students can know about the agent communication, interaction protocols.
3. Students can gather the knowledge of key types of possible multi-agent system interaction and agreement.
4. Students can be able to apply the multi-agent expert systems to solve small or large scale real life problems.
5. Comprehend the concept of expert system, expert system architecture, production rules and implementation tools.

UNIT I INTRODUCTION TO AGENTS AND DESIGN OF INTELLIGENT AGENTS — 9 hours

Introduction to Agents:

Agents and Environment; Performance measure; Nature of Environment; Abstract and Concrete Architecture for intelligent agents; Problem solving and planning: Result sharing, Task sharing and Distributed planning.

Design of Intelligent Agent:

Deductive reasoning agents: AgentO, Practical Reasoning Agents: HOMER architecture; Reactive agents: Subsumption architecture; Hybrid agents: Touring Machines, InteRRaP.

UNIT II AGENT COMMUNICATION AND INTERACTION PROTOCOLS — 9 hours

Agent Communications: Knowledge Query and manipulation Language (KQML), Knowledge Interchange Format (KIF), Ontology, Coordination protocols, Cooperation Protocols, Contract Net, Blackboard Systems, Negotiation, Multi-agent Belief Maintenance, Market Mechanisms

UNIT III MULTI-AGENT SYSTEM INTERACTIONS & AGREEMENTS — 9 hours

Classifying multi-agent interactions: Multi-agent Encounters - Dominant Strategies and Nash Equilibria - Competitive and zero-sum and other interactions; Cooperation: The Prisoner's dilemma and Axelrod's experiments; Reaching Agreements: Interactions between self-interested agents auctions & voting systems – negotiation - Argumentation; Interactions between benevolent agents: Cooperative Distributed Problem Solving (CDPS), partial global planning; coherence and Coordination.

UNIT IV MULTI-AGENT METHODOLOGIES AND APPLICATIONS 9 hours

Agent Methodologies- Mobile agents; Typical application areas of agent systems: Business Process Management, Distributed Sensing, Information Retrieval and Management, Electronic Commerce, Human-Computer Interfaces, Social Simulation etc.

UNIT V INTRODUCTION TO EXPERT SYSTEM, MODELS AND IMPLEMENTATION 9 hours

Expert Systems: Introduction, Architecture, Production rules and inference, Basic forms of inference: abduction; deduction; induction. Rule-based representations (with backward and forward reasoning); logic-based representations (with resolution refutation)

Implementation Tools: Prolog, CLIPS.

Course Outcomes:

After completing this Unit, students will be able to

6. Describe the notion of an agent, intelligent agent systems characteristics and the structure of agents, how agents are distinct from other software paradigms (e.g. objects), and typical applications of agent based technology.
7. Design intelligent agents that can effectively cooperate to solve problems.
8. Apply the concepts of agent communication, interaction protocols, multi-agent interactions and agreements
9. Build agents capable of intelligent autonomous actions using appropriate methodologies.
10. Describe the concept of expert system, models, production rules, implementation tools and existing system models for developing an expert system.

Text Book(s)

1. Michael Wooldridge, ―An Introduction to Multi Agent Systems‖, Second Edition, Wiley, 2009.
2. G. Weiss (ed.), ―Multi-Agent Systems - A Modern Approach to Distributed Artificial Intelligence‖, (2nd Ed.). MIT Press, 2013.
3. Dan W. Patterson, ―Introduction to AI & Expert System‖, PHI, 2007.

Reference Books

1. Stuart Russell and Peter Norvig, ―Artificial Intelligence - A Modern Approach‖, 3rd edition, Prentice Hall, 2011.
2. J. Giarratano and G. Riley, "Expert Systems - Principles and Programming". 4th Edition, PWS Publishing Company, 2004.
3. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective – III

20CAI410 GPU PROGRAMMING USING CUDA

L	T	P	C
3	0	0	3

Pre-requisite: Programming and Data Structure, Digital Logic, Computer architecture.

Course Description:

The course covers the basics of conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD) in modern GPUs. We cover GPU architecture basics in terms of functional units and then dive into the popular CUDA programming model commonly used for GPU programming. The architecture specific details like memory access coalescing, shared memory usage, GPU thread scheduling etc. which primarily affect program performance is also covered in detail. Throughout the course we provide different architecture-aware optimization techniques relevant to both CUDA and OpenCL.

Course Objectives:

This course enables students to

1. Introduce the basics of GPU architectures
2. Expose the student to a variety of Optimizing CUDA Applications
3. Analyze the CUDA Error Handling Parallel Programming Issues
4. Analyze the openCL standards and the Memory Models
5. Evaluate the Parallel Patterns with different algorithms

UNIT I GPU Architecture **9 hours**

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory, and Texture Memory

UNIT II CUDA Programming **9 hours**

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III Programming issues **9 hours**

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT IV OpenCL Basics **9 hours**

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT V Algorithms on GPU **9 hours**

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

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Course Outcomes:

After completing this Unit, students will be able to
1. Interpret the design of GPU Architecture
2. Develop simple applications using CUDA Programming
3. Utilize efficient parallel programming patterns to solve problems
4. Analyze the Memory Models and openCL Examples
5. Evaluate the Parallel Patterns algorithms

Text Book(s)

1. Shane Cook, CUDA Programming: ―A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.

2. David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, ―Heterogeneous computing with OpenCL‖, 3rd Edition, Morgan Kauffman, 2015.

Reference Books

1. Nicholas Wilt, ―CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison - Wesley, 2013.

2 Jason Sanders, Edward Kandrot, ―CUDA by Example: An Introduction to General Purpose GPU Programming‖, Addison - Wesley, 2010.

3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors - A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Professional Elective -III

20CAI411 ETHICS AND AI

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course explores the ethical implications of artificial intelligence (AI), covering its impact on society, psychology, law, environment, and trust. Topics include international ethical initiatives, case studies in healthcare and warfare, AI standards and regulation, roboethics, and challenges and opportunities of AI from an ethical perspective.

Course Objectives:

This course enables students to

1. Study the morality and ethics in AI.
2. Learn about the Ethical initiatives in the field of artificial intelligence.
3. Study about AI standards and Regulations.
4. Study about social and ethical issues of Robot Ethics.
5. Study about AI and Ethics - challenges and opportunities.

UNIT I INTRODUCTION **9 hours**

Definition of morality and ethics in AI - Impact on society - Impact on human psychology - Impact on the legal system - Impact on the environment and the planet - Impact on trust.

UNIT II ETHICAL INITIATIVES IN AI **9 hours**

International ethical initiatives - Ethical harms and concerns - Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponization.

UNIT III AI STANDARDS AND REGULATION **9 hours**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems - Data Privacy Process - Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS **9 hours**

Robot – Roboethics - Ethics and Morality - Moral Theories - Ethics in Science and Technology - Ethical Issues in an ICT Society - Harmonization of Principles - Ethics and Professional Responsibility - Roboethics Taxonomy.

UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES **9 hours**

Challenges – Opportunities - ethical issues in artificial intelligence - Societal Issues Concerning the Application of Artificial Intelligence in Medicine - decision-making role in industries - National and International Strategies on AI.

Course Outcomes:

After completing this Unit, students will be able to

Learn about morality and ethics in AI.

1. Understand the ethical harms and ethical initiatives in AI.
2. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems.
3. Understand the concepts of Roboethics and Morality with professional responsibilities.
4. Learn about the societal issues in AI with National and International Strategies on AI.

Text Book(s)

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020.
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

Reference Books

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020
3. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
4. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteenchallenges-and-opportunities
5. https://sci-hub.mksa.top/10.1159/000492428

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - IV

20CAI412 DATA VISUALIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Pre-requisite: **NIL**

Course Description:

This course aims to provide a strong understanding of fundamental concepts of data visualization. It explains the most popular data visualizations tools such as Tableau, Microsoft Power Bi. It envisions the students to best present the data using storytelling and dashboards.

Course Objectives:

1. To understand the fundamental design principles and different types of data visualization.
2. To identify both positive and negative impacts of data-informed decision across a variety of domains.
3. To apply the fundamental concepts of data visualization to define a project in your field of study.
4. Practice the core principles using widely available tools (e.g. Tableau, Power Bi).
5. Demonstrate the best practice that presents your story in the process of creating data visualization including connecting to different data sources, assessing to the quality of the data, and converting raw data into data visualizations that provide actionable information.

UNIT I INTRODUCTION **9 hours**

Introduction to data visualization, mapping data onto aesthetics, coordinate systems and axes. Introduction to Tableau, Installation, Data types in Tableau, Data Analytics in Tableau, saving tableau works - Create a simple bar chart on sales forecasts using Tableau.

UNIT II VISUALIZING DISTRIBUTIONS **9 hours**

Color scales, Directory of visualizations, visualizing amounts, visualization distributions: Histograms & density plots, empirical cumulative distributions and q-q plots - Introduction to Microsoft Power Bi, Installation - Infer the accurate trends for flight prices using the flight information dataset - Plot a histogram for the California housing dataset using Tableau and Power Bi.

UNIT III VISUALIZING PROPORTIONS **9 hours**

Visualizing many distributions at once, visualizing proportions, visualizing associations, visualizing time series, visualizing trends, visualizing uncertainty. Draw box plot, violin plot and ridgeline plot for the temperature dataset.

UNIT IV COLOR AND CODING **9 hours**

The principle of proportional link, common pitfalls of color use, redundant coding, multi-panel figures, titles, captions and tables, Balance the data and the context, Avoid line drawings. Predict the higher number of crime cases for the crime information dataset using Tableau and Power Bi.

UNIT V STORYTELLING **9 hours**

Introduction to most used image formats, choosing the right visualization software, telling a story and making a point. Create a dashboard for the COVID-19 dataset using Tableau and Power Bi. Practice story telling for adult income dataset and explore Q & A in Power Bi.

Course Outcomes:

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

1. Employ best practices in data visualization to develop charts, maps, tables, and other visual representations of data.
2. Use visualization tools such as Tableau, Power Bi to conduct data analysis, especially exploration of an unfamiliar dataset.
3. Create compelling, interactive dashboards to combine several visualizations into a cohesive and functional whole.
4. Utilize advanced Tableau features including parameters, data blending, custom SQL, very large datasets, custom date hierarchies, and others.
5. Use data visualizations, dashboards, and Tableau Stories to support relevant communication for diverse audiences.

Text Book(s)

1. Fundamentals of Data Visualization by Claus O. Wilke

2. Visual Analytics with Tableau by Alexander Loth.

Reference Books

1. Visual Data Storytelling With Tableau, Lindy Ryan, Pearson India
2. A Step by Step Guide for Data Visualization using Tableau by Gourav Singh
3. https://www.projectpro.io/article/-tableau-projects-ideas/479
4. https://docs.microsoft.com/en-us/power-bi/fundamentals/service-get-started
5. Best Tableau Dashboard Examples
6. https://rigorousthemes.com/blog/15-best-tableau-dashboard-examples/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - IV

20CAI413 BUSINESS ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Data Mining

Course Description:

The course aims at understanding the needs of decision support and analytics, to design the framework for Business Intelligence. Emphasize the conceptual foundations, phases of decision making; to understand the data warehousing architecture.

Course Objectives:

1. Understand the fundamentals of business intelligence and data analytics.
2. Summarize the concepts of Decision support system.
3. Understand the concepts of data warehouse.
4. Apply the techniques of Predictive modelling.
5. Apply the Heuristic Search Methods and Simulation.

UNIT I AN OVERVIEW OF BUSINESS INTELLIGENCE, ANALYTICS AND DATA SCIENCE — 9 hours

Overview of Business Analytics, Changing Business Environments and Evolving Needs for Decision Support and Analytics, Evolution of Computerized Decision Support to Analytics/Data Science, A Framework for Business Intelligence- Definitions of BI, A Brief History of BI, The Architecture of BI, The Origins and Drivers of BI. A Multimedia Exercise in Business Intelligence, Analytics Overview- Descriptive Analytics, Predictive Analytics, Prescriptive Analytics, Analytics Applied to Different Domains, Analytics or Data Science.

UNIT II DECISION MAKING — 9 hours

Foundations and Technologies for Decision Making- Decision Making: Introduction and Definitions- Characteristics of Decision Making, Working Definition of Decision Making, Decision-Making Disciplines, Decision Style and Decision Makers, Phases of the Decision-Making Process, Decision Making: The Intelligence Phase, The Design Phase, The Choice Phase, The Implementation Phase, Components of Decision Support Systems.

UNIT III DESCRIPTIVE ANALYTICS: — 9 hours

Business Intelligence and Data Warehousing--Data Warehouse, A Historical Perspective to Data Warehousing, Characteristics of Data Warehousing, Data Marts, Operational Data Stores, Enterprise Data Warehouses (EDW), Metadata, Data Warehousing Process Overview, Data Warehousing Architectures, Data Integration and the Extraction, Transformation, and Load (ETL) Processes, Data Warehouse Development Approaches, Representation of Data in Data Warehouse, Analysis of Data in Data Warehouse-OLAP versus OLTP, OLAP Operations, Real time data warehousing

UNIT IV PREDICTIVE ANALYTICS: TEXT AND WEB ANALYTICS — 9 hours

Text Analytics, Text Mining, and Sentiment Analysis **:** Text Analytics and Text Mining Concepts and Definitions, Natural Language Processing, Text Mining Applications Text Mining Process. Sentiment Analysis Overview, Sentiment Analysis and Speech Analytics.

Web Mining Overview: Web Content and Web Structure Mining.Web Usage Mining—Web Analytics Technologies, Web Analytics Metrics, Web Site Usability, Social Analytics—Social

Network Analysis, Social Network Analysis Metrics, Connections, Distributions, Segmentation, Social Media Analytics.

UNIT V PREDICTIVE ANALYTICS: OPTIMIZATION AND SIMULATION **9 hours**

Model-Based Decision Making: Identification of the Problem and Environmental Analysis, Model Categories. Structure of Mathematical Models for Decision Support, Certainty, Uncertainty and Risk. Modeling and Analysis**:** Heuristic Search Methods and Simulation– Problem-Solving Search Methods, Genetic Algorithms and Developing GA Applications, Basic Concepts of Expert Systems. Introduction to Simulation-- Major Characteristics of Simulation

Course Outcomes:

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

1. Define the framework for Business Intelligence.
2. Use the concepts of Decision support system for Business Analytics.
3. Understand the role of data warehouses in decision support system.
4. Apply Web Mining, Web Analytics and Social Media Analytics.
5. Apply Decision Analysis with Decision Tables and Decision Trees.

Text Book:

1. Ramesh Sharda, DursunDelen, &Efraim Turban ―Business Intelligence, Analytics, and Data Science: A Managerial Perspective‖, 10th ed. Pearson Education, 2018.

Reference Books:

1. Marc J. Schniederjans,Dara G. Schniederjans, Christopher M. Starkey-- Business Analytics Principle, concepts and applications with SAS.
2. Ramesh Sharda, DursunDelen, &Efraim Turban, Business Intelligence and Analytics – Systems for Decision Support‖, 10th Edition, Pearson, 2015.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective –IV

20CAI414 MEDICAL IMAGE DATA ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: **Probability and statistics for computer science**

Course Description:

This course gives an overview of medical image formation, enhancement, analysis, visualization, and communication with many examples from medical applications. It starts with a brief introduction to medical imaging modalities and acquisition systems. As a focus, image enhancement techniques, segmentation, texture analysis and their application in diagnostic imaging will be discussed.

Course Objectives:

1. To Understand the nature of medical images and various medical imaging methods.
2. To apply the concepts of medical image processing and filtering techniques.
3. To execute the various image restoration and feature extraction methods on medical images.
4. To apply the Segmentation techniques used in medical image processing.
5. To analyze the applications of medical image processing for Diagnosis.

UNIT I NATURE OF MEDICAL IMAGES & FUNDAMENTALS OF DIGITAL IMAGES — 9 hours

Nature of Medical Images: Body temperature as an image**,** Transillumination**,** Light Microscopy, Electron microscopy, X-ray Imaging, Breast cancer and mammography, Tomography, Nuclear medicine imaging, Ultrasonography, Magnetic Resonance Imaging.

Fundamentals of Digital Images: Introduction, Image Resolution and Aspect Ratio, Components of Digital Image processing, Sampling and Quantisation, Application areas, Vision Fundamentals, CAD system.

UNIT II MEDICAL IMAGE PROCESSING & NOISE REDUCTION FILTERS FOR MEDICAL IMAGES — 9 hours

Medical Image Processing: Various modalities of medical imaging, Problems with medical images, Image enhancement, other modalities of medical imaging.

Noise Reduction filters for medical images: Sources of Noise and Filters used for Noise Reduction, Spatial domain filters, Frequency domain filters, Practical Results with case studies.

UNIT III MEDICAL IMAGE RESTORATION, FEATURE EXTRACTION AND STATISTICAL MEASUREMENT — 9 hours

Medical Image Restoration: Image Restoration, Degradation Model**,** Estimation of Degradation function, Blur model, Medical Image restoration, Blur identification, Applications of Image Restoration.

Feature extraction and statistical measurement: Selection of features, Shape related features, Fourier descriptors, Texture analysis, Breast Tissue Detection, Analysis of Tissue Structure.

UNIT IV MEDICAL IMAGE SEGMENTATION & FUZZY BASED TECHNIQUES — 9 hours

Medical Image Segmentation: Image Segmentation, Points Detection, Line Detection, Edge Detection Methods, Histogram-based Image Segmentation, Segmentation using split and merge method, Region growing method, Watershed method, k-means clustering method, Comparison of Segmentation methods.

Fuzzy based Techniques: Fuzzy Clustering, Fuzzy partition, Fuzzy c-means clustering, Principal component analysis.

UNIT V APPLICATIONS OF AI IN MEDICAL IMAGING 9 hours

Applications of AI in Medical Imaging: MR brain image classification, Mammogram image segmentation, Image enhancement in retinal images, medical image compression, Histopathological blood cell image analysis, Nodule detection in lung images, Cancer detection in skin images.

Course Outcomes:

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

1. Understand the nature of medical images and fundamentals of digital image processing. (L2)
2. Apply various noise filters for different modalities of imaging. (L4)
3. Execute restoration and Feature extraction techniques in medical images. (L4)
4. Apply the Image segmentation and Fuzzy Techniques in medical images. (L4)
5. Analyze the various applications of AI in medical imaging, (L3)

Text Book(s)

1. Rangaraj M. Rangayyan, “Biomedical Image Analysis”, CRC Press, 2000
2. G.R. Sinha, Bhagwati Charen Patel, “Medical Image Processing: Concepts and Applications”, PHI Learning private limited.2014

Reference Books

1. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, 1st Edition, PHI Learning Pvt. Ltd., 2011.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - IV

20CAI415 PREDICTIVE ANALYSIS IN IOT

L	T	P	C
3	0	0	3

Pre-requisite: **Probability and statistics**

Course Objectives:

1. Understand the basic concepts of predictive analysis in IOT.
2. Applying IOT data analytics in cloud computing.
3. Understand how to add personal touch to IOT.
4. Analyse applications of IOT generated data environments for the developments of smart cities.
5. Learn Challenges and Opportunities in Data Security in the Internet of Things.

UNIT I INTRODUCTION TO DATA ANALYTICS FOR THE INTERNET OF THINGS: 9 hours

An Overview, Data, Analytics and Interoperability Between Systems (IoT)- Context, Models in the Background, Problem Space, Solutions Approach, The Illusion of Data, Delusion of Big Data, and the Absence of Intelligence in AI, Data Science in Service of Society: Knowledge and Performance from PEAS, Machine Learning Techniques for IoT Data Analytics- Introduction, Taxonomy of Machine Learning Techniques.

UNIT II IOT DATA ANALYTICS USING CLOUD COMPUTING 9 hours

Introduction, IoT Data Analytics Cloud Computing for IoT, Cloud-Based IoT Data Analytics Platform, Machine Learning for IoT Analytics in Cloud, Challenges for Analytics Using Cloud, Deep Learning Architectures for IoT Data Analytics- Introduction, DL Architectures.

UNIT III ADDING PERSONAL TOUCHES TO IOT 9 hours

A User-Centric IoT Architecture- Introduction, Enabling Technologies for BDA of IoT Systems, Personalizing the IoT, Related Work, User Sensitized IoT Architecture, The Tweaked Data Layer, The Personalization Layer, Concerns and Future Directions.

UNIT IV SMART CITIES AND THE INTERNET OF THINGS 9 hours

Introduction, Development of Smart Cities and the IoT, The Combination of the IoT with Development of City Architecture to Form Smart Cities, Unification of the IoT, Security of Smart Cities. A Roadmap for Application of IoT-Generated Big Data in Environmental Sustainability: Role of Big Data in Sustainability, Present Status and Future Possibilities of IoT in Environmental Sustainability, Proposed Roadmap, Identification and Prioritizing the Barriers in the Process.

UNIT V INTELLIGENT ENTERPRISE 9 hours

Types of Mail Server – Data Collection from mail server – Naive Bayes theorem to detect spam – Laplace smoothing – Featurization Techniques to covert text-based emails to numeric values – Logistic regression to spam filters - Anomaly detection techniques for SMTP and HTTP.

Course Outcomes:

After completing this Unit, students will be able to

11. Understand the basic concepts of data analytics in IOT, various context models and Machine Learning Techniques for IOT data analytics.
12. Apply IOT data analytic using cloud computing and Deep Learning
13. Understand various user centric IOT architectures.
14. Analyse the role of data analytics in the development of IOT based smart cities.
15. Learn bid data architecture for modelling smart internet of Roads and data security challenges and opportunities.

Text Book(s)

1. "Big Data Analytics for Internet of Things", Tausifa Jan Saleem (Editor), Mohammad Ahsan Chishti (Editor), Wiley.

Reference Books

1. Big Data Analytics for Cloud, IoT and Cognitive Computing, Kai Hwang and Min Chen, 2017.
2. Big Data Analytics, Venkat Ankam, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - IV

20CAI416 VIDEO ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: **NIL**

Course Description:

This course covers the basic steps of image processing system and video analytics. Algorithms used for feature extraction and dimensionality reduction. video classification and object recognition explained. Also, case studies like Advanced Driver Assistance System given.

Course Objectives:

1. To understand the basics of Image processing.
2. To determine the features of an object.
3. To recognize objects using different algorithms.
4. To analyses the behavior of object.
5. To explore and demonstrate real time video analytics in solving practical problems of commercial and scientific interests.

UNIT I INTRODUCTION 9 hours

Basic steps of Image processing system, Pixel Relationship, Image Transforms, Image Enhancement, Color Models, Digital Video, Sampling of video signal, Video Standards, Rate control and buffering.

UNIT II FEATURE EXTRACTION AND DIMENSIONALITY REDUCTION 9 hours

Feature extraction - Binary object feature, Histogram-based (Statistical) Features, Intensity features, Shape feature extraction, Motion compensated features, Texture Analysis - Concepts and classification, statistical, structural, and spectral analysis, SIFT - SURF, Content based features, Convolutional features for visual recognition, PCA, LDA.

UNIT III OBJECT RECOGNITION AND VIDEO CLASSIFICATION 9 hours

Object Recognition: Feature Selection and Boosting, Template-Matching, Scene and Object Discrimination, Object Modelling, Saliency Map, Self-supervised object detection, Object Classification with CNN. **Video Classification:** Exploring Dataset, Convolutional Neural Network (CNN) + Long short-term memory network (LSTM), Multi resolution CNN, Multi-modal fusion.

UNIT IV INTELLIGENT SURVEILLANCE AND BEHAVIOR ANALYSIS 9 hours

Intelligent Surveillance: Change Detection, Background modeling, Motion Estimation and Segmentation, Kalman Particle Filter based tracking, multi-target tracking. **Behavior Analysis:** Learning Based Analysis, Rule Based Analysis, Facial Analysis, Gesture Recognition, Human Counting and Distribution – BLOB based, Feature based.

UNIT V SCENE ANALYSIS 9 hours

Intelligent Context and Scene Understanding, Captioning using Neural Networks. Case Study: Surveillance - Advanced Driver Assistance System – Robotics.

Course Outcomes:

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

1. Understand basic image and video processing concepts.
2. Explore both the theoretical and practical aspects of intelligent perception and understanding of images.
3. Apply principles and techniques of video processing in applications related to intelligent and automated visual system design and analysis.
4. Analyze techniques for action representation and recognition.
5. Develop algorithms that can perform high-level visual recognition tasks on real-world images and videos.

Text Book(s)

1. Rafael C. Gonzalez and Richard E. Woods, ―Digital Image Processing, Third Ed., PrenticeHall, 2008.
2. A. Murat Tekalp, ―Digital Video Processing, Second Edition, Prentice Hall, 2015.
3. Oge Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, 2011.

Reference Books

1. Yu Jin Zhang, ―Image Engineering: Processing, Analysis and Understanding‖, Tsinghua University Press, 2009
2. Yuyu Yujin Zhang, ―Image Understanding‖, Walter de Gruyter GmbH & Co KG, 2017 Kluwer academic publisher, 2001.
3. Boguslaw Cyganek,‖Object Detection and Recognition in Digital Images: Theory and Practice‖,Wiley, 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - IV

20CAI417 HEALTHCARE DATA ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Objectives:

1. Describe how data-based healthcare can help in improving outcomes for patient health.
2. To design data models that combine patient records from multiple sources to form a patient centric view of data.
3. To use data analytics to find health concerns and solutions to the problem faced by a patient.
4. To find meaningful patterns and trends in healthcare data to help the overall population.
5. To Apply with the Application which is used in emerging technology.

UNIT I INTRODUCTION TO HEALTHCARE DATA ANALYTICS, HEALTHCARE FOUNDATIONS — 9 hours

Introduction – Need for Healthcare Analytics - Foundations of Healthcare Analytics – Examples of Healthcare Analytics.

Healthcare Foundation: Healthcare delivery - Healthcare financing - Healthcare policy – Handling Patient data: the journey from patient to computer - Standardized clinical codesets - Breaking down healthcare analytics: population, medical task, data format, disease.

UNIT II MACHINE LEARNING FOUNDATIONS FOR HEALTHCARE — 9 hours

Model frameworks for medical decision making: Tree-like reasoning, Probabilistic reasoning and Bayes theorem, Criterion tables and the weighted sum approach, Pattern association and neural networks - Machine learning pipeline: Loading the data, Cleaning and pre-processing the data, Exploring and visualizing the data, Selecting features, Training the model parameters, Evaluating model performance.

UNIT III MEASURING HEALTHCARE QUALITY — 9 hours

Introduction to healthcare measures, Medicare value-based programs: The Hospital Value Based Purchasing (HVBP) program, The Hospital Readmission Reduction (HRR) program, The Hospital-Acquired Conditions (HAC) program, The End-Stage Renal Disease (ESRD) quality incentive program, The Skilled Nursing Facility Value-Based Program (SNFVBP), The Home Health Value-Based Program (HHVBP), The Merit-Based Incentive Payment System (MIPS).

UNIT IV MAKING PREDICTIVE MODELS IN HEALTHCARE — 9 hours

Introduction to Predictive Analytics – Obtaining and Importing the NHAMCS Dataset – Making the Response Variable - Splitting the Data into Train and Test Sets – Pre-processing the Predictor Variables – Building the Models – Using the Models to Make Predictions – Improving our Models.

UNIT V HEALTHCARE ANALYTICS APPLICATIONS, EMERGING TECHNOLOGIES — 9 hours

Introduction - Descriptive Analytics Applications - Predictive Analytics Applications - Prescriptive Analytics Application.

Healthcare analytics and the internet - Healthcare and the Internet of Things – Healthcare analytics and social media - Healthcare and deep learning - Obstacles, ethical issues, and limitations.

Course Outcomes:

At the end of the course, the student will be able to
1. Explain the concepts of Healthcare Data Analytics and healthcare foundations.
2. Apply machine learning techniques on healthcare data analytics.
3. Measure and analyse the quality of health-care systems.
4. Develop models for effective predictions in healthcare applications.
5. Use modern day emerging technologies in healthcare data analytics process.

Text Book:

1. Kumar, Vikas Vik. Healthcare Analytics Made Simple: Techniques in healthcare computing using machine learning and Python. Packt Publishing Ltd, 2018.
2. El Morr, Christo, and Hossam Ali-Hassan. Analytics in healthcare: a practical introduction. Springer, 2019

Reference Books:

1. Dinov, Ivo D. "Data Science and Predictive Analytics." Springer, Ann Arbor, MI, USA https://doi. org/10 1007 (2018): 978-3.
2. Yang, Hui, and Eva K. Lee, eds. Healthcare analytics: from data to knowledge to healthcare improvement. John Wiley & Sons, 2016.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - V

20CAI418 ROBOTIC PROCESS AUTOMATION

L	T	P	C
3	0	0	3

Pre-requisite: **Nil**

Course Description:

The course covers basic concepts of RPA and describes where it can be applied and how it's implemented. Describes about UI Path and its importance in the automation and gives the information about sequence, Flowchart & Control Flow, and data manipulation techniques. This course helps us to understand App integration, Recording and Scraping and gives knowledge on the User Events and various types of Exceptions and strategies. Topics related to user events and assistant bots are discussed.

Course Objectives:

1. To learn the evolution and future of RPA.
2. To understand about automation using UI path.
3. To have knowledge automation process activities, data manipulation and File Operations.
4. To explore on app integration, recording and scraping data from website.
5. To describe how to handle user evets and the exception handling, launching an assistant bot.

UNIT I INTRODUCTION TO RPA 9 hours

RPA Foundations- History of RPA-Difference between RPA and AI - Benefits of RPA - Components of RPA - RPA Architecture - RPA Skills - Process Methodologies in RPA - Planning for RPA-RPA Platforms - Types of Bots - Deployment platforms - Future of RPA.

UNIT II UI PATH 9 hours

Introduction to UI Path: UI Path Studio - UI Path Robot - The future of automation - Record and Play - Downloading and installing Ui Path Studio -Learning Ui Path Studio-Task recorder - Step-by step examples using the recorder.

UNIT III AUTOMATION PROCESS ACTIVITIES 9 hours

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, Application with Plug-ins and Extensions Terminal Plug-in, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer.

UNIT IV APP INTEGRATION, RECORDING AND SCRAPING 9 hours

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, scraping data from website and writing to CSV. Process Mining.

UNIT V EXCEPTION HANDLING, HANDLING USER EVENTS & ASSISTANT BOTS 9 hours

Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots, debugging techniques- Collecting crash dumps- Error reporting. What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event.

Course Outcomes:

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

1. Understand the history of RPA technology, benefits, drawbacks, and comparisons to other automation technologies.
2. Use UiPath to design control flows and workflows for the target process.
3. Analyse the different types of variables, control flow and data manipulation techniques.
4. Implement recording, web scraping and process mining by automation.
5. Utilize UIPath Studio to detect, and handle user events, exceptions in automation processes.

Text Book(s)

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.

Reference Books

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: A Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018.
2. Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018.
3. A Gerardus Blokdyk, "Robotic Process Automation Rpa a Complete Guide ", 2020
4. Jonathan Sireci," The Practitioner's Guide to RPA: A Practical Guide for Deploying Robotics Process Automation, Kindle Edition,2020.

Web References

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.co

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - V

20CAI419 EDGE AND FOG COMPUTING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

This course provides an overview of the concepts and principles of Edge Computing and Fog Computing. Students will learn about the architecture, infrastructure, services, and applications of Edge Computing, as well as the basics of Fog Computing, its platforms, and applications. The course covers a range of topics related to Edge Computing and Fog Computing, including hardware and software components, communication and networking, security, and quality of service. Students will gain hands-on experience working with different tools and technologies used in Edge Computing and Fog Computing, enabling them to design, develop, and deploy solutions in various domains.

Course Objectives:

1. To understand the fundamental concepts and architecture of Edge Computing, including its role in distributed computing, IoT, and real-time applications.
2. To gain knowledge of the different hardware and software components used in Edge Computing, including edge devices, gateways, and servers.
3. To learn about communication and networking in Edge Computing, including protocols, middleware, data analytics, and data processing.
4. To develop skills in working with Fog Computing platforms and tools, including containerization, virtualization, and software-defined networking.
5. To apply the knowledge and skills gained to design, develop, and deploy Fog Computing solutions in various domains, including healthcare, smart cities, and industrial automation.

UNIT I INTRODUCTION TO EDGE COMPUTING 9 hours

Introduction to Edge Computing: Definition, Characteristics, Applications, and Challenges - Edge Computing Architecture: Layers and Components - Edge Nodes: Hardware and Software Components - Edge Computing Platforms: Open Edge Computing Platform (OECP): Overview, Architecture, and Components. Apache Edgent: Overview, Architecture, and Components. Azure IoT Edge: Overview, Architecture, and Components - Mobile Edge Computing: Introduction, Architecture, and Applications - Edge Computing for IoT: Architecture, Applications, and Challenges - Edge Computing for 5G Networks: Architecture, Applications, and Challenges.

UNIT II EDGE COMPUTING INFRASTRUCTURE 9 hours

Edge Computing Services: Cloudlet Services: Overview, Architecture, and Components. Augmented Reality Services: Overview, Architecture, and Components. Video Streaming Services: Overview, Architecture, and Components. Gaming Services: Overview, Architecture, and Components - Service Orchestration in Edge Computing: Introduction, Challenges, and Techniques - Service Composition in Edge Computing: Introduction, Challenges, and Techniques - Service Discovery in Edge Computing: Introduction, Challenges, and Techniques - Edge Computing Security: Threats, Challenges, and Solutions. Edge Computing Quality of Service: Metrics, Techniques, and Challenges.

UNIT III EDGE COMPUTING APPLICATIONS 9 hours

Industrial Internet of Things (IIoT): Overview, Applications, and Challenges. - Smart Grids: Overview, Applications, and Challenges - Smart Transportation Systems: Overview, Applications, and Challenges - Smart Healthcare Systems: Overview, Applications, and

Challenges - Edge Computing for Augmented Reality: Applications, Challenges, and Solutions - Edge Computing for Gaming: Applications, Challenges, and Solutions.

UNIT IV INTRODUCTION TO FOG COMPUTING 9 hours

Introduction to Fog Computing: Definition, Characteristics, Applications, and Challenges. - Fog Computing Architecture: Layers and Components - Fog Nodes: Hardware and Software Components - Fog Computing Platforms: Cisco Fog Computing: Overview, Architecture, and Components. OpenFog Consortium: Overview, Architecture, and Components. Google Cloud IoT Edge: Overview, Architecture, and Components.

UNIT V FOG COMPUTING APPLICATIONS 9 hours

Smart Cities: Overview, Applications, and Challenges - Smart Agriculture: Overview, Applications, and Challenges - Smart Manufacturing: Overview, Applications, and Challenges - Fog Computing for Video Analytics: Applications, Challenges, and Solutions - Fog Computing for Smart Health Monitoring: Applications, Challenges, and Solutions - Fog Computing for Intelligent Transportation Systems: Applications, Challenges, and Solutions.

Course Outcomes:

After completing this Unit, students will be able to

1. Explain the fundamental concepts and architecture of Edge Computing, including its role in distributed computing, IoT, and real-time applications.
2. Understand the different hardware and software components used in Edge Computing, including edge devices, gateways, and servers.
3. Analyze communication and networking in Edge Computing, including protocols, middleware, data analytics, and data processing.
4. Develop skills in working with Fog Computing platforms and tools, including containerization, virtualization, and software-defined networking.
5. Apply the knowledge and skills gained to design, develop, and deploy Fog Computing solutions in various domains, including healthcare, smart cities, and industrial automation.

Text Book(s)

1. "Edge Computing: A Primer" by Xinwen Zhang, Yunhao Liu, and Jianhua Ma (ISBN-13: 978-1970041104)
2. "Fog Computing: Concepts, Frameworks and Technologies" by Mukesh Singhal and Niharika Mishra (ISBN-13: 978-3319514809)
3. "Edge Computing: Principles and Applications" by Haibo Hu, Mukesh Singhal, and Deyun Gao (ISBN-13: 978-9811090525)

Reference Books

1. "Fog and Edge Computing: Principles and Paradigms" edited by Rajkumar Buyya, Amir Vahid Dastjerdi, and Negin Rahmati (ISBN-13: 978-1119524989)
2. "Fog Computing: Theory and Practice" by K. Srinivasa Rao and A. Suresh (ISBN-13: 978-9811087242)
3. "Edge Computing: Technologies and Applications" edited by Danda B. Rawat, Jaydip Sen, and Hui Song (ISBN-13: 978-0367337541)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective – V

20CAI420 SOFTWARE PROJECT MANAGEMENT

L	P	T	C
3	0	0	3

Pre- requisite: Nil

OBJECTIVES:

1. To understand the Software Project Planning and Evaluation techniques.
2. To plan and manage projects at each stage of the software development life cycle (SDLC).
3. To learn about the activity planning and risk management principles.
4. To manage software projects and control software deliverables.
5. To develop skills to manage the various phases involved in project management and people management.

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9 hours

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9 hours

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9 hours

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9 hours

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9 hours

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns –

Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

OUTCOMES:

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

1. Understand Project Management principles while developing software.
2. Gain extensive knowledge about the basic project management concepts, framework and the process models.
3. Obtain adequate knowledge about software process models and software effort estimation techniques and estimate the risks involved in various project activities.
4. Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.
5. Learn staff selection process and the issues related to people management.

TEXTBOOK:

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

REFERENCES:

1. Robert K. Wysocki ―Effective Software Project Management‖ – Wiley Publication, 2011.
2. Walker Royce: ―Software Project Management‖-Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, ―Managing Global Software Projects‖ – McGraw Hill Education (India), Fourteenth Reprint 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - V

20CAI421 BLOCKCHAIN ARCHITECTURE DESIGN

L	T	P	C
3	0	0	3

Pre-requisite : Cryptography and Network Security

Course Description:

A blockchain is a decentralized, distributed, and public digital ledger that is used to record transactions across many computers so that the record cannot be altered retroactively without the alteration of all subsequent blocks and the consensus of the network.This course provides a broad overview of the essential concepts of blockchain technology and by initially exploring the Bitcoin protocol followed by the Ethereum protocol. It familiarizes with the functional/operational aspects of cryptocurrency eco-system.

Course Objectives:

This course enables students to

1. understand the importance of fundamentals of blockchain technology
2. acquire knowledge about cryptography and algorithms.
3. understand the knowledge in the concepts of bitcoin and consensus algorithms.
4. implement decentralized blockchain-based software Ethereum
5. examine the needed frameworks, standards, tools and libraries to build blockchains and related applications using Hyper ledger.

UNIT I INTRODUCTION TO BLOCKCHAIN 9 hours

Introduction to Blockchain Technology - The growth of blockchain technology - Distributed systems - The history of blockchain - Benefits and limitations of blockchain - Types of blockchain - Consensus - CAP theorem and blockchain - Decentralization using blockchain - Methods of decentralization - Routes to decentralization - Platforms for decentralization.

UNIT II CRYPTOGRAPHY IN BLOCKCHAIN 9 hours

Cryptography in Blockchain: Introduction - Cryptographic primitives - Symmetric Cryptography - Data Encryption Standard (DES) - Advanced Encryption Standard - Asymmetric Cryptography - public and private keys - RSA - Secure Hash Algorithms.

UNIT III INTRODUCTION TO BITCON 9 hours

BitCoin - Introduction – Transactions - Structure - Transactions types – Blockchain - Wallets and its types - Bitcoin payments - Bitcoin improvement proposals (BIPs) - Bitcoin investment and buying and selling bitcoins - Bitcoin installation - Bitcoin limitations - Consensus Algorithms - Smart Contract - History of Smart Contract - Ricardian contracts

UNIT IV ETHEREUM 9 hours

Ethereum - The yellow paper - The Ethereum network - Ethereum block chain - Components of the Ethereum block chain - Accounts and its types - The Ethereum Virtual Machine - Blocks and blockchain - Mining - Wallets - Applications developed on Ethereum - Scalability and security issues - Blockchain usecases in Banking & Financial Service

UNIT V HYPERLEDGER 9 hours

Hyperledger as a protocol - The reference architecture - Fabric - Hyperledger Fabric - Distributed Ledger - Sawtooth lake - Corda - Hyperledger projects

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Course Outcomes:

After completing this Unit, students will be able

1. To understand the fundamentals of blockchain technology.
2. To obtain knowledge on analysing various cryptographic algorithms.
3. To implement Bitcoin to develop solutions in the appropriate domains.
4. To device a decentralized blockchain-based software Ethereum
5. To apply Hyperledger Fabric to implement the Block chain Application.

Text Book(s)

1. Imran Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition, 2nd Revised edition edition. Birmingham: Packt Publishing, 2018.

Reference Books

1. Andreas M. Antonopoulos, Mastering bitcoin, First edition. O'Reilly,2015.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder "Bitcoin and Cryptocurrency Technologies a Comprehensive Introduction", Princeton University Press.
3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
4. Merunas Grincalaitis, "Mastering Ethereum: Implement Advanced Blockchain Applications Using Ethereum-supported Tools, Services, and Protocols" Packt Publishing.
5. Prof. Sandip Chakraborty, Dr. Praveen Jayachandran, "Blockchain Architecture Design and Use Cases" [MOOC], NPTEL: https://nptel.ac.in/courses/106/105/106105184

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - V

20CAI422 DESIGN PATTERNS

L	T	P	C
3	0	0	3

Pre-requisite: **Object Oriented Principles and Design**

Course Description:

This course is designed to equip students with the knowledge and skills to effectively utilize design patterns in their projects. Through a comprehensive syllabus, students will be introduced to the fundamental principles and concepts of design patterns, exploring their history and importance in software development. The course delves into various categories of design patterns, including creational, structural, and behavioral patterns, providing practical examples and real-world applications.

Course Objectives:

1. Understand the significance of design patterns.
2. Identify and apply various design patterns.
3. Enhance software design skills.
4. Solve common software design challenges.
5. Apply design patterns in real-world scenarios.

UNIT I INTRODUCTION TO DESIGN PATTERNS 9 hours

Definition and importance of design patterns-History and evolution of design patterns-Principles of object-oriented design-Common terminology and concepts in design patterns

UNIT II CREATIONAL DESIGN PATTERNS 9 hours

Singleton pattern-Factory Pattern-Abstract Factory Pattern-Builder Pattern-Prototype pattern

UNIT III STRUCTURAL DESIGN PATTERNS 9 hours

Adapter pattern-Decorator Pattern-Composite Pattern-Facade Pattern-Bridge pattern

UNIT IV BEHAVIORAL DESIGN PATTERNS 9 hours

Observer pattern-Strategy Pattern-Template method pattern-Command Pattern-Iterator pattern

UNIT V ADDITIONAL DESIGN PATTERNS 9 hours

Proxy pattern-Flyweight Pattern-Chain of Responsibility pattern-Mediator pattern-Visitor pattern

Course Outcomes:

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

1. Gain a solid understanding of the significance and historical context of design patterns.
2. Develop the ability to identify and implement creative design patterns.
3. Acquire the knowledge and skills to apply structural design patterns.
4. Gain proficiency in utilizing behavioral design patterns.
5. Understand the applications of additional design patterns.

Text Book(s)

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides,"Design patterns: Elements of Reusable object-oriented software", Addison-Wesley, 1995.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Professional Elective - V

20CAI423 MALWARE ANALYSIS

L	T	P	C
3	0	0	3

Pre-requisite: Operating System, Computer Networks and Basics of Malware, Security Concepts.

Course Description:

This course introduces the fundamentals of malware and to set up a protected static and dynamic malware analysis environment. This course is to provide an insight to fundamentals of malware analysis and to learn various malware behaviour monitoring tools and actionable detection signatures from malware indicators. Learn how to trick malware into exhibiting behaviours that only occur under special conditions.

Course Objectives:

1. To Introduce the fundamentals of malware, types and its effects.
2. To learn various malware types by static analysis.
3. To understand and analyse various malware types by dynamic analysis.
4. To explore different types of Malware Functionalities.
5. To practice the android malware analysis techniques for real world applications.

UNIT I INTRODUCTION 9 hours

Introduction: Definition of Malware – Goals of. Malware Analysis– Malware Analysis Techniques - Types of Malware Analysis – General Rules for Malware Analysis. Analysing malicious windows programs: Windows API – Windows Registry – Networking APIs – Following Running Malwares – Kernel vs User Mode- Native API.

UNIT II STATIC ANALYSIS 9 hours

X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

UNIT III DYNAMIC ANALYSIS 9 hours

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching.

UNIT IV MALWARE FUNCTIONALITY 9 hours

Downloaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

UNIT V ANDROID MALWARE 9 hours

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis. **Case Study** – Recent Trends.

Course Outcomes:

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

1. Understand the nature of malware, its capabilities, and how it is combated through detection and classification. Implement different malware analysis techniques.
2. Apply the tools and methodologies used to perform static analysis on unknown executables.
3. Identify the skills necessary to carry out independent analysis of modern malware samples using dynamic analysis techniques.
4. To be able to safely analyze, debug, and disassemble any malicious software by malware analysis.
5. Understand the concept of Android malware analysis their architecture, and App development.

Text Book(s)

1. Michael Sikorski and Andrew Honig, “Practical Malware Analysis” by No Starch Press, 2012,ISBN: 9781593272906.
2. Bill Blunden, “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System”, Second Edition,Jones & Bartlett Publishers, 2009.
3. Android Malware and Analysis by Dunham Ken, CRC.

Reference Books

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel” by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3. Android Malware by Xuxian Jiang and Yajin Zhou, Springer ISBN 978-1-4614-7393-0, 2005.
4. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis",CRC Press, Taylor & Francis Group, 2015.
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Courses

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course – I

20CAI601 WEB SCRIPTING

L	T	P	C
1	0	2	2

Pre-requisite NIL

Course Description:

This course will expose students to the techniques used in programming web pages for interactive content. The course begins by reviewing basic web technologies (HTML, CSS style sheets, XML, JavaScript (Node and Angular) and jQuery and exploring the use of event-driven programming in JavaScript to add interactive elements such as buttons and text fields to web pages.

This course provides the knowledge necessary to design and develop dynamic, database-driven web pages using PHP. Students also learn how to configure PHP and Web Servers like Apache, IIS, WAMP and XAMPP.

Course Objectives:

1. To build web applications using HTML, CSS and PHP with client side validations.
2. To build XML documents with DTD, Schemas and style sheets.
3. To maintain session management tracking using cookies & HTTP Sessions.
4. To develop a web application with database interaction using Node JavaScript and Angular JavaScript
5. To build jQuery enabled web applications.

UNIT – I: HTML & CSS **6 Hours**

Introduction to HTML, HTML5 New Features, Structural, Content, Application-focused tags. History of CSS, The Power of CSS, Selectors and Pseudo Classes, Fonts and Text Effects, Colors.

a. Creation College Website using HTML.
b. Design a website using style sheets so that the pages have uniform style.

UNIT – II: INTRODUCTION TO JAVASCRIPT **6 Hours**

Introduction to JavaScript, Comments, Variables, Exploring JavaScript Data Types, Popup Boxes, Objects, Functions, Conditions, Loops, Form Validation.

a. Design a form and validate all the controls placed on the form using Java Script.
b. Write a JavaScript program to measure the time taken by a function to execute.

UNIT – III: JQUERY WITH HTML **6 Hours**

Introduction to jQuery, Installation, Selectors, Events, Effects, Callbacks, jQuery and HTML, jQuery

a. Working on Blink text using jQuery.
b. Using jQuery right click to toggle background color.

UNIT – IV: INTRODUCTION TO XML AND PHP DATABASE **6 Hours**

Introduction to XML, Creating XML Documents, XSL, PHP Concepts: Sessions, authenticating users Database Access: Database Concepts, MYSQL database connectivity and operations.

a. Display Library information using XML.
b. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page,
c. Write a PHP program to connect to that database and extract data from the tables and display them. Experiment with various SQL queries.

UNIT – V: NODEJS AND ANGULAR JS **6 Hours**

Introduction to Node JS, Advantage of Node JS, File System: Using file operation. Data base Connectivity: Connecting strings and configuring. Database operations on create table data -Angular JS forms.

a. Working on file write, read and delete using Node.js
b. Write a Node JavaScript program to connect to that database and extract data from the tables and display them.
c. Using AngularJS to read input value from text box and will be displayed it.
d. Using AngularJS to demonstrate Arithmetic operations of two numbers.

Course Outcomes:

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

1. Design pages with HTML and CSS attributes.
2. Design and develop web applications with the support of client side validations.
3. Use well-formed XML documents and develop PHP scripts with may support of object oriented features.
4. Manage the session in web browser through Cookies & Sessions and able to communicate with other web pages through form GET and POST methods.
5. Design and develop web applications with the database interactions (thorough SQL queries) and apply Node JavaScript and Angular JavaScript for faster performance.

Text Books:

1. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M.Kromann and Jon Stephens.
2. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J.Leeand B.Ware(Addison Wesley) Pearson Education.
3. Professional Angular JS, Valeri Karpov and Diego Netto, John Willey Edition.
4. Beginning Node.JS by Basarat Syed, 2014.

Reference Books:

1. HTML & CSS:The Complete Reference ,Thomas.A Powel “Fifth Edition”Kindle Edition,2017
2. Marty Hall and Larry Brown,”Core Web Programming” Second Edition, Volume I andII, Pearson Education, 2001. Learning jQuery, Jonathan Chaffer, Karl Swedberg, Third Edition, Packt Publishing Ltd
3. HTML & CSS:The Complete Reference ,Thomas.A Powel “Fifth Edition”Kindle Edition,2017
4. Marty Hall and Larry Brown,”Core Web Programming” Second Edition, Volume I andII, Pearson Education, 2001. Learning jQuery, Jonathan Chaffer, Karl Swedberg, Third Edition, Packt Publishing Ltd

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course – I

20CAI602 ANDROID APPLICATION DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite NIL

Course Description:

This course is concerned with the development of applications on Android platform. Android is used as a basis for the development of mobile applications. This course starts with the basic concepts of Java, history of android and architecture. It also covers the development of applications using widgets, events, networking. It provides ideas on sensors, their types and writing programs based on sensor classes for application development. They will design and develop Mobile applications with the use of J2ME, like SMS, MMS, Gaming, Multimedia, JavaFX & Android.

Course Objectives:

While studying this course student will be able to

1. Understand Android history and its fundamentals and know the building blocks of android
2. Get idea on the creation of android user interface and its testing mechanisms
3. Identify the usage of threads, broadcast receivers, indents, services and their working methodology
4. Know about the storage mechanism in android using SQLite and the usage of content providers
5. Recognize the usage of android widgets and sensors in android based applications

UNIT- I INTRODUCTION AND INSTALLATION OF ANDROID TOOLS 6 Hours

Installation and Use of Android Tools: Installing the Android SDK - Anatomy of an Android Project Drawable Resources – XML Introduction - Creating user interface using XML – Overview of Android Building Blocks.

a) Develop an android application to display a simple text in the emulator

b) Develop an android application to display the internal keyboard in the emulator

UNIT- II USER INTERACTION 6 Hours

Input Components – Text View – Image View – List View and Alert Dialogues – Menus: Popup, Options and Context Menus – Screen Navigation through App Bar – Recycler View – Material Design – Testing the User Interface

a) Write an android program to display a message in the toast

b) Write an android program to input a text through a text and the same must be displayed in the toast when a button is clicked on the screen

c) Develop an application to perform 5 arithmetic operations: Addition, Subtraction, Multiplication, Division and Modulo operation with necessary user interface creation

d) Develop an android application to process a student mark list by creating proper UI using the necessary controls

UNIT-III THREADS, LOADERS AND ASYNCTASK LOADER, SERVICES 6 Hours

Threading in Android – AsyncTask – Loaders – AsyncTask Loader -Alarms and system services – Examples on alarms and services – Services: Services Life Cycle – Intent Service – Implementing Intent Service – Notifications.

1. Write an android application to create a calculato

2. Create an android UI that consists of Different Departments of a company namely Production, Finance, Marketing and HR. If the user clicks on any department it should show details of that department. Use indents.

UNIT IV: SAVING, RETRIEVING AND LOADING DATA **6 Hours**

Android File systems and Files, Databases on Android - SQLite - Status Contract Class, Update Refresh Service – Cursors – Backups - Content Providers: Overview – Role of Content Providers, Content Resolver.

a) Design an android application to display a list of items on the android screen. If the user clicks any one of the list items a dialogue box should show that the user has clicked that particular item (Use array adopters)
b) Develop an android application to show some categories such as education, entertainment, health, provisions etc., If the user clicks on any one of the items it should show the sub categories of the category and if is again clicked it should the details of those items. (Use indents and lists)
c) i. Design an android application to create a service that shows the service is running in the background in the form of a toast

UNIT-V APPLICATIONS WIDGETS, INTERACTION AND SENSORS **6 Hours**

App Widgets: Creation of Application Widgets - Interaction and Animation- Sensors: Sensor API in Android - Motion Sensor, Position Sensor, Sensor Values, Sensor Manager Class, Sensor Event class, Sensor Event Listener.

a) Develop an android application to demonstrate the concept of Fragments in Android
b) Develop an android application to demonstrate the database connectivity with the SQLite database to post and retrieve data through the User Interface
(Example: Student mark list processing, Email Registration and Login, Products and sales)
c) Demonstrate the usage of Sensors in android by developing proper application.

Course Outcomes:

Upon successful completion of this course, students can able to:

1. Work on android basic components and Install android
2. Create User Interfaces with various Layouts and views using android building blocks
3. Work with Broadcast Receivers and Services
4. Create Database in Android, Store and Retrieve data using SQLite and Content Providers
5. Develop widgets, Wall papers for an android application and write programs based on Sensors

Text Books:

1. Android Programming-The Big Nerd Ranch Guide, Bill Philips, Christ Stewart, Kristin Mariscano, Big Nerd Ranch publishers, 3rd Edition,2017
2. Android Programming for Beginners, John Horton, PACKT publishers,2018
3 Learning Android, By Marko Gargenta& Masumi Nakamura, O'Reilly, II Edition,2014
4 Android Application Development All in One for Dummies, Barry Burd, Wiley, 2nd Edition,2015

Reference Books:

1. Android application Development-Black Book, Pradeep Kothari, dreamtech,2014
2. Android Programming - Unleashed, B.M.Harwani, Pearson Education, 2013
3 Head First Android Development: A Brain-Friendly Guide, Dawn Griffiths and David Griffiths, O'Reilly, 2nd Edition,2017
4 Android System Programming, Roger Ye, PACKT publishers,2017

5 Programming Android,ByZigurdMednieks,LairdDornin,G.BlakeMeike& Masumi Nakamura,O'Reilly,2011

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course – II

20ENG601 CORPORATE COMMUNICATION

L	T	P	C
1	0	2	2

Pre-requisite: **20ENG201**

Course Description:

English is practical and it is a must for any institution to provide students with opportunities to indulge in actively applying their language skills. Thus the Communication Skills Lab facilitates students with adequate opportunities to put their communication skills in use. It also accommodates peer learning by engaging students in various interactive sessions. This lab will be accompanied by a practical lab component.

Course Objectives:

This course enables the students to –

1. Focus on their interactive skills
2. Develop their communicative competency
3. Fortify their employability skills
4. Empower their confidence and overcome their shyness
5. Become effective in their overall performance in the industry

UNIT I LISTENING SKILLS **8 hours**

Listening/watching interviews, conversations, documentaries, etc.; Listening to lectures, discussions from TV/Radio/Podcast.

UNIT II SPEAKING **10 hours**

Articulation of sounds; Intonation.; Conversational skills (Formal and Informal); Group Discussion; Making effective Oral presentations**:** Role play.

UNIT III READING SKILLS **8 hours**

Reading for main ideas; Applying background knowledge to predict content; Skimming; Scanning; Making inferences; Reading different genres of texts ranging from newspapers to creative writing; Reading Comprehension.

UNIT IV WRITING SKILLS **9 hours**

Writing an introduction; Essay structure; Descriptive paragraphs; Writing a conclusion.
Writing job applications and resume; Emails; Letters; Memorandum; Reports; Writing abstracts and summaries; Interpreting visual texts.

UNIT V INTERVIEW SKILLS **10 hours**

Different types of interviews: Answering questions and offering information; Mock interviews; Body Language.

Course Outcomes:

At the end of the course, learners will be able to—

1. Read articles from magazines and newspapers
2. Participate effectively in informal conversations
3. Introduce themselves and their friends and express opinions in English
4. Comprehend conversations and short talks delivered in English
5. Write short essays of a general kind, draft Reports and personal letters and emails in English.

Text Books:

1. Sanjay Kumar and Pushp Lata; Communication Skills; Oxford University Press, 2012.
2. Sabina Pillai and Agna Fernandez; Soft Skills and Employability Skills; Cambridge University Press, 2018.
3. S.P. Dhanavel; English and Communication Skills for Students of Science and Engineering; Orient Blackswan, 2009.
4. M. Ashraf Rizvi; Effective Technical Communication; Tata Mc Graw Hill Co. ltd, 2005.

Reference:

1. Dr. M.Adithan; Study Skills for Professional Students in Higher Education; S.Chand & Co. Pvt., 2014.
2. Guy Brook Hart & Vanessa Jakeman; Complete IELTS: Cambridge University Press, 2014.
3. Vanessa Jakeman & Clare Mcdowell; Action Plan for IELTS: Cambridge University Press, 2006.
4. Guy Brook Hart; Instant IELTS; Cambridge University Press, 2004.
5. S.P.Bakshi & Richa Sharma; Descriptive General English; Arihant Publications, 2012.
6. Charles Browne, Brent Culligan 7 Joseph Phillips; In Focus (level 2); Cambridge University Press.
7. Steven Gershon; Present Yourself 2 (second edition); Cambridge University Press.
8. Leo Jones; Let's Talk 3 (second edition); Cambridge University Press.
9. Nutall J. C.; Reading Comprehension; Orient Blackswan.
10. www.cambridgeenglish.org/in/
11. https://learnenglish.britishcouncil.org/en/english-grammar
12. https://www.rong-chang.com/

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course - III

20CAI603 MULTIMEDIA COMPUTING

L	T	P	C
1	0	2	2

Pre-requisite : NIL

Course Description:

This course provides interactive, computer-based applications that allow students to communicate ideas and information with digital and print elements. It helps to develop and manage online graphics and content. It provides an interaction between users and digital information.

Course Objectives:

This course enables students to

6. develop student's competency in producing dynamic and creative graphic solutions for multimedia productions.
7. Introduce the advanced scripting skills necessary for implementing highly interactive, rich internet applications using multimedia technologies and authoring tools.
8. Develop aesthetic value and competencies in multimedia authoring.
9. Learn visual style and layout design are stressed, as well as the editing and integration of graphic video, audio, images and animation, files.
10. Master industry-wide software and technologies to create highly interactive, rich internet applications.

UNIT I Introduction to Editing and multimedia Technologies 6 hours

Video editing is used to structure and present all video information, including films and television shows, video advertisements and video essays. Non-linear editing systems (NLE) allow video to be edited on computers with specialized software. Offline editing is the process by which raw footage is copied from an original source, without affecting the original film stock or video tape. Online editing is the process of reassembling the edit to full resolution video after an offline edit has been performed.

(a) Video Editing
(b) Audio Editing
(c) Image Editing

UNIT II Principles of Animation 6 hours

The term 2D means 2 dimensional which means that an image for the animation can be moved in two-dimensional space that is X-axis and Y-axis. 3D animation is an animation that is created in three-dimensional space which makes the characters and objects appear realistic and lively. Thus, a 3D animation has height, width as well as depth.

(a) 2D Animation
(b) 3D Animation

UNIT III Multimedia Technologies 6 hours

Multimedia combines different media for text, sound, and images into one presentation to create a more enriched and entertaining message. Multimedia technologies include the machines and systems used to create and transmit these messages. You experience multimedia when you go to the movies, watch television, play video games, or explore Web sites on the Internet.

(a)Write a Program to create an animated e-card using adobe flash
(b)Write a Program to create an animation to indicate a ball bouncing on steps
(c)Write a Program to simulate a ball hitting another ball

UNIT IV Multimedia Technologies using flash 6 hours

For computer-drawn animation, the beginning and ending images in a sequence are drawn first. The artist then saves the images to the animation program's memory. The computer fills in the images in between the beginning and the ending images. Feature-length animated films contain hundreds of thousands of separate digital images. Without the aid of computers, these films would take years to draw.

(a)Write a Program to change a circle into a square using flash
(b)Write a Program to perform motion tweening operation using flash

UNIT V Video motion analysis 6 hours

In video and computer games, the graphics on the screen are always changing. Game software has many animation sequences and sounds stored in its memory. Each move you make with the controller tells the computer which sequence to run. As you play, you create a story.

(a)Write a Program to change and object shape using a shape tweening concept
(b)Write a Program to create a 24 spokes on a wheel using flash

Course Outcomes:

After completing this course, students will be able to

16. Describe different realizations of multimedia tools and the way in which they are used.
17. Compare various data compression schemes.
18. Analyse user interface for a given application.
19. Ability to apply different multimedia development tools to produce web based and standalone user interfaces.
20. Demonstrate 2D and 3D animations using animation software.

Text Book(s)

1. "Fundamentals of Multimedia" by Ze-Nian Li and Mark S. Drew, PHI Learning, 2004.
2. "AJAX, Rich Internet Applications, and Web Development for Programmers" by Paul J Deitel and Harvey M Deitel, Deitel Developer Series, Pearson Education, 2008. (UNITS 4,5)

Reference Books

1. "Professional Adobe Flex 3" by Joseph Balderson, Peter Ent, et al, Wrox Publications, Wiley India, 2009
2. "Multimedia Communications: Applications, Networks, Protocols and Standards" by Fred Halsall, Pearson Education, 2001, RP 2005

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course – III

20CAI604 PYTHON FOR DATA SCIENCE

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Description:
This course is designed to equipping students to be able to use python programming for solving data science problems.

Course Objectives:
1. To train the students in solving computational problems
2. To elucidate solving mathematical problems using Python programming language
3. To understand the fundamentals of Python programming concepts and its applications.
4. Practical understanding of building different types of models and their evaluation.

UNIT I INTRODUCTION TO DATA SCIENCE 6 hours

The life cycle of Data Science- The Art of Data Science - Work with data – data Cleaning, data Managing, data manipulation. Establishing computational environments for data scientists using Python with IPython and Jupyter.

1. Create NumPy arrays from Python Data Structures, Intrinsic NumPy objects and Random functions.

UNIT II INTRODUCTION TO NUMPY 6 hours

NumPy Basics: Arrays and Vectorized Computation- The NumPy ndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing –Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions.

2. Manipulation of NumPy arrays- Indexing, Slicing, Reshaping, Joining and Splitting.
3. Computation on NumPy arrays using Universal Functions and Mathematical methods.
4. Import a CSV file and perform various Statistical and Comparison operations on rows/columns.
5. Load an image file and do crop and flip operation using NumPy Indexing.
6. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
7. Create Pandas Series and Data Frame from various inputs.

UNIT III DATA MANIPULATION WITH PYTHON 6 hours

Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries, Indexing, Selection, and Filtering, Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership.

8. Import any CSV file to Pandas Data Frame and perform the following:
   (a) Visualize the first and last 10 records
   (b) Get the shape, index and column details.
   (c) Select/Delete the records(rows)/columns based on conditions.
   (d) Perform ranking and sorting operations.
   (e) Do required statistical operations on the given columns.
   (f) Find the count and uniqueness of the given categorical values.
   (g) Rename single/multiple columns.

UNIT IV DATA CLEANING, PREPARATION AND VISUALIZATION 6 hours

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Dens

9. Import any CSV file to Pandas Data Frame and perform the following:
   (a) Handle missing data by detecting and dropping/ filling missing values.
   (b) Transform data using apply () and map () method.
   (c) Detect and filter outliers.
   (d) Perform Vectorized String operations on Pandas Series.
   (e) Visualize data using Line Plots, Bar Plots, Histograms, Density Plots and Scatter Plots.

UNIT V MACHINE LEARNING USING PYTHON 6 hours

Introduction Machine Learning: Categories of Machine Learning algorithms, Feature Engineering, Naive Bayes Classification - Linear Regression – K-Means Clustering

10. Write a program to demonstrate Linear Regression analysis with residual plots on a given data set.
11. Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
12. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.
13. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions using Python ML library classes.

Course Outcomes:

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

1. Illustrate the use of various data structures.
2. Analyze and manipulate Data using Numpy and Pandas.
3. Creating static, animated, and interactive visualizations using Matplotlib.
4. Understand the implementation procedures for the machine learning algorithms.
5. Identify and apply Machine Learning algorithms to solve real-world problems using appropriate data sets.

Text Book(s)

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.

Reference Books

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.

2. Francois Chollet, Deep Learning with Python, 1/e, Manning Publications Company, 2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Dept. of. Computer Science & Engineering (Artificial Intelligence)

Skill Oriented Course – III

20CAI610 NETWORK PROGRAMMING

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Description:

This course helps the students to understand and implement OSI layers, simulation of various protocols, Error detection techniques, Routing and Congestion Algorithms simulation using NS, and protocol analysis, packet analysis, and traffic analysis using Wireshark.

Course Objectives:

1. To study the evolution of computer networks, foundational principles, architectures, and techniques employed in computer networks.
2. To study the concepts of communication networks from layered perspective
3. To provide students with a theoretical and practical base in computer networks issues
4. Student will be able purse his study in advanced networking courses.
5. To Prepare students for easy transfer from academia into future directions of research.

UNIT-I INTRODUCTION 9 hours

Introduction, Advantages and Applications, Network Types, Topologies, Internet History, Standards and Administration. Protocols and Standards Network Models: Protocol Layering, The ISO Model, Layers in the OSI Model, TCP/IP Protocol Suite, Cross-layering, Addressing.
Data and Signals, Transmission impairment, Data rate limits, Performance. Transmission media: Introduction, Guided Media, Unguided Media. switching: Structure of Circuit Switched Networks, Packet switched networks.

1. Study of Basic Network Commands and Network Configuration commands
2. Implement a program for OSI functionality to transmit data from client to server.
3. Implement a program for the following Encoding Techniques - NRZ, NRZ-I ,Manchester.

UNIT-II THE DATA LINK LAYER 9 hours

Introduction, Link layer addressing. Error detection and Correction: Cyclic codes, Checksum, Forward error correction. Data link control: DLC Services, Data link layer protocols, Frames, Flow & Error Control, Protocols, HDLC, Point to Point Protocol. Media Access control: Random Access, Controlled Access, Channelization, and connecting devices.

4. Implement a program for framing Techniques
   a) Character Count b) Bit Stuffing and Destuffing c) Byte Stuffing and Destuffing
5. Implement a program for Flow control based on Sliding Window protocol
   a) Go Back N ARQ b) Selective repeat ARQ
6. Implement a program for CRC polynomials.
7. Simulation of Transferring data between two nodes using NS.
8. Simulation of data transfer and packet loss using NS.

UNIT-III THE NETWORK LAYER 9 hours

Network layer design issues, Routing algorithms, (Optimal, Shortest path, Distance Vector routing, Link State routing, Hierarchical routing, Routing in adhoc networks), Congestion control algorithms, Quality of service, Internetworking, The network layer in the Internet: IP Classes, IPV4 and IPV6, IP Addressing, NAT, IP support protocols, OSPF, BGP, RIP, IGMP.

9. Simulation of Congestion Control Algorithm using NS.
10. Simulate a 3 nodes point-to-point network with duplex links between them. Set the queue size vary the bandwidth and find the number of packets dropped.

UNIT-IV THE TRANSPORT LAYER 9 hours

The Transport Service, Elements of Transport Protocols, Flow control, Congestion Control, The internet transport protocols: UDP, TCP, SCTP. Performance problems in computer networks, Network performance measurement. Performance Issues.

11. Simulate a 4 nodes point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP n1-n3. Apply relevant Applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.

UNIT-V THE APPLICATION LAYER 9 hours

Introduction, Client Server Programming, WWW and HTTP, FTP, e-mail, TELNET, Secure Shell, Domain Name System, SNMP. DNS, TELNET, e-mail, File Transfer, WWW and HTTP, SNMP, Streaming Audio & Video, Content delivery.Case study- Computer Networks in health care.

12. Simulate an Ethernet LAN using N-nodes (6-10), change error rate and data rate and compare the throughput.
13. Protocol analysis with Wireshark.
14. Packet Capture & Traffic Analysis with Wireshark.

Course Outcomes:

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

1. Understand and choose the transmission media and topologies depending on the requirements.
2. Apply error detection and error correction wherever required.
3. Analyze the concepts of routing, and congestion control
4. Evaluate the computer network logically, by enumerating the layers of the TCP/IP.
5. Create and make use of application-level protocols for file communication, and file transfer.

Text Book(s)

1. Data Communications and Networking, Behrouz A. Forouzan, 6th , Tata McGraw Hill, 2021.

Reference Books

1. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose, K.W.Ross, Third Edition, Pearson Education
2. Understanding Communications and Networks, Third Edition, W.A.Shay, Cengage Learning. Implementation and Management,6th Edition,2012.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination

Skill Oriented Course - IV

20CAI605 FULL STACK DEVELOPMENT

L	T	P	C
1	0	2	2

Pre-requisite: NIL

Course Description:

Full Stack Web Development course will help students become masters in front-end technology. It provides basic information and experiments to grow to be a Full-Stack web developer. With fast growing technologies, the students can update their knowledge of technologies. This will help the students to learn the complete set of process like designing development and deployment.

Course Objectives:

This course enables students to

1. Build web applications using HTML, JavaScript, CSS, and PHP with client-side validations.
2. Create and integrate Plug-ins with jQuery (Events, Animation).
3. Build XML documents with DTD, Schemas, and style sheets.
4. Develop a web application with database interaction using Node JavaScript and Angular JavaScript
5. Implement MongoDBModels.

UNIT I INTRODUCTION TO HTML & CSS 6 hours

History of HTML/XHTML/HTML5, HTML5 New Features, HTML5 vs HTML4 vs XHTML, Structural, Content, Application-focused tags, Deprecated elements. History of CSS, The Power of CSS, Selectors and Pseudo Classes, Fonts and Text Effects, Colors.

(a). Develop static pages (using only HTML) of an online ticket reservation.

(b). Design a website using style sheets so that the pages have uniform style.

UNIT II INTRODUCTION TO JAVASCRIPT 6 hours

Introduction to JavaScript, Comments, Variables, Exploring JavaScript Data Types, Popup Boxes, Objects, Functions, Conditions, Loops, JavaScript Break and Continue, Error handling, Form. Validation, RegExp Object, String Object, Date Object

(a). Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference, and quotient.

(b). Design a form and validate all the controls placed on the form using Java Script.

(c). Write a JavaScript code that displays text “TEXT-GROWING” with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays. “TEXTSHRINKING” in BLUE color. Then the font size decreases to 5pt.

UNIT III INTRODUCTION TO PHP 6 hours

Overview of PHP Data types and Concepts: Variables and data types, Operators, Expressions and Statements. Advanced Concepts: Using Sessions, authenticating users. PHP and Database Access: Basic Database Concepts, connecting to a MYSQL database, Retrieving and Displaying results, Modifying, Updating and Deleting data.

(a). Write a PHP program to store page views count in SESSION, to increment the count on each. refresh, and to show the count on web page.

(b). Design Webpage for Data collection, store, retrieve and manipulate data using SQL database. using PHP

UNIT IV INTRODUCTION TO JQUERY, NODEJS AND ANGULAR JS 6 hours

Introduction to jQuery, Installation, Selectors, Events, Effects, Callbacks, jQuery, and HTML, jQuery. Introduction to Node JS, Advantage of Node JS, File System: Using file operation (open, read, write, and delete). Introduction to AngularJS: What is Angular JS? Why Angular JS? Features of Angular JS. Working with Angular JS forms.

(a). Working on Blink text using jQuery.
(b). Using jQuery right click to toggle background color.
(c). Develop a Form and validate using Angular JS
(d). Working on file write, read, and delete using Node.js

UNIT V INTRODUCTION TO XML & MONGODB 6 hours

Introduction to XML, Creating ML Documents, Creating XML DTDs, XMLSchemas, XSL. Introduction to MongoDB – Data Modelling, Data Types.

(a). Design an XML document to store information about a student. The information must include Roll no, Name, and Name of the College, Branch, Year of Joining, and email id. Make up. sample data for 3 students. Create a CSS style sheet and use it to display the document.
(b). Implement MongoDB data models.

Course Outcomes:

After completing this course, students will be able to

1. Design pages with HTML and CSS attributes.
2. Design and develop web applications with the support of client-side validations.
3. Use well-formed XML documents and develop PHP scripts with may support of object-oriented features.
4. Manage the session in web browser through Sessions and able to communicate with other web pages through form GET and POST methods.
5. Design and develop web applications with the database interactions (thorough MongoDB) and apply Node JavaScript and Angular JavaScript for faster performance.

Textbook(s)

1. PHP 5 Recipes A problem Solution Approach Lee Babin, Nathan A Good, Frank M. Kromann and Jon Stephens.
2 HTML & CSS: The Complete Reference, Thomas. A Powel “Fifth Edition” Kindle Edition,2017.
3 Professional Angular JS, Valeri Karpov and Diego Netto, John Willey Edition.
4 Beginning Node.JS by Basarat Syed, 2014.
5 MongoDB Basics 1st ed. Edition by Peter Membrey (Author), David Hows (Author), Eelco Plugge (Author)

Reference Books

1. Web Coding Bible, An Accelerated Course, Chong Lip Phang, 2015
2. Java Script for ProgrammersPaul J. Deitel, Deitel & Associates, Inc.Harvey M. Deitel, Deitel& Associates, Inc.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – IV

20CAI606 UML DESIGN

L	T	P	C
1	0	2	2

Pre-requisite : None

Course Description:

This course will give an overview of UML and how to use UML diagrams and views to support requirements, architectural and systems design. The main contents are using case diagram, class diagram, sequence diagram, state diagram, activity diagram, component diagram and deployment diagram of UML. CASE tool of UML is used to analyse and design the course project systems.

Course Objectives:

This course enables students to

1. To analyze and design solutions to problems using object-oriented approach.
2. To make the student to learn and apply the process of object-oriented analysis and design to solve complex problems with the different applications.

UNIT I INTRODUCTION **6 hours**

Introduction about Object Orientated Technology, Development and OO Modeling, History, Modeling design Technique.

1. To develop a problem statement.
2. 2.Develop an IEEE standard SRS document. Also develop risk management and project plan (Gantt chart)

UNIT II INTERACTION MODELING **6 hours**

Object and class concepts, link and association, Generalization, Inheritance, Use case Models, Activity model.

1. Identify Use Cases and develop the Use Case model.
2. Identify the business activities and develop an UML Activity diagram.
3. Identity the conceptual classes and develop a domain model with UML Class diagram.

UNIT III BEHAVIORAL MODELING **6 hours**

Event, state, Transition and conditions, state diagram, state diagram, behaviour, concurrency, State models

1. Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams.
2. Draw the State Chart diagram.

UNIT IV LOGICAL ARCHITECTURE AND UML PACKAGE DIAGRAMS **6 hours**

Layers-User Interface, Technical Services layer, Domain objects layer, Software architecture, UML package diagrams

1.Identify the User Interface, Domain objects, and technical services.
2.Draw the partial layered, logical architecture diagram with UML package diagram notation.
3. Implement the Technical services layer.
4. Implement the Domain objects layer.
5. Implement the User Interface layer

UNIT V Architectural Modeling **6 hours**

Architectural Modeling: Components, Deployment, Component diagrams, Deployment diagrams Common modeling techniques

1. Draw Component and Deployment diagrams.

Suggested domains for Mini project

1. Passport automation system
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference Management System
13. BPO Management System

Course Outcomes:

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

1. Analyse problems using object-oriented approach.
2. Design structural and behavioral diagrams.
3. Apply forward engineering to the given problems.
4. Design object-oriented models using UML.
5. Develop real time applications using object oriented concept

Text Book(s)

1. "The Unified Modeling Language User Guide" by Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, 2nd Edition.

Reference Books

1. "Design Patterns: Elements of Reusable Object Oriented Software" by Erich Gamma, Richard Belm, Ralph Johnson, John Vlissides, Addison-Wesley, 1994.
2. "Fundamentals of Object Oriented Design in UML" by Meilir Page-Jones, Pearson Education, 2000.
3. "Object Oriented Analysis & Design" by Atul Kahate, McGraw-Hill, 2004.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course – V

20CAI608 NoSQL

L	T	P	C
1	0	2	2

Pre-requisite: Basic Knowledge about DBMS

Course Description:

This course will provide you with technical hands-on knowledge of NoSQL databases and Database-as-a-Service (DaaS) offerings. Explore the origins of NoSQL databases and the characteristics that distinguish them from traditional relational database management systems. Understand the basic architecture and data models of a NoSQL database (key-value stores, document databases, column-family stores, graph databases) Discuss the criteria that decision makers should consider when choosing between relational and non-relational databases and techniques for selecting the NoSQL database that best addresses specific use cases.

Course Objectives:

1. To learn to implement and work with NoSQL databases
2. To understand the basic storage architecture of distributed file systems
3. To learn about the various tools available such as MongoDB, Cassandra.
4. To perform CRUD operations (create, read, update and delete) on data in NoSQL Environment
5. To develop Application with Graph Data model

UNIT I Introduction to NoSQL 9 hours

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch. Application and Integration of Databases, Attack of the Clusters, The Emergence of NoSQL. Benefits of using NoSQL DB. Backend Management, Deployment, Front-End Development, Open Source, Drawbacks of Using NoSQL DB, NoSQL vs. SQL

1. Install and Configure MongoDB in local machine.
2. Creating databases and collections in MongoDB.
3. Creating and managing documents in MongoDB.

UNIT II NoSQL Development 9 hours

Schemaless Development, Data Models, Distribution Models, Consistency. Categories of NoSQL: Key-Value Stores, Wide-Column Family Stores, Document Databases, Graph Databases, Object-Oriented Databases, and Others, NoSQL Scalability, Searching.

Wide-Column NoSQL Databases - NoSQL Databases: Cassandra, Bigtable, MapReduce, and Others.

4. Querying documents in MongoDB
5. Indexing documents in MongoDB

UNIT III An Open-Source NoSQL Database 9 hours

Various open source NoSQL Databases : MongoDB, CouchDB, Apache Casandra, Neo4J, Redis, Apache HBase, RavenDB – Pros and cons , Applications of open source databases.

Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In MongoDB, Creating and Using Indexes In MongoDB, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

6. Install Cassandra in local machine and configure it.
7. Creating and managing keyspaces in Cassandra.

8. Creating and managing tables in Cassandra.

UNIT IV NoSQL Operations 9 hours

The set of essential operations – CRUD - Create, Read, Update and Delete operations in the context of a NoSQL database environment. Practical experience of CRUD operations for document databases using MongoDB. Queries using MongoDB

9. Build a simple CRUD application with MongoDB

UNIT V Data Modelling with Graph & Case Studies 9 hours

Building Graph Model, Edges, Nodes, Relationships, Example NoSQL Databases: Neo4J, Info Grid. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases. Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use. Case Study: Optimizing Transportation Routes

10. Build a simple social network with Neo4j.

Course Outcomes:

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

1. Understand various types of NoSQL Databases
2. Define, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph)
3. Outline the application and Integration of NoSQL Databases.
4. Apply Nosql Development tools
5. Understand the detailed architecture and performance tune of Graph NoSQL databases

Text Book(s)

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications,1st Edition ,2019

Reference Books

1. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN-13: 978-9332557338)
2. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022)
3. Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course - V

20CAI610 CRYPTOGRAPHY ALGORITHMS

L	T	P	C
1	0	2	2

Pre-requisite: **Linear Algebra, Computer Networks**

Course Description:

This course covers the principles and practices of cryptography. The fundamental topics of attacks, attack model, and few classical techniques are introduced. Symmetric and Asymmetric ciphers are illustrated. Message authentication and Hash functions are exemplified. Also, practical exposure on encryption algorithms, authentication techniques.

Course Objectives:

1. To understand the basic categories of threats to computers and networks
2. To learn the Symmetric cryptographic algorithms.
3. To learn the Asymmetric cryptographic algorithms
4. To have knowledge about the cryptographic Hash Functions
5. To have knowledge about the message authentication and Digital Signature

UNIT-I

Overview: The OSI security Architecture, security Attacks, Security Services, Security Mechanisms, A model for Network Security.

Classical Encryption Techniques: Symmetric Cipher model, substitution techniques, Transposition Techniques.

1. a) Implementation of Caesar cipher.
   b) Implementation of playfair cipher.
   c) Implementation of Column transposition.

UNIT II

Block ciphers and Data Encryption Standard: Block cipher principles, Data Encryption Standard (DES), DES Example, The Strength of DES, Differential and Linear cryptanalysis, Block cipher design principles. **Advanced Encryption Standard:** The Origins AES, AES Structure, AES round functions, AES Key Expansion, An AES Example.

2. a) Implementation of DES.
   b) Implementation of AES.

UNIT-III

Number Theory: Prime Numbers, Fermat's Theorem, Euler's Theorem, Testing for primality, The Chinese Remainder Theorem, Discrete Logarithms. **Public –Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, RSA Algorithm, Diffie-Hellman key exchange, ElGamal cryptosystems, Elliptic curve Arithmetic, Elliptic curve cryptography.

3. a) Implementation of RSA Algorithm.
   b) Implementation of Diffie-Hellman Algorithm.

UNIT IV

Stream Ciphers and Pseudorandom number generation: Principles of Pseudorandom number generation, Pseudorandom number generators, Pseudorandom number generation using a block cipher, stream ciphers, RC4. **Cryptographic Hash Functions:** Applications of cryptographic Hash Functions, two simple hash functions, requirements and security, Hash functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

4. a) Implementation of RC4 Algorithm.
   b) Implementation of SHA-3 Algorithm.

UNIT V

Message Authentication Codes: Message Authentication Requirements, Message Authentication functions, Message Authentication codes, security of MAC's, HMAC. **Digital Signatures:** Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital signature scheme, Digital Signature Standard (DSS).

5. a) Implementation of HMAC.
   b) Implementation of DSS.

Course Outcomes:

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

1. Implement classical Encryption Techniques.
2. Apply symmetric key cryptographic algorithms.
3. Experiment with various asymmetric key cryptographic algorithms.
4. Execute stream cipher algorithms and hash algorithms.
5. Make use of Authentication functions.

Text Book(s)

1. Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition.

Reference Books

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley, India, 1st Edition.
2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Skill Oriented Course - V

20CAI611 ADVANCED MACHINE LEARNING

L	T	P	C
1	0	2	2

Pre-requisite Machine Learning concepts

Course Description:

This course helps the students to understand and implement advanced Machine Learning (ML) algorithms such as Exploratory Data Analysis, Dimensionality Reduction techniques, cross-validation on a learning problem, Apriori algorithm, FP-Growth algorithm, K-means clustering, hierarchical clustering algorithms, DBSCAN clustering algorithm, density-based clustering, graph-based clustering, Web scraping.

Course Objectives:

1. To understand feature engineering techniques in machine learning
2. To learn simple regression algorithms
3. To apply comparative analysis among simple and advanced regression algorithms
4. To explore various types of clustering methods
5. To analyze feature extraction in NLP and object detection techniques using OpenCV

UNIT I: INTRODUCTION 9 Hours

Exploratory Data Analysis (EDA), Outliers, Dimensionality Reduction, Apriori Algorithm, FP-Growth Algorithm

1) Implement a program to perform Exploratory Data Analysis on real time datasets using the following approaches: a) Univariate Analysis b) Multivariate Analysis c) Visualization using correlation matrix
2) Implement a program to evaluate and compare learning curves of leave-one-out with two, three, five and ten-fold cross-validation on a learning problem using real time dataset
3) Implement a program to perform any of the following Dimensionality Reduction techniques on real time datasets. a) Principal Component Analysis b) Single value Decomposition c) Linear Discriminant Analysis d) Factor Analysis
4) Implement a program to generate Association Rules using the Apriori algorithm
5) Implement a program to generate Association Rules using the FP-Growth algorithm

UNIT II: SIMPLE REGRESSION 9 Hours

Simple Linear Regression, Multiple Linear Regression, One Hot Encoding, Polynomial Linear Regression

1) Implement a program to evaluate r2_score for finding the accuracy using simple linear regression
2) Implement a program to perform multiple linear regression model for predicting house prices
3) Implement a program to convert textual data into numeric data using one hot encoding
4) Implement polynomial regression for finding salary based on experience data

UNIT III: ADVANCED REGRESSION 9 Hours

Ride Regression, Lasso Regression, Elastic net Regression, Logistic Regression: binary classification and multi-class classification

1) Implement a program using Ridge Regression to predict height depending on weight
2) Implement a program using Lasso regression on Boston house prices and select the best feature that mostly influences the price of the house

3) Develop a program to create Elastic Net model and find out which factor is most determining factor for diabetes in India.
4) Apply binary and multi-class classification techniques to develop a program using logistic regression

UNIT-IV: CLUSTERING

K-Means, Hierarchical, DBSCAN, density-based, graph-based clustering algorithms

1) Develop a program to implement K-means clustering algorithm
2) Develop a program to implement hierarchical clustering algorithm
3) Develop a program to implement the DBSCAN clustering algorithm
4) Implement a program for density-based clustering algorithm
5) Implement a program for graph-based clustering algorithm

UNIT-V: NLP and Computer Vision

Tokenization, Stemming, Lemmatization, Stop words, Parts of Speech (Pos), Count Vectorizer
Face Detection, Contours

1) Implement bag of words technique for converting text into vectors
2) Implement a program to extract SURF/SIFT feature using OpenCV on a sample image
3) Write a program to implement YOLO algorithm
4) Develop a program to eliminate multiple rectangular boxes

Course Outcomes:

After completing this course, the students should be able to

1. Understand various Feature Extracting, Feature Engineering techniques and Exploratory Data Analysis on real time datasets
2. Develop various simple regression techniques
3. Implement various advanced regression techniques
4. Develop clusters from real time data using various Clustering Algorithms
5. Implement bag of words and object detection techniques using NLP and computer vision

Text Book(s)

1. Dipanjan Sarkar, Raghav Bali, Tushar Sharma. Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems, Apress. 2018.

Reference Books

1. Sikar Dutt, Subramanian Chandra mouli, Amit Kumar Das, Machine Learning, Ninth Impression, Pearson, 2022.
2. Manohar Swamynathan, Mastering Machine Learning with Python in Six Steps -A Practical Implementation Guide to Predictive Data Analytics Using Python, Apress,2017.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

HONORS

Honors

20HDCAI101 COGNITIVE SCIENCE AND ANALYTICS

L	T	P	C
3	0	0	3

Pre-requisite:
A course on AI should be studied by students, to study this course.

Course Description:
This course explores the area of cognitive computing and its implications for now a days world of big data analytics and evidence-based decision making. Cognitive computing design principles, natural language processing, knowledge representation, this is an opportunity to build cognitive applications, and explore how knowledge-based artificial intelligence and deep learning are impacting the field of data science.

Course Objectives:
To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions and to understand how Cognitive computing supports human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

UNIT I **9 Hours**
Introduction: Cognitive science and cognitive Computing with AI, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind - The Nature of Cognitive Psychology – Cognitive architecture – Cognitive processes – The Cognitive Modeling Paradigms - Declarative / Logic based Computational cognitive modeling – connectionist models – Bayesian models.

UNIT II **9 Hours**
Introduction to Knowledge-Based AI – Human Cognition on AI – Cognitive Architectures. Cognitive Computing with Inference and Decision Support Systems: Intelligent Decision making, Fuzzy Cognitive Maps,

UNIT III **9 Hours**
Learning algorithms: Nonlinear Hebbian Learning – Data driven NHL - Hybrid learning, Fuzzy Grey cognitive maps, Dynamic Random fuzzy cognitive Maps. Cognitive Computing with Machine Learning: Machine learning Techniques for cognitive decision making.

UNIT IV **9 Hours**
Hypothesis Generation and Scoring - Natural Language Processing - Representing Knowledge - Taxonomies and Ontologies - Deep Learning

UNIT V **9 Hours**
Case Studies: Cognitive Systems in health care – Cognitive Assistant for visually impaired – AI for cancer detection, Predictive Analytics - Text Analytics - Image Analytics -Speech Analytics – IBM Watson

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

1. Understand basics of Cognitive Computing and its differences from traditional Approaches of Computing
2. Plan and use the primary tools associated with cognitive computing.
3. Plan and execute a project that leverages Cognitive Computing.

Textbook(s)

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, Indianapolis, IN, 2005, ISBN: 978-1-118-89662-4.
2. Masood, Adnan, Hashmi, Adnan, Cognitive Computing Recipes-Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, 2015**.**

Reference Books

1. Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2. Gerardus Blokdyk, Cognitive Computing Complete Self-Assessment Guide, 2018
3. Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series, 2019

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI102 BUSINESS INTELLIGENCE

L	T	P	C
3	0	0	3

Pre-requisite Database Management Systems, Basic probability and statistics

Course Description:

The course aims at examining Business Intelligence (BI) as a broad category of applications and technologies for gathering, storing, analyzing, sharing and providing access to data to help enterprise users make better managerial decisions. To learn the principles and best practices for how to use data in order to support fact-based decision making. Emphasis will be given to applications in marketing, where BI helps in, e.g., analyzing campaign returns, promotional yields, or tracking social media marketing; in sales, where BI helps performing for sales analysis; and in application domains such as Customer Relationship Management and e-Commerce. Practical experience will be gained by developing a BI project (case-study) with leading BI software.

Course Objectives:

1. Be exposed with the basic rudiments of business intelligence system
2. Understand the modeling aspects behind Business Intelligence
3. Understand of the business intelligence life cycle and the techniques used in it
4. Be exposed with different data analysis tools and techniques
5. Learn different reporting tools

UNIT I INTRODUCTION TO BUSINESS INTELLIGENCE 9 hours

What is business intelligence and analytics (BIA)? Evolution of BIA, Interplay among Business Intelligence, Business Analytics, Data Science, Data Mining, Data Analytics, Data Warehousing, Statistics and Machine Learning. Drawing insights from data: DIKW pyramid Business Analytics project methodology - detailed description of each phase, Data exploration and data preparation.

UNIT II DECISION MANAGEMENT SYSTEMS 9 hours

Study of Information Technology resources such as database systems, enterprise systems, and networks, role of supporting, decision makers, Decision Taxonomy Principles of Decision Management Systems, Building Decision Management Systems, Characteristics of Suitable Decisions, Prioritizing Decisions, Decision Analysis, Monitor Decisions, Fact-Based Decisions - The OODA Loop – Technology Enablers, Business Rules Management Systems

UNIT III DATA PREPROCESSING: 9 hours

Mechanisms of data collection and challenges involved therein. Notion of data quality. Typical preprocessing operations: combining values into one, handling incomplete or incorrect data, handling missing values, recoding values, sub setting, sorting, transforming scale, determining percentiles, data manipulation, removing noise, removing inconsistencies, transformations, standardizing, normalizing - min-max normalization, z-score standardization, rules of standardizing data Enterprise Reporting: Metrics, Measurement, Measures, KPIs, Dashboards, Reports,
Scorecards

UNIT IV ARCHITECTING THE DATA 9 hours

Introduction, Types of Data, Enterprise Data Model, Enterprise Subject Area Model, Enterprise Conceptual Model, Enterprise Conceptual Entity Model, Granularity of the Data, Data Reporting and Query Tools, Data Partitioning, Metadata, Total Data Quality Management (TDQM).

UNIT V DATA WAREHOUSING 9 hours

What is a data warehouse, need for a data warehouse, architecture, data marts, OLTP vs OLAP, Multidimensional Modeling: Star and snow flake schema, Data cubes, Enterprise Reporting OLAP operations, Data Cube Computation and Data Generalization, Data lake Descriptive statistics, Inferential statistics.

Data visualization: Role of visualization in analytics, different techniques for visualizing data based on the nature of data and what kind of insights need to be drawn

Course Outcomes:

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

1. Construct an end-to-end data warehousing solution for business intelligence involving various data sources, ETL, multi -dimensional modeling, OLAP, reporting and analytics
2. Evaluate various data processing algorithms in their applicability to different problems
3. Display the process of converting data into a user defined format required for particular analysis
4. Utilize statistical tools in deriving insights from data
5. Describe various techniques for descriptive, predictive and prescriptive analytics
6. Apply various techniques to solve real-world data analysis problems

Text Book:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 9th Edition, Pearson 2013.

Reference Books:

1. R. N. Prasad, SeemaAcharya , “Fundamentals of Business Analytics”,ISBN: 978-81-256-3203-2, Wiley-India – Types of Digital Data, OLTP-OLAP, Introduction to BI (ch 4 and 5), data integration (ch 6), MDDM (ch 7), Reporting (ch 8, 9)
2. Wolfgang Jank , Business Analytics for managers, exploring and discovering data (ch 2), Data Modeling (ch 3, 4, 5, 6)
3. Ralph Kimball, Margy Ross ,“The Data Warehouse Toolkit – Complete Guide to Dimensional Modeling”, Wiley Computer Publishing

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI103 ADVANCED ALGORITHMS

L	T	P	C
3	0	0	3

Pre-requisite: Computer Programming and Data Structure

Course Description:
Advanced algorithms build upon basic ones and use new ideas. We will start with networks flows which are used in more typical applications such as optimal matchings, finding disjoint paths and flight scheduling as well as more surprising ones like image segmentation in computer vision.

Course Objectives:

1. Introduces the recurrence relations for analyzing the algorithms.
2. Introduces the graphs and their traversals.
3. Describes major algorithmic techniques (divide-and-conquer, greedy, dynamic programming, Brute Force, Transform and Conquer approaches) and mention problems for which each technique is appropriate.
4. Describes how to evaluate and compare different algorithms using worst-case, average-case and best-case analysis.
5. Introduces string matching algorithms.

UNIT I **9 hours**

Introduction: Role of Algorithms in computing, Order Notation, Recurrences, Probabilistic Analysis and Randomized Algorithms. Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time.
Advanced Design and Analysis Techniques: Dynamic Programming- Matrix chain Multiplication, Longest common Subsequence and optimal binary Search trees.

UNIT II **9 hours**

Greedy Algorithms - Huffman Codes, Activity Selection Problem. Amortized Analysis.
Graph Algorithms: Topological Sorting, Minimum Spanning trees, Single Source Shortest Paths, Maximum Flow algorithms.

UNIT III **9 hours**

Sorting Networks: Comparison Networks, Zero-one principle, bitonic Sorting Networks, Merging Network, Sorting Network.
Matrix Operations- Strassen's Matrix Multiplication, inverting matrices, Solving system of linear Equations

UNIT IV **9 hours**
String Matching: Naive String Matching, Rabin-Karp algorithm, matching with finite Automata, Knuth-Morris - Pratt algorithm.

UNIT V **9 hours**

NP-Completeness and Approximation Algorithms: Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Complete problems. Approximation Algorithms- Vertex cover Problem, Travelling Salesperson problem

Course Outcomes:

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

1. Ability to analyze the performance of algorithms.
2. Ability to choose appropriate data structures and algorithm design methods for a specified application.
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

Text Book(s)

1. Introduction to Algorithms," T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, Third Edition, PHI.

Reference Books

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd.
2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson
3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John Wiley and sons.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI104 DATA WAREHOUSING AND DATA MINING

L	T	P	C
3	0	0	3

Pre-requisite : Statistics for Data Analytics or equivalent working knowledge is required

Course Description:
This course covers the principles and practices of data mining and warehousing To extract knowledge from data repository for data analysis, frequent pattern, classification and prediction.

Course Objectives:

1. To understand the basic concepts of data mining and its applications and major issues.
2. To learn the various preprocessing technique in data mining.
3. To have knowledge about the data warehousing and OLAP.
4. To learn basic concepts and algorithms of classification.
5. To explore various data mining trends and research frontiers.

UNIT I INTRODUCTION TO DATA MINING 9 hours

Introduction :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted, Major issues in data mining

UNIT II DATA PREPROCESSING 9 hours

Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization

UNIT III DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING 9 hours

Data warehousing and online analytical processing: Data warehousing: Basic concepts, Data warehouse modeling: Data cube and OLAP, Data warehouse design and usage

UNIT IV CLASSIFICATION 9 hours

Classification: Basic Concepts: Basic Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection

UNIT V DATA MINING TRENDS AND RESEARCH FRONTIERS 9 hours

Data mining trends and research frontiers: Mining complex data types, other methodologies of data mining, Data mining applications, Data Mining and society.

Course Outcomes:

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

1. Understand various basic topics of data mining
2. Analyze the different preprocessing technique in data mining
3. Analyze about data warehousing and OLAP topics
4. Evaluate the concepts of classification and its algorithms
5. Explore the data mining trends and its applications in various fields

Text Book(s)

1. Data Mining Concepts andTechniques: Jiawei Han, MichelineKamber , Jian Pei, ELSEVIER,3rd editing 2012

Reference Books

1. Alex berson and Stephen J.Smith"Data Warehousing,Data Mining & OLAP",Tata McGraw-Hill Edition,Tenth Reprint 2007.

2. K.P.Soman,Shyam Diwakar and V. Ajay "Insight into Data Mining Theory and Practice",Easter Economy Edition, Prentice Hall of India,2006.

3. G.K. Gupta "Introduction to Data Mining with Case studies"Easter Economy Edition,Prentice Hall of India,2006.

4. Pang-Ning Tan,Michael Steinbach and Vipin kumar"Introduction to data Mining",Pearson Education,2007.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI105 EXPERT SYSTEM

L	T	P	C
3	0	0	3

Pre-requisite : Nil

Course Objectives:

1. To provide an overview of the Expert System.
2. To introduce students about insights of the several topics of Expert System such as
3. building an expert system and knowledge engineering
4. To provide comprehensive details about various Evaluation methods of the expert system.
5. To provide implementation insight about the topics covered in the course.

UNIT I INTRODUCTION TO EXPERT SYSTEM 9 hours

The nature of Expert Systems. Types of applications of Expert Systems; the relationship of Expert Systems to Artificial Intelligence and Knowledge-Based Systems. The nature of expertise. Distinguishing features of Expert Systems. Benefits of using an Expert System, choosing an application.

UNIT II THEORETICAL FOUNDATIONS OF EXPERT SYSTEM 9 hours

What an expert system is; how it works and how it is built—basic forms of inference: abduction; deduction; induction.

UNIT III THE REPRESENTATION AND MANIPULATION OF KNOWLEDGE IN A COMPUTER 9 hours

Rule-based representations (with backward and forward reasoning); logic-based representations (with resolution refutation); taxonomies; meronomies; frames (with inheritance and exceptions); semantic and partitioned nets (query handling).

UNIT IV BASIC COMPONENTS OF AN EXPERT SYSTEM 9 hours

Component of expert system, Generation of explanations. Handling of uncertainties. Truth Maintenance Systems. Expert System Architectures. An analysis of some classic expert systems. Limitations of first-generation expert systems. Deep expert systems. Co-operating expert systems and the blackboard model.

UNIT V BUILDING EXPERT SYSTEMS 9 hours

Methodologies for building expert systems: knowledge acquisition and elicitation; formalization; representation and evaluation. Knowledge Engineering tools, Case Study.

Course Outcomes:

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

1. Students will be able to explain and describe the concepts central to the creation of Knowledge bases and expert systems.
2. Students will be knowledgeable about the tools and the processes used for the creation of an expert system.
3. Students will know the methods used to evaluate the performance of an expert system.
4. Students will be able to conduct an in-depth examination of an existing expert system with an emphasis on basic methods of creating a knowledge base.
5. Students will be able to examine the properties of existing systems in a case-study manner, comparing differing approaches.

Textbook (s):

1. P Jackson, Introduction to Expert Systems, Addison Wesley, 1990 (2nd Edition)

Reference Books:

5. Elaine Rich, Kevin Knight, Artificial Intelligence, McGraw-Hill, Inc, 1991 (2nd Edition)
6. Jackson. Jean-Louis Lauriere, Problem Solving and Artificial Intelligence, Prentice Hall, 1990
7. P. Jackson, "Introduction to Expert Systems", Third Edition, Pearson Education. Author(s)

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI106 INFORMATION THEORY AND CODING

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

This course is meant to serve as an introduction to some basic concepts in information theory and error-correcting codes, and some of their applications in computer science and statistics. We plan to cover the following topics: Introduction to entropy and source coding.

Course Objectives:

1. Understand the basics of information theory and coding theories.
2. Introduce the concept of amount of information, entropy, channel capacity, error, detection and error-correction codes, block coding, convolution coding, and Viterbi decoding algorithm.
3. Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
4. Describe the real life applications based on the fundamental theory.
5. Calculate entropy, channel capacity, bit error rate, code rate, and steady-state probability and so on.
6. Implement the encoder and decoder of one block code or convolution code using any program language.

UNIT I CODING FOR RELIABLE DIGITAL TRANSMISSION AND STORAGE **9 hours**

Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

UNIT II LINEAR BLOCK CODES **9 hours**

Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT III CYCLIC CODES **9 hours**

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT IV CONVOLUTIONAL CODES **9 hours**

Encoding of Convolutional Codes- Structural and Distance Properties, state, tree, trellis diagrams, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT V BCH CODES **9 hours**

Minimum distance and BCH bounds, Decoding procedure for BCH codes, Syndrome computation and iterative algorithms, Error locations polynomials for single and double error correction.

Course Outcomes:

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

1. Learn measurement of information and errors.
2. Obtain knowledge in designing various source codes and channel codes
3. Design encoders and decoders for block and cyclic codes
4. Understand the significance of codes in various applications

Text Book(s)

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc 2014.
2. Error Correcting Coding Theory-Man Young Rhee, McGraw – Hill Publishing 1989

Reference Books

1. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.
2. Introduction to Error Control Codes-Salvatore Gravano-oxford
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI107 HUMAN COMPUTER INTERACTION

L	T	P	C
3	0	0	3

Pre-requisite: NIL

Course Description:

The course provides a comprehensive understanding of the fundamental theory of User Interface Design and the Multimedia applications. Human-computer interaction is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas. The course is intended to introduce the student to the basic concepts of human-computer interaction. It will cover the basic theory and methods that exist in the field.

Course Objectives:

1. Gain an overview of Human-Computer Interaction (HCI), with an understanding of user interface design.
2. Become familiar with the vocabulary associated with sensory and cognitive systems as relevant to task performance by humans
3. Be able to apply models from cognitive psychology to predicting user performance in various human-computer interaction tasks and recognize the limits of human performance as they apply to computer operation
4. Be familiar with a variety of both conventional and non-traditional user interface paradigms

UNIT I INTRODUCTION TO HCI 9 hours

Introduction: Importance of user Interface: Definition, Importance of Good Design, Benefits of Good Design, A Brief History of Screen Design.
The Graphical User Interface : Popularity of Graphics, the Concept of Direct Manipulation, Graphical System, Characteristics,
Web User –Interface Popularity, Characteristics- Principles of User Interface.

UNIT II DESIGN PROCESS AND SCREEN DESIGNING 9 hours

Design process –Understanding how people interact with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business functions.
Screen Designing: Design goals–Screen meaning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information– focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

UNIT III SYSTEM MENUS 9 hours

System menus: Structures of Menus, Functions of Menus, Content of Menus, Kinds of Graphical menus **Windows:** Window characteristics, Components of a window, Window presentation styles, Types of windows, Windom management.

UNIT IV CONTROLS 9 hours

Controls: Characteristics of device based controls, Selecting the proper device based controls, Operable controls, Text Entry/Read-only controls, Selection controls, Combination Entry/selection controls, Selecting the proper controls.

UNIT V GRAPHICS AND TESTING 9 hours

Graphics: Icons, Multimedia, Colour-what is it, Colour uses, Colour and Human vision, Choosing colours **Testing:** The purpose and importance of usability testing, Scope of testing, Prototypes, Kinds of Tests, Developing and conducting the test.

Course Outcomes:

At the end of the course students will be assessed to determine whether they are able to

1. Find innovative ways of interacting with computers
2. Help the disabled by designing non-traditional ways of interacting
3. Use cognitive psychology in the design of devices for interaction.

Text Books :

1. The essential guide to user interface design, Wilbert O Galitz, 2nd edition, 2013, Wiley .

Reference Books :

1. Designing the user interface, 3rd Edition Ben Shneidermann, Pearson Education
2. Human –Computer Interaction, D.R.Olsen, Cengage Learning.
3. Human – Computer Interaction, I.Scott Mackenzie, Elsevier Publishers.
4. Interaction Design, Prece, Rogers, Sharps, Wiley Dreamtech.
5. User Interface Design, Soren Lauesen, Pearson Education.
6. Human –Computer Interaction, Smith - Atakan, Cengage Learning

Mode of Evaluation: Assignments, Internal Mid Examinations, External End Examination.

Honors

20HDCAI108 MACHINE TRANSLATION

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:

A definitive objective of machine translation model is to take a sentence in one language as input and return that sentence converted into an alternate language as output.

Course Objectives:

By reading this course students can:

1. Get an idea about machine translation and relationship among AI, NLP and Machine Translation
2. Learn the role of MT in logistic notations and linguistic knowledge resources in MT.
3. Recognize the importance of lexical tuning, pragmatics and future scope of MT.
4. Identify the role of Neural networks and its translation models in MT
5. Acquire the knowledge about EBMT through some real time case studies.

UNIT I INTRODUCTION 9 hours

Five Generations of MT- An Artificial Intelligence Approach to Machine Translation - It Works but How Far Can It Go: Evaluating the SYSTRAN MT System - The Reversibility of Analysis and Generation in Natural Language Processing.

UNIT II MT PRESENT 9 hours

Natural Languages, Logics or Arbitrary Notations - The Statistical Approach to MT at IBM - The Revival of US Government MT Research in 1990 - The Role of Linguistic Knowledge Resources in MT.

UNIT III MT FUTURE 9 hours

Senses and Texts - Sense Projection - Lexical Tuning - Pragmatics-Based Machine Translation - The Future of MT in the New Millennium.

UNIT IV NEURAL MACHINE TRANSLATION 9 hours

Introduction to Neural Networks - Computation Graphs - Neural Language Models - Neural Translation Models – Refinements - Current Challenges.

UNIT V EXAMPLE BASED MACHINE TRANSLATION 9 hours

Illustration – deep look at EBMT – EBMT and case based reasoning – test similarity computation – Recombination – EBMT and Translation Memory.

Course Outcome:

While completing the course students can:

1. Acquire an idea about machine translation and relationship among AI, NLP and Machine Translation
2. Obtain the role of MT in logistic notations and linguistic knowledge resources in MT.
3. Attain the importance of lexical tuning, pragmatics and future scope of MT.
4. Manage the role of Neural networks and its translation models in MT
5. Get comprehensive knowledge about EBMT through some real time case studies.

TEXT BOOK

1.file:///C:/Users/MITS-ACER01 APSSDC/Downloads/Machine_Translation_Its_Scope_and_Limits.pdf

2. Machine Translation- Yorick Wilks- Springer publication

https://books.google.co.in/books?id=G9_SDwAAQBAJ&pg=PT113&source=gbs_selected_pages&cad=2#v=onepage&q&f=false

Reference

1. Statistical Machine Translation - Neural Machine Translation BY Philipp Koehn

file:///C:/Users/MITS-ACER01-APSSDC/Downloads/Neural_Machine_Translation.pdf

2. MachineTranslation - https://books.google.co.in/books?id=G9_SDwAAQBAJ&pg=PT113&source=gbs_selected_pages&cad=2#v=onepage&q&f=false

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI109 FEDERATED MACHINE LEARNING

L	T	P	C
3	0	0	3

Pre-requisite: Nil

Course Description:
The goal of this course is to introduce the concept, technologies, systems, and applications related to an emerging machine learning field, federated learning (FL). Students will acquire fundamental knowledge of data privacy and security, privacy-preserving machine learning and distributed AI. The course will discuss new research and application trends in federated learning and cover new challenges and open problems in this field. Some of the lectures will be designed to provide real-world implementations and use cases of FL and to encourage students to explore limitations and maturity of FL technologies. Besides the basic FL theories, students are required to read and present latest FL papers and conduct projects in the FL direction.

UNIT I INTRODUCTION TO FEDERATED LEARNING 9 hours

Introduction – Definition, categorization, key components, Federated learning systems overview, Applications of Federated learning, Datasets, Open-source platform for Federated Learning. Privacy preserving technologies, HFL-horizontal federated learning and VFL-vertical federated learning, security analysis.

UNIT II PRIVACY PRESERVING MACHINE LEARNING AND DISTRIBUTED MACHINE LEARNING 9 hours

Privacy Preserving Machine Learning: Secure Machine Learning, Privacy Preserving Computation: Categorization, Secure Multi-party Computation, Differential Privacy (DP), PPML vs Secure ML, Threat and Security Models.

Distributed Machine Learning: Categorization of DML, DML Platforms, Privacy-Preserving Decision Trees - Preserving Gradient, Descent Preserving Gradient Descent

UNIT III HORIZONTAL FEDERATED LEARNING, VERTICAL FEDERATED LEARNING 9 hours

Horizontal Federated Learning: Client-Server Architecture, Peer-to-Peer (P2P) Architecture, Model Training Process, Model Evaluation, Challenges of HFL.

Vertical Federated Learning: Algorithms of VFL - Secure Federated Linear Regression - Secure Federated Tree-Boosting

UNIT IV FEDERATED LEARNING APPLICATIONS: CV AND RECOMMENDATION 9 hours

Federated Natural Language Processing, Examples - medical care - smart city surveillance, Requirements of the real-world federated learning systems, FL typical applications: Computer vision models are data-driven - Use of AI Technology Federated Recommendation: Horizontal Federated Recommendation - Vertical Federated Recommendation

UNIT V ADVANCES AND OPEN PROBLEMS 9 hours

FL Datasets, FL open-sourced Project, Federated Learning's unique challenges, Addressing Privacy-Accuracy-Efficiency Trilemma over Various heterogeneity, Architecture of Vertical Federated Learning, Differentially Private Federated Learning, Towards Efficient and Secure FL, New Trends in Federated Learning.

Course Outcomes:

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

1. Knowledge of the basic concepts, architecture and applications of FL.
2. Understanding of new research and application trends in FL.
3. Ability to deploy real-world FL projects.
4. hands-on experience in applying FL tools to solve privacy-preserving AI challenges.

Textbook(s)

1. Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, Han Yu Morgan & Claypool Publishers, 2019 ISBN: 978-1681736983

Reference Books

1. Q. Yang, Y. Liu, T. Chen & Y. Tong. Federated machine learning: Concept and applications. ACM Transactions on Intelligent Systems and Technology, vol. 10, no. 2, pp. 12:1–12:19 (2019).

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

Honors

20HDCAI601 R PROGRAMMING

L	T	P	C
1	0	2	2

Pre-requisite : Basic programming concepts and mathematical concepts

Course Description:

This course is designed to introduce the fundamentals of R programming and its application in data analysis. R is a powerful and widely-used programming language specifically designed for statistical computing and data manipulation. Throughout the course, students will learn how to utilize R for data analysis, visualization, and basic statistical operations.

Course Objectives:

This course enables students to

1. Provide a solid understanding of R programming language and its syntax.
2. Manipulate and analyze data using R.
3. Introduce basic statistical operations and their implementation in R.
4. Enable students to create meaningful data visualizations using R.
5. Introduce data import/export techniques for seamless data handling.
6. Provide an introduction to machine learning concepts and decision trees in R

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UNIT I Introduction to R and Basic Syntax 9 hours

Overview of R and its applications in data analysis - Installing R and RStudio - R Syntax: Variables, data types, basic operations - Working with R console and scripts - R packages and their installation

1.Study of basic Syntax's in R.

UNIT II Control Structures, Functions, and Data Structures 9 hours

Implementation of loop control structures: for, while, if-else - Understanding and creating functions in R - Working with lists and vectors in R - Vector operations and functions

1. Implementation of loop control structures.
2. Learn to implement Functions in R
3. List, Vector operations in R language.

UNIT III Matrices, Arrays, and Factors 9 hours

Creation and manipulation of matrices in R - Array implementation and operations - Understanding factors and their use in R

1. Implementation of matrix operations in R.
2. Implementation and use of array and factors in R.

UNIT IV Data Frames and Basic Statistical Operations 9 hours

Implementation and use of data frames in R - Data manipulation and exploration - Basic statistical operations: mean, median, variance, standard deviation, etc.

1. Implementation and use of data frames in R.
2. Learn basic statistical Operations using R

UNIT V Data Visualization, Data Import/Export, and Machine Learning 9 hours

Data visualization using R: ggplot2 and other libraries - Importing and exporting data from Excel and CSV files - Introduction to machine learning with decision trees - Implementation of regression using decision trees in R - Implementation of classification using decision trees in R

1. Implementation of Data Visualization in R.
2. Import and export data from excel and csv files and perform analytics on it.
3. Implementation of Regression with decision tree in R.
4. Implementation of Classification with decision tree in R.

Course Outcomes:

After completing this course, students will be able to

1. Utilize R programming language proficiently for data analysis tasks.
2. Manipulate data using vectors, matrices, and data frames.
3. Create meaningful data visualizations with R's plotting libraries.
4. Perform basic statistical operations for data analysis.
5. Implement decision trees for regression and classification tasks in R.

Text Book(s)

1. R for Data Science" by Hadley Wickham and Garrett Grolemund, O'Reilly Media, 2021.

Reference Books

1. "An Introduction to Statistical Learning with Applications in R" by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tib shirani, Springer, 2017.
2. "Advanced R" by Hadley Wickham, CRC Press, Second Edition, 2019.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.