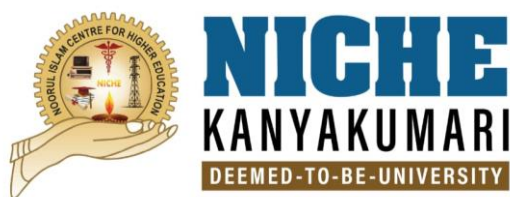


NOORUL ISLAM CENTRE FOR HIGHER EDUCATION
(Deemed to be University Under Section 3 of the UGC Act, 1956)
Kumaracoil, Thuckalay

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING



B.E. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
CURRICULUM AND SYLLABI

REGULATION 2021

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation : 2021

Curriculum and Syllabi

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and instill in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

Faculty of Information and Computer Engineering

Department of Computer Science and Engineering

Vision of the Department

To offer the most conducive environment for quality academic and research oriented undergraduate and postgraduate education in computer science and engineering and prepare the students for a globalised technological society and orient them towards serving the society.

Mission of the Department

- Impart high quality professional training at the undergraduate and postgraduate level with an emphasis on basic principles of computer science and engineering.
- Empower the students with the required skills to solve the complex technological problems of modern society and also provide them with a framework for promoting collaborative and multidisciplinary activities.
- Conduct research to advance the state of the art in computer science and integrate research results and innovations into other scientific disciplines.

Description of the program

The field of Artificial intelligence and Data science are to prepare students for the challenges of developing machine-generated intelligence and analytics that will soon permeate almost every aspect of our lives, prioritizing AI design and software development, with a heavier emphasis on computing theory, emanating to a greater focus on cybersecurity, algorithms, and computer networks.

Bachelor of Engineering in Artificial Intelligence and Data Science is a 4-year program that includes all the theoretical and technical aspects of computer science, engineering, and Artificial Intelligence and Data Science. This involves designing, programming and also more advanced topics like Cloud computing, data science, artificial intelligence, cybersecurity, and IoT. The curriculum and syllabus are on par with the best universities in the country. The curriculum of B.E. AI&DS program typically includes core courses related to AI and DS, such as machine learning, data mining, data visualization, big data analytics, statistical analysis, natural language processing, computer vision, and deep learning.

Students completing Artificial Intelligence and Data Science degree work as programmers or computer systems analysts, helping to build and maintain complex technological systems. The job profiles are Software Developer, System Designer, Software Engineer Research Analyst, and the highly paid job profiles like Data Scientist and Machine Learning experts are on the rise. AI&DS program, graduates can pursue various career opportunities in fields such as AI development, data analytics, business intelligence, and other AI and DS-related roles in industries such as technology, finance, healthcare, e-commerce, and more.

Programme Educational Objectives - PEO	
PEO-01	Graduates can apply their expertise in fundamental sciences, mathematics, artificial intelligence, data science, and statistics to develop systems for managing and analyzing large datasets.
PEO-02	Graduates can enhance their technical skills to engage in groundbreaking research in AI and Data Science, developing innovative and sustainable solutions for the benefit of ecosystems.
PEO-03	Graduates can think critically, embrace lifelong learning, and work ethically within a multidisciplinary team.
PEO-04	Graduates can design and model AI-based solutions for significant real-world problem areas.
PEO-05	Graduates can demonstrate innovative thinking and creative ideas to make meaningful contributions to economic development.

Graduate Attributes-GA	
GA-1	Innovative Engineering Solutions Develop creative and innovative solutions to complex engineering problems, incorporating the latest technologies and approaches to address current and future challenges.
GA-2	Global Perspective in Engineering Understand and apply engineering solutions in a global context, recognizing the diversity of global issues, standards, and the impact of engineering decisions on different cultures and communities.
GA-3	Sustainable Development and Green Engineering Design and implement engineering solutions that prioritize sustainability, resource efficiency, and environmental protection, contributing to a sustainable future.
GA-4	Social Responsibility and Community Engagement Demonstrate a commitment to social responsibility by engaging with and contributing to local communities, understanding societal needs, and addressing social challenges through engineering practices.
GA-5	Adaptability and Lifelong Learning Exhibit a proactive approach to continuous learning and adaptability, keeping pace with technological advancements and industry changes, and engaging in professional development activities.
GA-6	Entrepreneurship and Innovation Foster an entrepreneurial mindset, identifying opportunities for innovation and creating value through new technologies, products, and processes that meet market needs.
GA-7	Interdisciplinary Collaboration Work effectively in interdisciplinary teams, integrating knowledge from various fields to develop comprehensive solutions to complex engineering problems.
GA-8	Ethical Leadership and Integrity Lead with integrity and ethical principles, ensuring transparency, fairness, and respect in all professional and personal interactions.
GA-9	Digital and Data Literacy Utilize advanced digital tools and data analytics techniques to solve engineering problems, optimize processes, and make informed decisions based on data-driven insights.
GA-10	Safety, Health, and Risk Management Prioritize safety, health, and risk management in engineering practices, ensuring the well-being of individuals and communities while minimizing potential risks and hazards.
GA-11	Effective Communication and Negotiation Skills Communicate ideas, solutions, and technical information effectively to a variety of audiences, and engage in negotiation to resolve conflicts and reach consensus.
GA-12	Impact Assessment and Policy Making Assess the impact of engineering projects on society and the environment, and contribute to policy-making processes that promote sustainable and responsible engineering practices.

Programme Outcome – Pos

Programme Outcome – PO	
PO-A	Apply the knowledge of mathematical foundations and artificial intelligence based concepts to solve complex problems related to design, development, testing and maintenance of computing systems.
PO-B	Ability to identify, formulate and analyze complex problems in AI based applications.
PO-C	Manage effectively on teams to accomplish a common goal.
PO-D	Apply professional ethics and agree to the norms or responsibilities in engineering practice of artificial intelligence and data science.
PO-E	Communicate effectively and prepare technical documents and oral presentations.
PO-F	Ability to use current techniques, skills and state-of-art tools for computing system.
PO-G	Ability to carry out fundamental research to cater the critical needs of the society through cutting edge technologies of AI.

Mapping of Graduate Attributes and Programme Educational Objectives(PEO)

GA PEOs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10	GA-11	GA-12
PEO-01	H	A	A	A	A	A	A	A	H	A	A	A
PEO-02	H	A	H	A	A	A	A	A	A	A	A	A
PEO-03	A	A	A	A	H	A	H	H	A	A	A	A
PEO-04	A	A	A	A	A	A	A	A	A	A	A	A
PEO-05	H	A	H	A	A	A	A	A	A	A	A	A

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Graduate Attributes and Programme Outcomes (PO)

GA POs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10	GA-11	GA-12
PO-A	H	A	A	A	A	A	A	H	A	A	A	A
PO-B	A	A	A	A	A	A	A	A	H	A	A	A
PO-C	A	A	A	A	A	H	A	H	A	A	A	A
PO-D	A	A	A	H	A	A	A	H	A	A	A	A
PO-E	A	A	A	A	A	A	A	A	A	A	H	A
PO-F	A	A	A	A	A	H	A	A	H	A	A	A
PO-G	A	H	H	A	A	A	A	A	A	A	A	A

H- Highly Associated

A- Associated

Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes (POs)

PEO PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05
PO-A	H	A	A	H	A
PO-B	A	A	A	H	A
PO-C	A	A	A	A	A
PO-D	A	A	H	A	A
PO-E	A	A	A	A	A
PO-F	A	H	A	A	A
PO-G	A	H	A	H	A

H- Highly Associated

A- Associated

Not – Not Associated

Duration of the program: 4 Years/8 Semesters

Total credit: 163

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Total Credits	21	19	20	24	21	24	18	16	163

CURRICULUM & SYLLABI**SEMESTER I**

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EG3101	Technical English	3	1	0	4
2.	MA3101	Engineering Mathematics – I	3	1	0	4
3.	BS3101	Engineering Physics	3	0	0	3
4.	BS3102	Engineering Chemistry	3	0	0	3
5.	CS3101	Fundamentals of Computing and Python Programming	3	0	0	3
PRACTICALS						
6.	CS3171	Fundamentals of Computing and Python Programming Laboratory	0	0	4	2
7.	BS3171	Physics and Chemistry Laboratory	0	0	4	2
TOTAL			15	2	8	21

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	EG3102	Communicative English	3	0	0	3
2.	MA3102	Engineering Mathematics – II	3	1	0	4
3.	BE3101	Basic Electrical and Electronics Engineering	3	0	0	3
4.	BE3102	Basic Civil and Mechanical Engineering	3	0	0	3
5.	ME3101	Engineering Graphics	3	0	2	4
PRACTICALS						
6.	BE3171	Basic Electrical and Electronics Engineering Laboratory	0	0	2	1
7.	BE3172	Basic Civil and Mechanical Engineering Laboratory	0	0	2	1
TOTAL			15	1	6	19

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3201	Engineering Mathematics - III	3	1	0	4
2.	CS3201	Computer Organization and Architecture	3	0	0	3
3.	CS3202	Data structures and Algorithms	3	0	0	3
4.	CS3203	Digital Design Principles	3	0	0	3
5.	CS3204	Object Oriented Programming	3	0	0	3
PRACTICALS						
6.	CS3271	Data structures and Algorithms Laboratory	0	0	4	2
7.	CS3272	Digital Design Principles Laboratory	0	0	2	1
8.	CS3273	Object Oriented Programming Laboratory	0	0	2	1
TOTAL			15	1	8	20

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	MA3205	Probability and Queuing Theory	2	1	0	3
2.	BS3201	Environmental Studies	2	0	0	2
3.	CS3205	Computer Networks	3	0	0	3
4.	CS3206	Database Management Systems	3	0	0	3
5.	CS3207	Operating Systems	3	0	0	3
6.	AI3201	Principles of AI and Machine Learning	3	0	0	3
PRACTICALS						
7.	CS3274	Computer Networks Laboratory	0	0	4	2
8.	CS3275	Database Management Systems Laboratory	0	0	4	2
9.	CS3276	Operating Systems Laboratory	0	0	2	1
10.	AI32P1	Summer Internship-I	0	0	0	2
TOTAL			16	1	10	24

SEMESTER V

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	AI3202	Data Science	3	0	0	3
2	CS3210	Artificial Intelligence & Applications	3	0	0	3
3	CS3211	Web Technologies	3	0	0	3
4	AI3203	Scalable Systems for Data Science	3	0	0	3
5	MS3201	Professional and Business Ethics	2	0	0	2
6	*****	Elective-I	3	0	0	3
PRACTICAL						
8	AI3271	Data Science Laboratory	0	0	4	2
9	CS3277	Web Technologies Laboratory	0	0	4	2
TOTAL			17	0	8	21

SEMESTER VI

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	AI3204	Applications of NLP in Data Science	3	0	0	3
2	CS3214	Cloud Computing Techniques	3	0	0	3
3	CS3215	Cyber Security	3	0	0	3
4	****	Elective-II	3	0	0	3
5	****	Elective-III	3	0	0	3
6	*****	Open Elective I	3	0	0	3
PRACTICAL						
7	AI3272	NLP Laboratory	0	0	4	2
8	CS3280	Cloud Computing Laboratory	0	0	4	2
9	AI32P2	Summer Internship-II	0	0	0	2
TOTAL			18	0	8	24

SEMESTER VII

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	AI32**	Elective-IV	3	0	0	3
2	AI32**	Elective-V	3	0	0	3
3	AI3205	Internet of Things	3	0	0	3
4	*****	Open Elective-II	3	0	0	3
5	MS3202	Principles of Management	2	0	0	2
PRACTICAL						
6	AI32P3	Mini Project	0	0	6	3
7	AI3273	Artificial Intelligence Laboratory	0	0	2	1
TOTAL			14	0	8	18

SEMESTER VIII

Sl. No.	Course Code	Course Title	L	T	P	C
THEORY						
1	AI32**	Elective-VI	3	0	0	3
2	CS3216	Big Data Analytics	3	0	0	3
PRACTICAL						
3	AI32P5	Project Work	0	0	12	10
TOTAL			6	0	12	16

PROFESSIONAL ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
<u>Elective-I</u>						
1.	AI32A1	Knowledge Engineering	3	0	0	3
2.	AI32A2	Agile Methodologies	3	0	0	3
3.	AI32A3	Soft Computing	3	0	0	3
4.	AI32A4	Business Analytics	3	0	0	3
5.	AI32A5	Data Warehousing	3	0	0	3
<u>Elective-II</u>						
1.	AI32A6	ANN and Deep Learning	3	0	0	3
2.	AI32A7	Artificial Intelligence and Robotics	3	0	0	3
3.	AI32A8	Embedded Systems and IOT	3	0	0	3
4.	AI32A9	Text and Speech Analysis	3	0	0	3
5.	AI32B1	Web Services and API Design	3	0	0	3
<u>Elective-III</u>						
1.	AI32B2	Game Theory for AI and Data Science	3	0	0	3
2.	AI32B3	UI and UX design	3	0	0	3
3.	AI32B4	Bio-Inspired Optimization Techniques	3	0	0	3
4.	AI32B5	Probabilistic Graphical Models	3	0	0	3
5.	AI32B6	Visual Effects	3	0	0	3
<u>Elective-IV</u>						
1.	AI32B7	Android Wireless Application Development	3	0	0	3
2.	AI32B8	Ethics in AI	3	0	0	3
3.	AI32B9	Analysis of Large Scale Social Networks	3	0	0	3
4.	AI32C1	Virtualization	3	0	0	3
5.	AI32C2	Robotic Process Automation	3	0	0	3
<u>Elective- V</u>						

1.	AI32C3	Health Care Analytics	3	0	0	3
2.	AI32C4	Web Application Security	3	0	0	3
3.	AI32C5	Digital and Mobile Forensics	3	0	0	3
4.	AI32C6	Social Network Security	3	0	0	3
5.	AI32C7	Security and Privacy in Cloud	3	0	0	3
<u>Elective-VI</u>						
1.	AI32C8	Cognitive Science	3	0	0	3
2.	AI32C9	Cryptocurrency and Blockchain Technologies	3	0	0	3
3.	AI32E1	Genetic Algorithms	3	0	0	3
4.	AI32E2	Nano Computing	3	0	0	3
5.	AI32E3	Data Exploration and Visualization	3	0	0	3

OPEN ELECTIVE COURSES

Sl. No.	Course Code	Course Title	L	T	P	C
Open Elective-I						
1.	AI32D1	Fundamentals of Artificial Intelligence	3	0	0	3
2.	AI32D2	Drone Technology	3	0	0	3

Sl. No.	Course Code	Course Title	L	T	P	C
<u>Open Elective-II</u>						
1.	AI32D3	Introduction to Data Science	3	0	0	3
2.	AI32D4	Quantum Computing	3	0	0	3

SEMESTER - I

EG3101	Technical English	L	T	P	C
		3	1	0	4

OBJECTIVES

- To develop the linguistic, communicative and critical thinking competencies of First Year Engineering students.
- To enhance the understanding of the complex grammatical structures of the English language to students.
- To improve the language proficiency of students in English with emphasis on Vocabulary, Grammar, Listening, Speaking, Reading, and Writing skills
- To introduce the students to the basic phonetics of English and make them grasp the various sounds of the English language to improve their pronunciation

Course Outcomes		Cognitive Skill
CO-01	The students will be able to improve their vocabulary relating to Engineering and Technology, and use articles and prepositions effectively in sentences.	R
CO-02	The students will be able to learn grammatical items like tense, voice, compound nouns etc. and thereby enhance their linguistic competence.	U
CO-03	The students will be able to learn definitions of technical terms, relative pronouns etc. which will develop their language competence.	A
CO-04	The students will be able to acquire the essentials of writing skills relating to CV, Resume, Formal and Business Letters.	U
CO-05	The students will be able to learn English phonemes such as Vowels, Diphthongs and Consonants which will be instrumental in improving their pronunciation and speaking skills.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	M	M	S	S	M	S	S
CO-02	M	S	M	M	S	S	M	S

CO-03	S	M	M	S	M	M	S	M
CO-04	M	S	M	M	S	M	S	M
CO-05	S	M	S	S	M	S	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I:

9

Word formation with prefixes and suffixes – Articles – Conjunctions – Prepositions – Expansion of Abbreviations and Acronyms – Writing Checklists – Writing Instructions.

Unit II:

9

Tense – Voice – Punctuation – Expansion of Compound Nouns – Writing Recommendations – Paragraph Writing – Types, Structures and Features of a Paragraph – Creating Coherence— Organizing Principles of Paragraphs in Documents.

Unit III:

9

Discourse Markers – Gerunds and Present Participles – Relative Pronouns – Conditional Clauses – Definitions of Technical Terms – Transcoding : Bar Chart - Flow Chart - Pie Chart - Tree Diagram - Tabular Column.

Unit IV:

9

Concord – Clauses – Phrases – Numerical Adjectives – CV/Resume Writing – Virtual Communication: E-Mail Writing – Essay Writing : Basic Format of an Essay - Types – Examples.

Unit V:

9

Basic Phonetics : Phonemes – Vowels, Diphthongs and Consonants – Classification : Pure Vowels/Monophthongs – Vowel Glides /Diphthongs.

**L: 45 + T:15 = TOTAL:
60 HOURS**

EXTENSIVE READING:

Shiv Khara, *You Can Win*, Milan, Delhi, 2004

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

TEXT BOOK

1. Khaleel Rahuman A., Deepa P., Sheila J., Mathi Vathani J. , *Technical English*, R. K. Publishers, 2023.

REFERENCES:

1. Nagarajan S., Senthil C. S., *Engineering English I & II*, Sri Krishna Publications, 2004.
2. Jewelcy Jawahar , Rathna P., *English Work Book for First Year B.E./ B.Tech.*, VRB Publishers, Chennai, 2008.

MA3101	ENGINEERING MATHEMATICS - I	L	T	P	C
		3	1	0	4

OBJECTIVE:

The course objective is to develop the required skill of the students in the area of Engineering Mathematics with special emphasis on the characteristic equation of matrices, differential calculus, Beta and Gamma functions and to develop basic knowledge to the students in double and triple integration.

Subject Code: MA3101		Subject Name: ENGINEERING MATHEMATICS I	
Course Outcome – Cos Students able to		Cognitive Skill	
CO-01	Understand the characteristic equation and find eigen values and Eigen vector of a real matrix. Compute the eigen value and eigen vector using properties. Verify Cayley Hamilton theorem and its applications. Apply orthogonal transformation of a symmetric matrix.	U, A, E, R	
CO-02	Define the definitions and formula for curvature, radius of curvature, circle of curvature. Apply the formula and solve problems using the required formulas also find the evolute of the curves.	U, A, E, An	
CO-03	Know about the differentiation formulae and apply on partial derivatives, total derivatives and Jacobians. Verify the functions be maximum or minimum and Lagrange's multiplier method. Express the Taylor's expansion for two variables.	U, A, E, R	
CO-04	Know the Fundamental concepts of improper integrals, Beta and gamma function and their properties. Develop the skill in the relation between Beta and Gamma Functions. Calculate definite integral values using Beta and Gamma Functions.	U, A, An, E	
CO-05	Evaluate the double and multiple integrals and can apply these concepts to find areas of regions on a plane or in space. Graph Cartesian and polar equations. Convert Cartesian coordinates into polar coordinates.	U, A, An, E	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L
CO-01	S	M	S	M	S	S	S	S	M	S	S	M
CO-02	S	M	M	M	S	S	M	S	M	M	M	M
CO-03	S	M	M	M	S	S	M	M	M	S	S	M
CO-04	S	M	S	M	S	M	S	S	M	S	S	M
CO-05	S	M	S	M	S	M	S	S	M	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I MATRICES

9

Characteristic equation - Eigen values and Eigen vectors of a real matrix - Properties of eigen values and eigen vectors (without proof) - Cayley Hamilton theorem (statement only),

verification and its applications - Orthogonal and Symmetric matrices and their properties(excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT-II DIFFERENTIAL CALCULUS

9

Curvature - Cartesian co-ordinates and parametric form -Centre and radius of curvature, Circle of curvature - Evolutes.

UNIT-III FUNCTIONS OF SEVERAL VARIABLES

9

Partial derivatives - Total derivatives - Jacobians - Properties - Maxima and minima for functions of two variables - Lagrange Multiplier method- Taylor's expansion.

UNIT-IV IMPROPER INTEGRALS

9

Evaluation of improper integrals- Beta and Gamma functions - Properties - Relation between Beta and Gamma functions - Evaluation of integrals using Beta and Gamma functions.

UNIT-V MULTIPLE INTEGRALS

9

Evaluation of double and triple integrals - Area enclosed by plane curves as double integral in cartesian and polar co-ordinates - Change of order of integration- Transformation of Cartesian coordinates into polar coordinates.

L: 45 + T: 15, TOTAL: 60 Periods

OUTCOMES:

At the end of the course, the students will be familiar with various concepts of calculus which are essential for engineering. They also become acquainted with the basic ideas of multiple integrals and their usage.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics"- 40th Edition , Khanna Publishers, Delhi 2007

REFERENCES:

1. M.Immaculate Mary , K.Uma Samundesvari," Engineering Mathematics - I" Revised Edition, R.K Publishers, 2016.
2. Veerarajan T, " Engineering Mathematics (for first year)", Fourth Edition, Tata McGraw- Hill Publishing Company Ltd.,New Delhi , 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Seventh Edition, Wiley India, 2007.
4. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" Vol,1 ,S.Chand & Company Ltd.2002.
5. B.V. Ramana,"Higher Engineering Mathematics" Second Edition Tata McGraw- Hill, Publishing Company Ltd.,New Delhi, 2006 .

BS3101	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

The course objective is to provide basic ideas about the principles of physics related to properties of matter, wave optics, heat, quantum concepts and materials, engineering problems.

SubjectCode:BS3101		SubjectName: Engineering Physics	
Course Outcome-Cos		Cognitive Skill	
CO-01	Students will be able to understand and apply knowledge about the properties of materials.	R,U,A	
CO-02	Students will be able to understand the types of oscillations and the wave nature of light in interference, diffraction and polarization phenomenon.	R,U,A,E	
CO-03	Students will be able to state and explain the various laws of thermodynamics, understand entropy and its application.	R,U,A,An,,E	
CO-04	Students gain basic knowledge about quantum mechanics and will be able to solve time dependent and time independent Schrodinger equation for simple potentials.	R,U,A,E,S	
CO-05	Students will be able to know the different types of crystal structures and also gain basic knowledge about nanomaterials and biomaterials.	R,U,A,E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate,S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S-Strong,M-Medium,L-Low,N-Not Relevant

Unit I: Properties of Matter

9

Elasticity – Poisson's ratio – Stress-strain diagram – factors affecting elasticity – bending of beams – cantilever depression – Young's Modulus- theory and experiment of Young's

modulus determination (uniform and non-uniform bending) –Shear Modulus – twisting couple – hollow cylinder – torsion pendulum – determination of rigidity modulus - Bulk Modulus - applications of elastic behaviours of materials.

Unit II: Oscillations and Wave optics

9

Oscillations - Rectilinear motion - Oscillations or Vibrations - Simple Harmonic Motion - Damped Harmonic motion - Real oscillatory system - Forced or Driven oscillation. Wave optics -Interference of light – Photons - Young's Double Slit Experiment - Huygens's Principle - Diffraction - Diffraction Grating - Polarization.

Unit III: Thermal Physics

9

Transfer of heat energy (conduction, convection and radiation) - thermal expansion of solids and liquids – expansion joints – bimetallic strips-Thermal conductivity- Forbe's and Lee's disc methods (theory and experiment)- thermal insulation in buildings -Laws of thermodynamics- heat exchanger -solar power- applications of solar power (solar water heater, photo voltaic cell).

Unit IV: Quantum Physics

9

Matter waves- de-Broglie wavelength - Schrodinger's wave equation-time independent and time dependent equations- physical significance of wave function- uncertainty principle and its application- energy and momentum operators-particle in a one dimensional box-scanning electron microscope- transmission electron microscope-scanning tunnelling microscope.

Unit V:Material Physics

9

Single crystalline, polycrystalline and amorphous materials- Single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, miller indices – inter planar distances. Introduction and applications of Metallic glasses, Shape Memory Alloys (SMA), Nanomaterials, Biomaterials.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Engineering Physics I by Bindhu B, Sagi Rani C, Meenadevi V N, Ganapathi Raman R, RK Publishers 2015.
2. Engineering Physics II by Bindhu B, GeethaKumari R, SugirthaSuni N Y, RK Publishers 2016.
3. Engineering Physics by R K Gaur And S L Gupta, Dhanpat Rai Publications 2011.
4. A Text Book Oscillations, Waves & Acoustics by Dr. M. Gosh, Dr. D. Battacharya, S. Chand, Revised Edition.

REFERENCES:

1. Engineering Physics by Rajendran V, McGraw-Hill, New Delhi, 2013
2. Engineering Physics by Arumugam M, Anuradha Publications, 2014.
3. Principles of Physics by Halliday D, Resnick R and Walker J, Wiley 2015.
4. Physics for scientist and Engineers by Serway R A and Jewett J W, Cengage Learning 2010.
5. Engineering Physics by Bhattacharya D K and Poonam T, Oxford University Press 2015.

BS3102	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

To make the students conversant with the principles of the following topics:(i) Use of free energy in chemical equilibria (ii) Water chemistry (iii) Periodic properties (iv) Spectroscopic techniques and applications and (v) Organic reactions and synthesis of a drug molecule.

Course Outcome		Cognitive Skill
CO-01	Students will be able to understand the estimation of free energy and entropy	U,A,An
CO-02	Students will be able to apply the different techniques in water technology	R,A
CO-03	Students will be able to analyze the properties of periodic tables.	E,A,E
CO-04	Students will be able to describe the different types of spectroscopic techniques.	An,U
CO-05	Students will be able to predict the structure of organic molecules.	S,U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E
CO-01	S	M	S	L	S
CO-02	M	S	L	S	S
CO-03	S	S	S	M	S
CO-04	S	M	S	S	S
CO-05	S	L	M	S	S

UNIT I USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA 9

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.

Acid base, oxidation reduction and solubility equilibria. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

UNIT II WATER CHEMISTRY

9

Water as a universal solvent – hard and soft water – reasons for hardness – disadvantages of hard water in washing and industrial purposes - estimation of hardness by EDTA method, problems; boiler feed water – characteristics- softening methods - external conditioning – demineralization (ion exchange) process, desalination by reverse osmosis method- internal conditioning (phosphate, calgon and carbonate conditioning methods); stages in domestic water treatment – disinfection by chlorination, ozone and UV treatments.

UNIT III PERIODIC PROPERTIES

9

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

UNIT IV SPECTROSCOPIC TECHNIQUES AND APPLICATIONS

9

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

UNIT V ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE

9

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

TOTAL: 45 PERIODS

TEXT BOOKS

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition.

CS3101	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problemsolving
- To read and write simple Pythonprograms.
- To develop Python programs with conditionals and loops.
- To define Python functions and callthem.
- To use Python data structures — lists, tuples,dictionaries.
- To do input/output with files inPython.

Subject Code: CS3101 Subject Name: Fundamentals of Computing and Python Programming		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basics of algorithmic problem solving.	R,U
CO-02	Ability to analyze various techniques for read and write simple Python programs.	A
CO-03	Introduce Python programs with conditionals and loops.	An
CO-04	Evaluate and Define Python functions, call them and use Python data structures – lists, tuples, dictionaries.	E
CO-05	Apply input/output with files in Python.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G
CO-01	N	M	S	L	M	M	L
CO-02	N	S	L	L	M	S	S
CO-03	M	L	S	M	L	L	M
CO-04	M	L	L	S	M	M	L
CO-05	M	L	L	L	M	S	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ALGORITHMIC PROBLEM SOLVING

9

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS

9

Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROLFLOW, FUNCTIONS

9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS,TUPLES, DICTIONARIES

9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tupleassignment, tupleasreturnvalue; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, merge sort, histogram.

UNIT V FILES, MODULES, PACKAGES

9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

TOTAL: 45 PERIODS

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
2. (<http://greentepress.com/wp/thinkpython/>)
3. 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. John V Guttag, —Introduction to Computation and Programming Using Python``, Revisedand Revised and expanded Edition, MIT Press ,2013
2. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd.,2016.
3. Timothy A. Budd, —Exploring Python®, Mc-Graw Hill Education (India) Private Ltd.,,2015.
4. KennethA.Lambert,—FundamentalsofPython:FirstPrograms®,CENGAGELearning, 2012. Charles Dierbach, —Introduction to Computer Science using Python: A Computational ProblemSolving Focus, Wiley India Edition,2013.
5. Paul Gries, Jennifer Campbell and Jason Montojo, —Practical Programming: An Introduction to Computer Science using Python 3®, Second edition, Pragmatic Programmers, LLC,2013.

CS3171	FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.

- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

Subject Code: CS3171 Subject Name: FUNDAMENTALS OF COMPUTING AND PYTHON PROGRAMMING LABORATORY		
Course Outcome – Cos		Cognitive Skill
CO-01	Understand the basic syntax of python	U
CO-02	Understand the problem solving techniques	An,U
CO-03	Analyze data structure concept in python	U
CO-04	Understand all tools of python	An
CO-05	Understand pygame with simulation	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	L	S	M	L	L	S
CO-02	L	L	M	M	S	M	L
CO-03	M	M	L	L	M	S	L
CO-04	S	L	L	M	M	M	L
CO-05	L	L	L	S	L	L	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (wordcount)
11. Find the most frequent words in a text read from a file

12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

TOTAL: 45 PERIODS

BS3171	PHYSICS & CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Objective: The course objective is to teach students, the importance of physics through involvement in experiments and to have knowledge of the world due to constant interplay between observations and hypothesis.

Subject Code: BS3171		Subject Name: PHYSICS LABORATORY	
Course Outcome – Cos			Cognitive Skill
CO-01	The students will be able to analyse the physical principle involved in various instruments and also relate the principle to new applications.		R,U,A,An,E
CO-02	Various experiments in the areas of optics, properties of matter and ultrasonics will nurture the students in all branches of engineering.		R,U,A,An,E
CO-03	The students will be able to think innovatively and also improve the creative skills that are essential for engineering.		R,U,A,An,E
CO-04	The students will be able to gain knowledge of new concept in the solution of practical oriented problems and theoretical problems.		R,U,A,An,E
CO-05	The students will be able to understand measurement technology ,usage of new instruments and real time applications in engineering studies.		R,U,A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

List of experiments: Physics Laboratory (Any Five Experiments)

1. Determination of velocity of ultrasonic waves and compressibility of the given liquid by Ultrasonic interferometer.(Real and Virtual Lab)

2. Determination of rigidity modulus by Torsional pendulum. (Real and Virtual Lab)
3. Determination of coefficient of viscosity by Poiseulli's method.
4. Determination of Young's modulus by non-uniform bending method. (Real and Virtual Lab)
5. Determination of LASER parameters using LASER diode. (Real and Virtual Lab)
6. Determination of band gap of the semi-conductor. (Real and Virtual Lab)
7. Determination of wavelength of mercury spectrum by diffraction grating. (Real and virtual lab)
8. Determination of wavelength of light by Newton's rings. (Real and Virtual Lab)
9. Determination of angle of the prism using spectrometer. (Real and Virtual Lab)

CHEMISTRY LAB (Any FIVE experiments)

OBJECTIVE

The objective of the course is to develop the interest among the students regarding chemistry and their applications in engineering.

Course Outcomes

The student at the end of the course will

Subject Code: BS3171 Subject Name: CHEMISTRY LABORATORY		
Course Outcome – Cos		Cognitive Skill
CO-01	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	R,U,A,An, E
CO-02	Be able estimate the ions/metal ions present in domestic/industry waste water.	R ,U,A, An,
CO-03	Utilize the fundamental laboratory techniques for analyses such as titrations, separation/purification and spectroscopy.	R,U,An,E
CO-04	Able to analyze and gain experimental skill.	R,U,A,An
CO-05	The students will be able to understand measurement technology ,usage of new instruments and real time applications in engineering studies.	R,U,A,An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO- C	PO- D
CO-01	S	S	S	S
CO-02	S	S	S	M
CO-03	S	S	S	S
CO-04	S	M	S	S
CO-05	S	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

List of Experiments

1. Determination of conductance of solutions

2. Potentiometry - determination of redox potentials and emfs
3. Synthesis of drug
4. Determination of Chloride content
5. Determination of hardness of water sample
6. Determination of Alkalinity of water sample
7. Virtual lab experiments

TOTAL: 45 PERIODS

SEMESTER - II

EG3102	Communicative English	L	T	P	C
		3	0	0	3

OBJECTIVES

- To widen and expand students' knowledge of English vocabulary
- To develop skills of students in the areas of vocabulary, grammar, listening, speaking, reading, and writing
- To develop the knowledge, skills and strategies the student must possess to become proficient readers
- To make the students learn the importance and purpose of communication skills and overcome the communication barriers by gaining confidence
- To make the students understand how to apply technical information and knowledge in practical documents

Course Outcomes		Cognitive Skill
CO-01	The students will be able to understand the basic vocabulary items, sentence structures and error detection and correction which, in turn, will expand their knowledge of the English language.	R
CO-02	The students will be able to grasp the LSRW Skills and gain exposure to absorb Comprehension and Note-making.	U
CO-03	The students will get real time practice in speaking through Oral Presentation, Small Talk, Role Play, Debate, Group Discussion etc.	A
CO-04	The students will be able to improve their writing skills through exposure to Report Writing and Letter Writing.	U
CO-05	The students will be able to learn the Theory of Communication, the Importance of Communication, and be introduced to the various facets of Verbal and Non verbal Communication.	R

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcomes with Programme Outcomes

PO CO	PO- A	PO- B	PO- C	PO- D	PO- E	PO- F	PO- G	PO- H
CO-01	S	M	M	S	S	M	S	S
CO-02	M	S	M	M	S	S	M	S
CO-03	S	M	M	S	M	M	S	M
CO-04	M	S	M	M	S	M	S	M
CO-05	S	M	S	S	M	S	M	S

UNIT – I – VOCABULARY AND GRAMMAR

9

Parts of Speech – Sentence Structures – Technical Vocabulary – Synonyms – Antonyms – Homonyms – Homophones – Misspelled Words – One word Substitutes – Odd Words Out – Changing words from one form to another – Common Errors in English – Correction of Errors in Sentences.

UNIT – II – LISTENING and READING

9

Reading Comprehension – Skimming – Scanning – Predicting the Content – Comprehension Questions – Inductive Reading – Close Reading – Note Making – Précis Writing.

UNIT – III – SPEAKING

9

Introducing Oneself – Exchanging Personal Information – Small Talk : Family, Friends, Studies, Profession – Speaking : Greeting , Taking Leave – Product Description – Completing information – Gap Exercises – Presentation / Public Speaking Skills – Group Discussion – Debate – Role Play.

UNIT – IV- TECHNICAL WRITING

9

Report Writing – Characteristics of a Report – Categories of Reports – Letter Writing (Formal Letters) : Job Application Letter with Resume – Letter Seeking Permission – Letter of Invitation – Letter Declining an Invitation – Letter of Complaint – Letter of Requisition.

UNIT – V- TECHNICAL COMMUNICATION

9

The Theory of Communication – Definition and Scope – Nature, Importance and Types – Different Communication Models – Barriers to Communication – Effective Communication (Verbal / Non-verbal).

TOTAL: 45 PERIODS

EXTENSIVE READING :

1. CanField Jack, *Chicken Soup for the Soul*, Westland, Chennai, 1999.

NOTE:

The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

REFERENCE BOOKS:

1. Communication Skills. Oxford University Press.
2. Wood, F. T. (2007). Remedial English Grammar. Macmillan.
3. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
4. The Four Skills for Communication – Josh Sreedharan – Foundation Books
5. Communicative English – E. Sureshkumar and P. Sreehari – Orient Blackswan

MA3102	ENGINEERING MATHEMATICS – II	L	T	P	C
		3	1	0	4

Objective: To develop basic knowledge to the students in differential equations and vector calculus. This subject is further broadened to the functions of complex variables and complex integration. A thorough knowledge about Laplace transforms is also covered to aid the students solve the differential equations.

Subject Code: MA3102		Subject Name: ENGINEERING MATHEMATICS -II	
Course Outcome – Cos			Cognitive Skill
CO-01	The Students will be able to solve ordinary differential equations		An , E , S
CO-02	The Students will be able to solve complex variables		E
CO-03	The Students will be able to synthesize complex integration		S
CO-04	The Students will be able to solve Vector Calculus		E , S
CO-05	The Students will be able to Synthesize Laplace transforms		S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	P O -B	PO- C	PO- D	PO- E	PO- F	PO- G	PO- H	P O -I	PO- J	PO- k	PO- L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M
CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I ORDINARY DIFFERENTIAL EQUATIONS**9**

Linear differential equations of second order with constant and variable coefficients- Cauchy's and Legendre's linear equations – Method of variation of parameters.

UNIT II: COMPLEX VARIABLES**9**

Functions of a complex variable – Analytic function – Necessary conditions- Cauchy-Riemann equations in cartesian and polar co-ordinates - Sufficient conditions(excluding proof) –Properties of analytic function – Harmonic and its conjugate – Construction of analytic function by Milne Thomson method – Conformal mappings $w = z + c$, cz , $1/z$ and Bilinear transformation.

UNIT III: COMPLEX INTEGRATION**9**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's expansion – Singular points – Residues – Cauchy's Residue theorem – Evaluation of real definite integral using contour integration(excluding poles on the real

axis) - $\int_0^{2\pi} f(\cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} \frac{f(x)}{g(x)}dx$

UNIT IV: VECTOR CALCULUS**9**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT V: LAPLACE TRANSFORMS

Laplace transform –Existence condition– Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Transform of Periodic functions. Inverse Laplace transform – Convolution, Initial and Final value theorems (statement only) – Solutions of linear ordinary differential equation of second order with constant coefficients using Laplace transform techniques.

L: 45 + T: 15 = TOTAL 60 PERIODS**TEXT BOOKS:**

1. Grewal B.S., "Higher Engineering Mathematics"- 40th Edition , Khanna Publishers, Delhi 2007.

REFERENCES:

1. M.Immaculate Mary , K.Uma Samundesvari, Engineering Mathematics – II" First Edition, Anuradha Publications, ,2013.
2. Erwin Kreyszig, " Advanced engineering Mathematics", Seventh Edition, Wiley India, 2007.
3. Veerarajan T, " Engineering Mathematics (for first year)", Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2007.
4. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" S.Chand & Company Ltd.2002.
5. B.V. Ramana,"Higher Engineering Mathematics" Second Edition Tata McGraw-Hill, Publishing Company Ltd.,New Delhi, 2006.

BE3101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic solutions of AC and DC circuits.
- To study the basic principle and operation of AC and DC machines.
- To study the fundamental operations of measuring instruments.
- To study the layout of power system
- To understand the fundamental operation and characteristics of Electron devices
- To understand the implementation of Boolean expression using logic gates.
- To become familiar with basic concepts of Communication system.

Course Outcome		Cognitive Skill
CO-01	Understand the basic principle and operation of electrical circuits.	R, U
CO-02	Study the fundamental operations of measuring instruments and the layout of power system.	R, U
CO-03	Understand the fundamental operation and characteristics of semiconductor devices.	R, U
CO-04	Understand the implementation of Boolean expression using logic gates.	R, U
CO-05	Become familiar with basic concepts of Communication system.	R, U

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	M	S	M	S	S	N	M	M	S	S	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M
CO-03	S	L	S	S	L	L	S	S	M	M	S	S
CO-04	S	L	M	S	N	L	S	S	M	S	S	M
CO-05	S	L	M	M	M	L	N	S	M	M	M	S

UNIT: 1 – ELECTRICAL CIRCUITS

9

Ohms Law, Kirchhoff's laws, Mesh and Nodal Analysis for DC Circuits.

Introduction to AC Circuits, Faraday's Law of Electromagnetic Induction, Lenz law, Inductor, Capacitor, Power factor, Waveforms and RMS value, Average Value, Peak factor and Form factor, Single phase circuits- Series and Parallel, Three phase balanced circuits. Fundamentals of wiring and earthing.

UNIT: II – ELECTRICAL MEASUREMENTS, MACHINES AND POWER SYSTEM

9

Operating principles of Moving coil and Moving iron instruments (Ammeter and voltmeter), Dynamometer type watt meter and Energy meter, Errors in Measurements.

Construction, Principle of operation and Applications of DC Generators, DC Motors, Single phase transformers. Structure of power system.

UNIT- III SEMICONDUCTOR DEVICES

9

Introduction to Semiconductors, PN Junction diode-Zener diode and its characteristics-Half wave and Full wave Rectifiers-Bipolar Junction transistor-CB,CE,CC Configuration and characteristics-JFET and MOSFET construction, operation ,characteristics (CS only) and uses.

UNIT-IV DIGITAL ELECTRONICS

9

Number systems-binary arithmetic--Boolean algebra-laws and theorems-Simplification of Boolean expression- logic gates –Implementation of Boolean expression using logic gates-standard forms of Boolean expression.

UNIT – V COMMUNICATION SYSTEMS

9

Block diagram of basic communication system-need for modulation-Types of modulation-Principles of Amplitude and Frequency modulation – pulse analog and digital modulation-AM and FM transmitter and receiver(Block diagram description only) –Satellite Communication Radar Systems-Data transmission and MODEM.

TOTAL: 45 PERIODS

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
3. V.K.Mehta “Principles of Power System”, S.Chand & Company Ltd, New Delhi, 2001.
4. R.S.Sedha,”Applied electronics”S.Chand&Co.,2006.

BE3102	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain the basic knowledge in Surveying and civil Engineering materials.
- Students can attain the basic knowledge in basic civil structures and building components.
- Can obtain the basic fundamental knowledge of Engineering Mechanics.
- Students can expand their knowledge in knowing about IC engines and power plants.
- Can increase the skill in basic manufacturing processes.

Course Outcome		Cognitive Skill
CO-01	Understand surveying: Objects – types – classification – principles – measurements of distances – angles –levelling–determination	R,U,A
CO-02	Understand the types, bearing capacity– Requirement of good foundation	R,U,A
CO-03	Understand the statics –Basics concepts, Fundamental principles & concepts: Newton’s laws, gravitation, force, couple	R,U,A
CO-04	Understand the introduction to IC Engines, working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles	R,U,A,
CO-05	Understand the foundry- Investment casting, Die casting, Centrifugal casting, Continuous casting, Stir casting, Squeeze casting.	R,U,A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	M	L	L	M	L	L	L	M	M	L	M
CO-02	M	N	M	L	N	M	L	L	S	M	L	M
CO-03	S	M	L	L	N	M	L	L	L	N	M	L
CO-04	S	L	M	M	N	M	M	L	N	M	M	M
CO-05	S	L	N	M	N	M	L	L	M	M	M	M

A– CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – types – classification – principles – measurements of distances – angles –leveling–determination of areas–illustrative examples.

Civil Engineering Materials: Bricks–stones–sand–cement–concrete–steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 9

Foundations: Types, Bearing capacity– Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring –plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams–Basics of Interior Design and Landscaping.

B– MECHANICAL ENGINEERING

UNIT III FUNDAMENTALS OF ENGINEERING MECHANICS 9

Statics –Basics Concepts, Fundamental principles & concepts: Newton’s laws, gravitation, force, couple, moment (about point and about axis), Varignon’s theorem, resultant of

concurrent and non-concurrent coplanar forces, Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, 3-D statics.

UNIT IV BASIC CONCEPTS OF THERMAL ENGINEERING 9

Introduction to IC Engines, Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles, Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants, Principle of vapour compression and absorption system.

UNIT V BASIC MANUFACTURING PROCESSES 9

Foundry-Investment casting, Die casting, Centrifugal casting, Continuous casting, Stir casting, Squeeze casting. Metal fusion welding processes- Oxyfuel gas welding – Arc welding processes. Additive Manufacturing-3D Printing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, “Basic Civil and Mechanical Engineering”, Tata McGraw Hill Publishing Co., New Delhi,(1996).
2. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P)Ltd. (1999).

REFERENCES:

1. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies,(2005).
2. Venugopal K. and Prahu Raja V., “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam,(2000).
3. Shantha KumarSRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai,(2000).

ME3101	ENGINEERING GRAPHICS	L	T	P	C
		3	0	2	4

OBJECTIVE

- To develop skills for communication of concepts, ideas and design of Engineering Products.
- To expose them to existing national standards related to technical drawings
- To know and understand the conventions and the methods of engineering drawing.
- Interpret Engineering drawings using fundamental technical mathematics.
- Construct basic and intermediate geometry.
- To improve their visualization skills so that they can apply these skills in developing new products.
- To improve their technical communication skill in the form of communicative drawings and comprehend the theory of projection.

Course Outcome		Cognitive Skill
CO-01	Students should able to understand the Use of drafting instruments, BIS conventions and specifications – Size, layout and folding of drawing sheets	U
CO-02	Students should able to learn Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations.	A
CO-03	Students should able to understand the Prisms, pyramids, cylinder and cone, axis perpendicular to any one reference plane. Axis parallel to both the planes	U
CO-04	Students should able to learn about Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, Isometric view,	E
CO-05	Students should able to understand the Fundamental of projection along with classification, Projections from the pictorial view of the object	R

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L	PO-M
CO-01	S	M	M	M	M	M	M	M	M	M	L	M	S
CO-02	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-03	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-04	S	S	M	M	M	M	M	M	M	M	L	M	S
CO-05	S	M	M	M	M	M	M	M	M	M	L	M	S

Unit I – Introduction

9

Concepts and conventions: Use of drafting instruments, BIS conventions and specifications – Size, layout and folding of drawing sheets, Lettering and dimensioning. General principles of orthographic projection, First angle projection – Layout of views. (Not for examination)

General Plane Curves

Conic sections including the Rectangular Hyperbola (General method); Cycloid, Epicycloid, Hypocycloid and Involute.

Unit II - Projection of Points, Lines & Planes

9

Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Projection of planes- parallel to any one reference

plane, perpendicular to any one reference plane, Inclined to any one reference plane and inclined to both reference planes

Unit III - Projection of Solids & Section of Solids

9

Prisms, pyramids, cylinder and cone, axis perpendicular to any one reference plane. Axis parallel to both the planes. Axis inclined to any one reference plane.

Sectioning of solids- Prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane. Obtaining the true shape of section

Unit IV –Development of Surfaces & Isometric Projection

9

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, Isometric view, Isometric scale to draw Isometric projection, Non-Isometric lines, construction of Isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

Unit V – Orthographic Projection & Perspective Projection

9

Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view. Perspective Projection of Solids (Any one Method).

L: 45+P: 15 = TOTAL: 60 PERIODS

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V, “*Engineering Graphics*”, New Age International Publishers, 2007.
2. Luzadder W J, “*Fundamentals of Engineering Drawing*”, Prentice Hall Book Co., New York, 1998
3. Bhat, N.D.& M. Panchal , *Engineering Drawing*, Charotar Publishing House,2008

REFERENCES:

1. Kumar M S, “*Engineering Graphics*”, Ninth Edition, DD Publications, Chennai, 2007.
2. Bureau of Indian Standards, “*Engineering Drawing Practices for Schools and Colleges SP 46-2003*”, BIS, New Delhi, 2003.
3. Shah, M.B. & B.C. Rana , *Engineering Drawing and Computer Graphics*, Pearson Education,2008

BE3171	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To make basic electrical connection
- To measure the electrical parameters
- To obtain the characteristics of Electron devices
- To verify the operation of logic gates.

Course Outcome		Cognitive Skill
CO-01	Study of Symbols, Cables and Earthing.	U,An
CO-02	Residential house wiring using switches, fuse, indicator, lamp and energy meter.	U,An
CO-03	Fluorescent lamp wiring.	U,An
CO-04	Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control	A,An
CO-05	Measurement of electrical quantities	A,An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	S	S	L	L	M	M	M	L	S	S	L
CO-02	S	S	M	L	L	M	S	S	L	S	S	L
CO-03	S	S	S	L	L	M	M	M	L	S	S	L
CO-04	S	S	S	L	L	M	M	S	L	S	S	L
CO-05	S	S	M	L	L	M	S	S	L	S	S	L

I. Electrical Engineering Lab

- 1 Study of Symbols, Cables and Earthing.
- 2 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 3 Fluorescent lamp wiring.
- 4 Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control
- 5 Measurement of electrical quantities – voltage, current, power & computation of power factor in RLC circuit.
- 6 Measurement of energy using single phase energy meter.
- 7 Fan Wiring.

II. Electronics Engineering Lab

1. Study of Electronic components and equipments – Resistor, colour coding, Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.

2. Characteristics of PN Junction diode
3. Characteristics of Zener diode
4. Voltage Regulator using Zener diode
5. Measurement of ripple factor of HWR and FWR.
6. Study of logic gates AND, OR, EX-OR and NOT, NAND and NOR.
7. Generation of Clock Signal.
8. Soldering practice – Components, Devices and Circuits – Using general purpose PCB

TOTAL: 30 PERIODS

BE3172	BASIC CIVIL AND MECHANICAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To gain fundamental knowledge about Buildings and pipe line works.
- To handle Carpentry and power tools.
- To gain knowledge in basic welding and machining process.
- To attain the practice of using gyroscope in dynamics.
- To understand the fundamental knowledge in foundry, fitting, sheet metal and IC engines.

Course Outcome		Cognitive Skill
CO-01	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.	U,An
CO-02	Study of pipe connections requirements for pumps and turbines.	U,An
CO-03	Preparation of plumbing line sketches for water supply and sewage works.	U,An
CO-04	Preparation of arc welding of butt joints, lap joints and tee joints.	A,An
CO-05	Demonstration on foundry, fitting and sheet metal exercises.	A,An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-K	PO-L
CO-01	S	L	M	M	L	M	M	M	L	S	S	L
CO-02	S	S	S	L	L	M	S	S	L	S	S	L

CO-03	S	S	S	M	L	S	M	M	L	S	S	L
CO-04	S	S	M	L	S	M	M	S	L	S	S	L
CO-05	S	S	S	L	S	M	S	S	L	S	S	L

I CIVIL ENGINEERING PRACTICE

Buildings:

- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in house hold fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise:
Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE

Welding:

Preparation of arc welding of butt joints, lap joints and tee joints.

Basic Machining:

Simple Turning and Taperturning

Dynamics:

Experiment using Gyroscope/Four bar link mechanism.

Demonstration on:

- (a) Demonstration on foundry, fitting and sheet metal exercises.
- (b) Demonstration on the working principle of two stroke and four stroke I.C. engines.

TOTAL: 30 PERIODS

SEMESTER - III

MA3201	ENGINEERING MATHEMATICS - III	L	T	P	C
		3	1	0	4

Objective:

To develop the skill of the students in the areas of boundary value problems and Transform techniques. This will be necessary for their effective studies in a large number of Engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. This course will also serve as a prerequisite for post graduate and specialized studies and research.

Course Outcomes		Cognitive Skills
At the end of the course students should be able to		
CO-01	Recognize a Partial Differential Equation and formulate a Partial Differential Equation from a given equation. Solve linear Partial Differential Equation of both first and second order using various methods.	R,U,A,An, E, S
CO-02	Derive a Fourier series expansion for a given periodic function by evaluating Fourier coefficient and expand Fourier cosine and Sine series for given function. Also find the Fourier series expansion for a given set of numerical values by applying harmonic analysis.	R,U,A,An, E, S
CO-03	Classify the second order Partial Differential Equation and solve second order Partial Differential Equations such as wave equation, heat equation and Laplace equation with boundary and initial conditions applying Fourier series expansion.	R,U,A,An, E, S
CO-04	Know fundamental and mathematical properties of Fourier transform. Calculate the Fourier transform of a given function and inverse Fourier transform of function. Know the applications of Parseval's and convolution theorem.	R,U,A,An, E, S
CO-05	Understand the characteristics and properties of Z-transform. Compute Z-transform of simple functions and inverse z transform of given functions and apply Z-transform for solving difference equations.	R,U,A,An, E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	P O - B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	P O - I	PO- J	PO -k	PO -L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M

CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

UNIT I : Partial Differential Equations

12

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Solutions of Clairaut's equations – Lagrange's linear equation – Homogeneous linear partial differential equations of second order with constant coefficients.

UNIT II : Fourier Series

12

Dirichlet's conditions – Fourier series – Change of interval - Odd and Even functions – Half range sine and cosine series – Parseval's identity – Harmonic Analysis.

UNIT III : Boundary Value Problems

12

Classification of second order linear partial differential equations – One dimensional wave and heat equations – Assumptions – Fourier series solution – Steady state solution of two dimensional heat equation (insulated edges excluded) – Fourier series solution in Cartesian co-ordinates.

UNIT IV : Fourier Transforms

12

Statement and meaning of Fourier integral theorem – Fourier transform — Properties - Inverse Fourier transform – Fourier Sine and Cosine transforms – Inverse sine and cosine transforms – Properties -Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V: Z-Transforms

12

Z- transform – Elementary properties – convolution theorem-Inverse Z-transform –Partial fraction Method, Inversion integral method and Convolution – Initial and Final value theorems –Formation of difference equations – Solution of difference equations using Z-transform

L: 45 + T: 15, TOTAL: 60 PERIODS

TEXT BOOK

1. Grewal B.S., "Higher Engineering Mathematics" – 40th Edition , Khanna Publishers, Delhi 2011.

REFERENCES

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, Inc., USA, 2011
2. Kandasamy P, Thilagavathy K, and Gunavathy K., "Engineering Mathematics Volume III", First Edition, S.Chand & Company Ltd., New Delhi.
3. Veerarajan T., "Engineering Mathematics(for Semester III), Third Edition, Tata McGraw – Hill Publishing Company Limited, New Delhi 2007.

4. Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Seventh Edition, Lakshmi Publications Pvt. Ltd., New Delhi, 2009

CS3201	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart basic concepts of computer architecture and organization.
- To explain key skills of constructing cost-effective computer systems.
- To familiarize the basic CPU organization.
- To help students in understanding various memory devices.
- To facilitate students in learning IO communication.

Course Outcomes		Cognitive Skill
CO-01	Identify various components of computer and their interconnection.	U
CO-02	Identify basic components and design of the CPU: the ALU and control unit.	U
CO-03	Compare and select various Memory devices as per requirement.	An
CO-04	Compare various types of IO mapping techniques	An
CO-05	Critique the performance issues of cache memory and virtual memory	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis
Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	L	N	L	L	L	M
CO-02	M	L	N	M	M	L	M
CO-03	S	M	N	L	N	M	S
CO-04	M	L	N	L	N	L	M
CO-05	S	L	N	M	N	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Structure of Computers

9

Computer types - Functional units - Basic operational concepts – Von Neumann Architecture - Bus Structures - Software - Performance - Multiprocessors and Multicomputer - Data representation - Fixed and Floating point - Error detection and correction codes. Computer Arithmetic: Addition and Subtraction - Multiplication and Division algorithms - Floating point Arithmetic Operations - Decimal arithmetic operations.

Unit II: Basic Computer Organization and Design**9**

Instruction codes - Computer Registers - Computer Instructions and Instruction cycle - Timing and Control - Memory Reference Instructions - Input Output and interrupt. Central processing unit: Stack organization - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Complex Instruction Set Computer (CISC) - Reduced Instruction Set Computer (RISC) - CISC Vs RISC.

Unit III: Register Transfer and Micro-Operations**9**

Register Transfer Language - Register Transfer - Bus and Memory Transfers - Arithmetic Micro-Operations - Logic Micro Operations - Shift Micro Operations - Arithmetic logic shift unit. Micro-Programmed Control: Control Memory - Address Sequencing – Micro Program example - Design of Control Unit.

Unit IV: Memory System**9**

Memory Hierarchy - Semiconductor Memories - RAM(Random Access Memory) - Read Only Memory (ROM) - Types of ROM - Cache Memory - Performance considerations - Virtual memory – Paging - Secondary Storage - RAID.

Unit V: Input/ Output**9**

I/O interface - Programmed IO - Memory Mapped IO - Interrupt Driven IO - DMA. Multiprocessors: Characteristics of multiprocessors - Interconnection structures - Inter Processor Arbitration - Inter processor Communication and Synchronization - Cache Coherence.

TOTAL:45 PERIODS**TEXT BOOK**

1. M. Morris Mano, Computer System Architecture, 3rd edition, Pearson/PHI, India, 2017 (Electronic Edition).

REFERENCES

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky, Computer Organization, 5th edition, McGraw Hill, New Delhi, India, 2019.
2. William Stallings, Computer Organization and Architecture- designing for performance, 11th edition, Prentice Hall, New Jersey, 2019 (Electronic Edition).
3. Andrew S. Tanenbaum, Structured Computer Organization, 6th edition, Pearson Education Inc, 2016.
4. John P. Hayes, Computer Architecture and Organization, 3rd edition, Tata McGrawHill, 2002.

CS3202	DATA STRUCTURES & ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the basics of C programming language.
- To understand the various algorithm design and analysis techniques
- To learn linear data structures – lists, stacks, and queues
- To learn different sorting and searching algorithms
- To understand Tree and Graph data structures

Course Outcome		Cognitive Skill
CO-01	Understand C Programming fundamentals	U
CO-02	Analyze the various algorithms in design and analysis techniques	R,U
CO-03	Apply linear data structures – lists, stacks, and queues	A
CO-04	Analyze and implement various searching and sorting algorithms.	An
CO-05	Evaluate trees and apply graphs to solve problems.	E,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	N	N	L	M	S	M
CO-02	N	M	L	L	M	L	S
CO-03	S	S	L	L	M	M	S
CO-04	M	S	L	L	M	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: C Programming Fundamentals

9

Data Types – Variables – Operations – Expressions and Statements – Conditional Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays- Structures – Union – Pointers.

Unit II:Algorithm Analysis, List ADT

9

Algorithms: Notation - analysis – running time calculations. Abstract Data Types (ADTs): List ADT – array-based implementation – linked list implementation – singly linked lists- applications of lists: Polynomial Manipulation. Implementation of List ADT using an array and using a linked list in C.

Unit III: Stacks and Queues

9

Stack ADT - Applications - Evaluating arithmetic expressions- Conversion of Infix to Postfix- Recursion. Queue ADT – Priority Queue - applications of queues. Implementation of Stack ADT and palindrome checking using C. Implementation of Queue operations using arrays.

Unit IV: Searching and Sorting Algorithms

9

Divide and conquer methodology - Searching: Linear Search - Binary Search. Sorting: Insertion sort – Merge sort – Quick sort – Heap sort. Analysis of searching and sorting

techniques. Implementation of linear search, binary search, insertion sort, merge sort and quick sort algorithms in C.

Unit V:Trees & Graphs

9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – binary search tree ADT – applications of trees. Heap – applications of heap-Representation of Graph – Traversal - Floyd’s algorithm – Greedy method - Dijkstra’s algorithm – applications of graphs.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2011.
2. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, 2nd Edition, Pearson Education, 2018 (Electronic Edition).
3. Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2016.
4. Narsimha Karumanchi,”Data Structures and Algorithms Made Easy”, Fifth edition 2017
5. Prateek Narang,”Data Structures and Algorithms Essential Using C++”, 2022.

REFERENCES

1. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education, 2021.
2. S.Sridhar, “Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
3. Byron Gottfried, Jitender Chhabra, “Programming with C” (Schaum’s Outlines Series), Mcgraw Hill Higher Ed., III Edition, 2010
4. Yashvant Kanetkar, “Data Structures through C”, BPB publications, II Edition, 2003.

CS3203	DIGITAL DESIGN PRINCIPLES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn how to design digital circuits by simplifying the Boolean functions.
- To give an idea about designs using PLDs
- To write HDL codes for designing larger digital systems.

Course Outcome		Cognitive Skill
CO-01	Remember the concept of Number system, Boolean algebra and Logic gates.	R
CO-02	Understand the concept and implement the ideas in combinational circuits and PLD’s.	U
CO-03	Apply the concept and design with MSI devices.	A

CO-04	Writing HDL codes for designing larger digital systems. Analyze the concept and apply it in the synchronous sequential logic circuit.	An
CO-05	Understand the concept and apply the ideas in asynchronous sequential logic circuit.	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	M	L	N	S	L
CO-02	L	S	L	S	M	N	M
CO-03	S	M	L	L	N	N	N
CO-04	L	S	L	M	L	N	S
CO-05	M	L	S	L	S	N	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Boolean algebra And Logic Gates

9

Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map – Logic Gates.

Unit II: Combinational Logic

9

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Introduction to HDL.

Unit III: Design with MSI Devices

9

Decoders and Encoders – Multiplexers and Demultiplexers-Memory and Programmable Logic-HDL for combinational circuits.

Unit IV: Synchronous Sequential Logic

9

Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits.

Unit V: Asynchronous Sequential Logic

9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design | With an Introduction to the Verilog HDL, VHDL, and SystemVerilog”, Sixth Edition, Pearson Education, 2018.

REFERENCES:

1. John F. Wakerly, "Digital Design Principles and Practices", Fourth Edition, Pearson Education, 2016 (Electronic Edition).
2. Charles H. Roth Jr, "Fundamentals of Logic Design", Seventh Edition – Jaico Publishing House, Mumbai, 2013.
3. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, 2017.
4. G. K. Kharate, "Digital Electronics", Oxford University Press, 2010.

CS3204	OBJECT ORIENTED PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the object oriented programming concepts
- To explore the basics of Java language.

Course Outcome		Cognitive Skill
CO-01	Understand the basics of java programming.	R,U
CO-02	Ability to analyze various techniques for constructing inheritance and interfaces.	A
CO-03	Introduction to exception handling and I/O.	An
CO-04	Evaluate and Define Multi-threading and generic programming	E
CO-05	Apply graphics programming in Java.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis
Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	S	S	M	N	M	M	S
CO-02	M	N	S	S	S	M	N	L
CO-03	S	L	M	N	N	M	S	N
CO-04	N	M	L	S	L	S	N	S
CO-05	S	S	L	L	N	M	S	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Introduction to OOP and Java Fundamentals**9**

Object Oriented Programming — Abstraction — objects and classes — Encapsulation-Inheritance — Polymorphism- OOP in Java — Characteristics of Java — The Java Environment — Java Source File -Structure — Compilation. Fundamental Programming

Structures in Java — Defining classes in Java — constructors, methods -access specifiers — static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages — JavaDoc comments.

Unit II: Inheritance and Interfaces

9

Inheritance — Super classes- sub classes –Protected members — constructors in sub classes- the Object class — abstract classes and methods- final methods and classes — Interfaces — defining an interface, implementing interface, differences between classes and interfaces and extending interfaces — Object cloning -inner classes, Array Lists — Strings

Unit III: Exception Handling and I/O

9

Exceptions - exception hierarchy - throwing and catching exceptions —built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics — Streams — Byte streams and Character streams — Reading and Writing Console — Reading and Writing Files

Unit IV: Multithreading and Generic Programming

9

Differences between multi-threading and multitasking - thread life cycle-creating threads, synchronizing threads-Inter-thread communication-daemon threads-thread groups. Generic Programming - Generic classes-generic methods-Bounded Types-Restrictions and Limitations.

Unit V: Event Driven Programming

9

Graphics programming - Frame - Components - working with 2D shapes - Using color, fonts, and images -Basics of event handling - event handlers-adapter classes - actions - mouse events - AWT event hierarchy -Introduction to Swing - layout management - Swing Components - Text Fields-Text Areas - Buttons- Check Boxes- Radio Buttons - Lists-choices- Scrollbars- Windows - Menus - Dialog Boxes.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Y.Daniel Liang, “Introduction to Java Programming”, 10th Edition, Pearson, December 2013.
2. Rajkumar Buyya, S Thamarai Selvi, Xingchen Chu, “Object oriented programming with Java “, Tata McGraw Hill Education Private Limited, 2009.
3. M.T. Somashekara , D.S. Guru , K.S. Manjunatha,”Object Oriented Programming with Java”, PHI Publications, 2017

REFERENCES

1. Sachin Malhotra, Saurabh Choudhary, “Programming in Java” , Oxford University Press, 2010
2. E Balagurusamy, “Programming with JAVA”, McGrawHill, Sixth Edition, March 2019
3. Cay Horstmann, “CORE JAVA volume –I”, Pearson, January 2013.

CS3271	DATA STRUCTURES & ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To implement linear and non-linear data structures
- To understand the different operations of search trees
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

Course Outcome		Cognitive Skill
CO-01	Understand and implement linear and non-linear data structures	U
CO-02	Understand and apply the concepts of Tress and heaps	U,A
CO-03	Understand and apply the different operations of search trees and graph traversal algorithms	U,A
CO-04	Apply and get familiarized to sorting and searching algorithms	An
CO-05	Evaluate hashing algorithms	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	N	N	L	M	S	M
CO-02	N	M	L	L	M	L	S
CO-03	S	S	L	L	M	M	S
CO-04	M	S	L	L	M	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF PROGRAMS

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues.

9. Graph representation and Traversal algorithms
10. Applications of Graphs
11. Implementation of searching and sorting algorithms
12. Hashing – any two collision techniques

TOTAL: 45 PERIODS

PLATFORM NEEDED

- C++ for Windows/Linux

CS3272	DIGITAL DESIGN PRINCIPLES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To understand and implement the design of digital circuits
- To understand the use of Hardware Description Language(HDL) in digital Electronics

Course Outcome		Cognitive Skill
CO-01	Remember the concept of Boolean algebra and Logic gates and study the characteristics of basic logic gates.	R
CO-02	Understand the concept and implement the ideas in combinational circuits and Analyze the characteristics.	U,An
CO-03	Analyze the characteristics of combinational circuits.	An
CO-04	Evaluate the characteristics of a Synchronous sequential circuit.	E
CO-05	Apply the combinational/sequential circuits using HDL.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	S	M	N	S	S	L
CO-02	N	S	N	L	L	M	M
CO-03	M	N	L	S	N	L	L
CO-04	S	L	M	N	L	N	N
CO-05	N	L	S	M	N	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Half adder and full adder
3. Half subtractor and full subtractor

4. Multiplexer and Demultiplexer using gates
5. Encoder and Decoder
6. Code converter
7. Synchronous Counters
8. Asynchronous Counters
9. Design and implementation of parity generator / checker using basic gates and MSI devices
10. Design and implementation of Shift registers
11. Coding combinational/sequential circuits using Hardware Description Language (HDL).

TOTAL: 30 PERIODS

CS3273	OBJECT ORIENTED PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To write, test, and debug simple object oriented Java programs.
- To implement Java programs with conditionals and loops.
- Use functions for structuring Java programs.
- Represent compound data using Java lists, tuples, and dictionaries.
- Read and write data from/to files in Java.

Course Outcome		Cognitive Skill
CO-01	Understand the basic Object Oriented concepts	U
CO-02	Remember and apply the concepts of classes, packages, and interfaces,	R,A
CO-03	Apply the concept of inheritance.	A
CO-04	Develop and implement Java programs with array list, exception handling and multi-threading.	An
CO-05	Design applications using file processing, generic programming and event handling.	E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H
CO-01	S	S	S	M	N	M	M	S
CO-02	M	N	S	S	S	M	N	L
CO-03	S	L	M	N	N	M	S	N

CO-04	N	M	L	S	L	S	N	S
CO-05	S	S	L	L	N	M	S	M

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Electricity Bill Generation using Classes
2. Currency converter, Distance converter and Time converter Implementation using Packages
3. Pay slip Generation using Inheritance
4. Stack ADT Implementation using Multiple Inheritance (Interface)
5. String Operations using Array List
6. Abstract Class Implementation
7. User Defined Exception Handling Implementation
8. File Handling
9. Multithreading Implementation
10. Generic Function Implementation

TOTAL: 30 PERIODS

PLATFORM NEEDED

- Java for Windows/Linux

SEMESTER - IV

MA3205	PROBABILITY AND QUEUING THEORY	L	T	P	C
		2	1	0	3

Objective:

To have the fundamental knowledge of basic probability concepts, the standard distributions and random variables which can describe real life phenomena. To acquire skills in the basic characteristic features of queuing system and in analyzing queuing models.

Course Outcomes		Cognitive Skills
At the end of the course students should be able to		
CO-01	To formulate the theorems about the concept of probability. To calculate probabilities using Conditional probability, Rule of total probability and Bayes' theorem. Express the features of discrete and continuous random variables. To calculate the moments and formulates the Moment Generating Function.	R,U,A,An,E, S
CO-02	Use discrete and continuous probability distributions, including requirements, mean and variance, and making decisions to solve simple practical problems.	R,U,A,An,E, S
CO-03	To acquire skills in handling situations involving more than one random variable and functions of random variables. To understand the central tendency, correlation and correlation	R,U,A,An,E, S

	coefficient and also regression.	
CO-04	To understand the concept of random processes and to determine covariance and spectral density of stationary random processes. To use discrete time Markov chains to model computer systems.	R,U,A,An,E, S
CO-05	To expose the basic characteristic features of a queuing system and acquire skills in analysing queuing models. To learn how to analyze a network of queues with Poisson external arrivals, exponential service requirements and independent routing.	R,U,A,An,E, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

PO CO	PO- A	P O - B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	P O - I	PO- J	PO -k	PO -L	PO- M
CO-01	M	S	M	S	S	N	M	M	S	S	M	M	M
CO-02	S	M	L	N	L	M	S	L	L	S	M	M	S
CO-03	S	L	S	S	L	L	S	S	M	M	S	S	M
CO-04	S	L	M	S	N	L	S	S	M	S	S	M	S
CO-05	S	L	M	M	M	L	N	S	M	M	M	S	N

UNIT I: Probability and Random Variable

9

Axioms of probability - Conditional probability – Independent Events - Total probability- Baye's theorem-Random variable - Probability mass functions - Probability density functions -Distribution functions- Properties – Expectation – Moments - Moment generating function and properties.

UNIT II: Standard Distributions

9

Binomial, Poisson, Uniform, Exponential, Gamma and Normal distributions and their properties (Problems only)-Central Limit Theorem(without proof).

UNIT III: Two Dimensional Random Variables

9

Joint distributions - Marginal and Conditional distributions–Expectation-Independence- Covariance – Correlation and Regression .

UNIT IV: Random Processes and Markov Chains

9

Classification - Stationary process - Markov process– Markov chains – Transition probabilities - Limiting distributions.

UNIT V: Queuing Theory

9

Birth and Death process - Markovian queuing models – Little's formulae - M/M/1, M/M/C, finite and infinite capacity- M/G/1 queue (steady state solutions only)-Pollaczek-Khintchine formula.

TOTAL:30+15 = 45 PERIODS

TEXT BOOK

1. Veerarajan. T., “Probability, Statistics and Random Processes”, Second Edition, Tata McGraw-Hill Publications, New Delhi, 2007.

REFERENCES

1. Ross, S. Ross, “A first course in Probability”, Sixth Edition, Pearson Education, Delhi, 2011.
2. Allen, A. O., “Probability, Statistics and Queuing Theory”, Second Edition, Academic press, New Delhi, 2010.
3. Medhi J., “Stochastic Processes”, New Age Publishers, Second Edition, New Delhi, 2006 (Chapters 2 to 4)
4. Taha, H. A., “Operations Research-An Introduction”, Seventh Edition, Pearson Education, Delhi, 2002 (Chapter 17).

BS3201	ENVIRONMENTAL STUDIES	L	T	P	C
		2	0	0	2

OBJECTIVES

- To understand the basic concepts in environmental science
- To gain the knowledge about structure and natural cycles of environment.
- To get an idea about control methods of pollution.
- To know the information about conservation methods of forest and wild life.

Course Outcome		Cognitive Skill
CO-01	Student will be able to demonstrate a general understanding of interdisciplinary nature of environmental uses and able to characterize natural resources.	U, A, An
CO-02	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, E, A
CO-03	Students will be able to explain the effects of air, water, soil, noise and thermal pollution environment and suggest ways to reduce them.	R, U, A
CO-04	Students will be able to understand the effects of human population and know about the awareness programme.	R, A, E
CO-05	Students apply systems concept and methodologies to analyse and understand interaction between social and environmental process.	R, A, An

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G	PO -H	PO -I	PO -J	PO -k	PO -L	PO -M
CO-01	S	M	S	M	M	S	S	S	M	S	S	M	S
CO-02	M	M	S	M	S	S	S	S	M	S	S	M	M
CO-03	M	M	S	M	S	S	S	S	M	S	S	M	M
CO-04	M	M	S	S	M	S	S	S	M	S	S	M	L
CO-05	M	M	S	S	L	S	M	S	M	S	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I:NATURE OF ENVIRONMENT STUDIES AND NATURAL RESOURCES 9

Environment studies- definition – scope and importance- need for public awareness- Methods to create environmental awareness- Natural resources- Forest resources- energy resources- food resources- water resources – land resources - mineral resources.

Unit II: ECO SYSTEMS AND BIO-DIVERSITY 9

Concept and component of eco systems- producer, consumer, decomposer- structure and function of eco system- food chain and food web- energy flow model- aquatic eco system-forest eco system- desert eco system- pyramid of biomass- ocean eco system- grass land eco system- Bio diversity in India- value of bio diversity- biodiversity threatens- biodiversity protection- In-situ and Ex-situ conservation.

Unit III: ENVIRONMENTAL POLLUTION 9

Meaning of environmental pollution- air pollution- acid rain – global warming- water pollution- water pollution control- soil pollution- urban waste and soil pollution- marine pollution- noise pollution- thermal pollution- solid and hazardous waste management- waste disposal methods- solid waste and India- natural disaster and disaster management.

Unit IV: HUMAN POPULATION AND ENVIRONMENT 9

Population growth- distribution of population- factors affecting variation in population-theories of population- future of human population- family welfare programme- HIV and AIDS- environment and human health- human rights- value education- women and child welfare.

Unit V: SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to sustainable development- sustainable development in India- water conservation, watershed management and water harvesting- environmental ethics- role of engineer in environmental protection.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cunnigham&saigo: 'Environmental science :A global concern' 4th Ed.W.c. Brown Publishers. USA. 1997
2. Chauhan A.S, 'Environmental studies' 2nd revised ed.2004, Jain Brother publishers, New Delhi

REFERENCES:

1. Benny Joseph : 'Environmental Science and Engineering', 2006, Tata McGraw-Hill Publication.
2. Siddique K.A. : Elements of Ecology and Environmental Pollution, 1st Ed. 2002, Kushal Publication, Varanasi. M

CS3205	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of networks, types of connections and reference model.
- To understand error detection and correction codes.
- To learn packet switching and routing protocols.
- To understand the duties of transport layer
- Familiarize with Domain Name System.

Course Outcome		Cognitive Skill
CO-01	Gain the knowledge of the basic computer technology	R, U
CO-02	Evaluate the performance of datalink layer	E
CO-03	Ability to identify how data flows from one node to another	U, A
CO-04	Design protocols for various functions in the network.	A
CO-05	Apply and implement the working of various application layer protocols.	U, A

R-Remember, U-Understand, A-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	S	N	N	N	N	N
CO-02	N	S	N	N	N	S	S
CO-03	S	N	N	S	N	N	M
CO-04	N	S	N	M	N	N	S
CO-05	M	N	N	S	N	N	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Data Communications**9**

Components - Direction of Data flow networks - Components and Categories - Types of Connections - Topologies - Protocols and Standards -Example Networks: ARPANET, Internet, ISO / OSI model – Physical Layer: Transmission Media -twisted pairs- Coaxial Cable - Fiber Optics - Line Coding - Modems - RS232 Interfacing sequences.

Unit II: Data Link Layer**9**

Design Issues - Framing-Error detection and correction - Parity - LRC - CRC - Hamming code - low Control and Error control - stop and wait - go back-N ARQ - selective repeat ARQ- sliding window - HDLC - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 - FDDI - SONET - Bridge

Unit III: Network Layer**9**

Inter networks - Packet Switching and Datagram approach - IP addressing methods - Subnetting - Routing - Distance Vector Routing - Link State Routing – Routers-Congestion control algorithms.

Unit IV: Transport Layer**9**

Duties of transport layer - Multiplexing - De Multiplexing - Sockets - User Datagram Protocol (UDP) - Transmission Control Protocol (TCP) - Quality of services (QOS) - Integrated Services.

Unit V: Application Layer**9**

Domain Name Space (DNS) - SMTP - FTP - HTTP - WWW - Security - Cryptography.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, Fifth Edition, 2013.

REFERENCES:

1. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2017.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, Inc., 2012.
3. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2013.
4. Andrew S. Tanenbaum, "Computer Networks", PHI, Fourth Edition, 2003.

CS3206	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.

- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
- To have an introductory knowledge about the emerging trends in the area of distributed DB- OODB- Data mining and Data Warehousing and XML.

Course Outcomes		Cognitive Skill
CO-01	Design and develop the data models using various data modeling concepts like network, hierarchical and ER models.	S
CO-02	Develop SQL queries to extract information from large, real time data sets.	S
CO-03	Analyze an information storage problem and evaluate an information model expressed in the form of B tree and B+ Tree.	An
CO-04	Apply the transaction processing techniques for computing systems that uses databases.	A
CO-05	Apply current trends, skills and tools for database systems.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	L	N	N	S
CO-02	S	L	N	L	L	N	S
CO-03	S	S	N	N	N	L	N
CO-04	S	M	N	M	N	N	S
CO-05	M	L	N	M	N	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction and Conceptual Modeling

9

Introduction to File and Database Systems - Database System Structure - Data Models - Introduction to Network and Hierarchical Models - ER Model - Relational Model - Relational Algebra and Calculus

Unit II: Relational Model

9

SQL - Data Definition - Queries in SQL - Updates - Views - Integrity and Security - Relational Database Design - Functional Dependences and Normalization for Relational Databases (Up to BCNF).

Unit III: Data Storage and Query Processing

9

RAID - Record Storage and Primary File Organization - Secondary Storage Devices - Operations on Files - Heap File - Sorted Files - Hashing Techniques - Index Structure for Files -Different Types of Indexes - B-Tree - B+Tree - Query Processing.

Unit IV: Transaction Management**9**

Transaction Processing - Introduction - Need for Concurrency Control - Desirable Properties of Transaction - Schedule and Recoverability - Serializability and Schedules - Concurrency Control - Types of Locks - Two Phases Locking - Deadlock - Time Stamp Based Concurrency Control - Recovery Techniques - Concepts - Immediate Update - Deferred Update - Shadow Paging.

Unit V: Current Trends**9**

Object Oriented Databases - Need for Complex Data types - OO data Model - Nested relations - Complex Types - Inheritance Reference Types - Distributed databases - Homogenous and Heterogenous - Distributed data Storage - XML - Structure of XML - Data - XML Document - Schema - Querying and Transformation - Data Mining and Data Warehousing.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Sixth Edition, McGraw-Hill, 2021 (Electronic Edition).

REFERENCES

1. RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Seventh Edition, Pearson Education, 2015.
2. Raghu Ramakrishnan, “Database Management System”, Third Edition, Tata McGraw-Hill Publishing Company, 2014.
3. Hector Garcia–Molina, Jeffrey D.Ullman and Jennifer Widom- “Database System Implementation”- Pearson Education- 2008.
4. Peter Rob and Corlos Coronel- “Database System, Design, Implementation and Management”, Heinle - Tenth Edition, 2013.

CS3207	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To have an overview of different types of operating systems
- To know the components of an operating system.
- To have a thorough knowledge of process management
- To have a thorough knowledge of storage management
- To know the concepts of I/O and file systems.

Course Outcome		Cognitive Skill
CO-01	Remember and understand various types of systems and recognize process management and scheduling concept.	R, U
CO-02	Understand scheduling concept and scheduling algorithm then apply real time values in algorithms	U, A
CO-03	Remember and Analyze deadlock detection, avoidance and memory management methods.	R,An

CO-04	Remember and Apply file system mounting, sharing and protection	R, A
CO-05	Analyze file systems and implementation, and various file allocation methods	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	M	N	L	S	L	L
CO-02	M	S	L	N	M	L	L
CO-03	S	M	L	L	S	N	N
CO-04	M	S	N	N	M	L	L
CO-05	S	M	L	N	S	N	N

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: PROCESS CONCEPTS

9

Introduction - Mainframe systems – Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems – Real Time Systems – Handheld Systems - Hardware Protection - System Components – Operating System Services – System Calls – System Programs - Process Concept – Process Scheduling – Operations on Processes – Cooperating Processes – Inter-process Communication.

UNIT II: SCHEDULING

9

Threads – Overview – Threading issues - CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Real Time Scheduling - The Critical-Section Problem – Synchronization Hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors.

UNIT III: DEADLOCK AND MEMORY MANAGEMENT

9

System Model – Deadlock Characterization – Methods for handling Deadlocks -Deadlock Prevention – Deadlock avoidance – Deadlock detection – Recovery from Deadlocks - Storage Management – Swapping – Contiguous Memory allocation – Paging – Segmentation – Segmentation with Paging.

UNIT IV: VIRTUAL MEMORY

9

Virtual Memory – Demand Paging – Process creation – Page Replacement – Allocation of frames – Thrashing - File Concept – Access Methods – Directory Structure – File System Mounting – File Sharing – Protection

UNIT V: FILE SYSTEM & OPERATING SYSTEM CASE STUDY**9**

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management. Kernel I/O Subsystems - Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management. Case Study: The Linux System, Windows

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, Sixth Edition, John Wiley & Sons (ASIA) Pvt. Ltd, 2003.

REFERENCES:

1. Harvey M. Deitel, “Operating Systems”, Second Edition, Pearson Education Pvt. Ltd, 2002.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, Prentice Hall of India Pvt. Ltd, 2003.
3. William Stallings, “Operating System”, Prentice Hall of India, 4th Edition, 2003.
4. Pramod Chandra P. Bhatt – “An Introduction to Operating Systems, Concepts and Practice”, PHI, 2003.

AI3201	PRINCIPLES OF AI AND MACHINE LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand basic principles of Artificial Intelligence
- To learn and design intelligent agents
- To understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action
- To master the fundamentals of machine learning, mathematical framework and learning algorithm

Course Outcome		Cognitive Skill
CO-01	Understand formal methods of knowledge representation, logic and reasoning	R,U
CO-02	Understand foundational principles, mathematical tools and program paradigms of artificial intelligence	U
CO-03	Understand the fundamental issues and challenges of machine learning: data, model selection, model complexity	U,An
CO-04	Analyze the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning	An
CO-05	Apply intelligent agents for Artificial Intelligence programming techniques	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate,S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	M	N	M	S
CO-02	N	L	N	N	L	L	N
CO-03	S	S	M	S	M	M	M
CO-04	S	M	M	L	L	M	S
CO-05	S	S	M	M	M	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: AI History and Applications

9

Attitudes toward Intelligence - Knowledge, and Human Artifice-Overview of AI Application Areas-Artificial Intelligence: An Attempted Definition-The Propositional Calculus-The Predicate Calculus-Using Inference Rules to Produce Predicate Calculus Expressions.

Unit II: Structures and Strategies for State Space Searches

9

Graph Theory-Structures for State Space Searches-State Space Representations of Problems-Strategies for State Space Searches-Data-Driven and Goal-Driven Searches-Depth-First and Breadth-First Searches.

Unit III: Control and Implementation of State Space Searches

9

Best-First Searches - Heuristic Searches and Expert Systems - Admissibility, Monotonicity, Informedness - Minimax Procedure - Recursion-Based Searches-Pattern-Directed Searches-Production Systems-The Blackboard Architecture for Problem Solving.

Unit IV: Knowledge Representation

9

AI Representational Schemes: Semantic Networks-Scripts, Frames-Conceptual Graphs: Types, Individuals, and Names-The Type Hierarchy-Generalization and Specialization-Propositional Nodes-Alternatives to Explicit Representation - Agent-Based and Distributed Problem Solving.

Unit V: Machine Learning

9

A Framework for Symbol-Based Learning- Version Space Searches-ID3 Decision Tree Induction Algorithm- Inductive Bias and Learnability-Knowledge and Learning-Unsupervised Learning-Foundations for Connectionist Networks-Perceptron Learning-Back-propagation Learning-Genetic and Emergent Models of Learning.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, Third Edition, 2010. Pearson Education, Inc.

- George F. Luger. Artificial Intelligence: Structures and Strategies for Complex Problem Solving: Addison-Wesley, 2008.

REFERENCES

- Nikos Vlassis, "A concise introduction to multiagent systems and distributed artificial intelligence", Morgan & Claypool Publisher, 2007.
- Hastie, Tibshirani, Friedman. The elements of statistical learning, Second edition, Springer, 2009
- Tsang. Foundations of constraint satisfaction, Academic press, 1993
- Daphne Koller and Friedman. Probabilistic Graphical Models - Principles and Techniques, The MIT Press, 2009

CS3274	COMPUTER NETWORKS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

Course Outcome		Cognitive Skill
CO-01	Implement various protocols using TCP and UDP.	A
CO-02	Compare the performance of different transport layer protocols.	An,U
CO-03	Use simulation tools to analyze the performance of various network protocols.	U, An
CO-04	Analyze various routing algorithms.	An
CO-05	Implement error correction codes.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	N	L	N	L	M	N
CO-02	S	L	N	N	L	M	S
CO-03	M	S	N	L	L	M	S

CO-04	S	S	L	N	N	M	M
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute.
Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like: a) Echo client and echo server b) Chat c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.
8. Simulation of Distance Vector/ Link State Routing algorithm.
9. Performance evaluation of Routing protocols using Simulation tool.
10. Simulation of an error correction code (like CRC).

TOTAL: 45 PERIODS

PLATFORM NEEDED

- C/C++/JAVA/Equivalent compiler.
- Network Simulator like NS2/OPNET/Wireshark.

CS3275	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To implement the basics of SQL and construct queries using SQL.
- To emphasize the importance of normalization in databases.
- To facilitate students in Database design.
- To design various real time systems.

Course Outcome		Cognitive Skill
CO-01	Apply DDL and DML commands in RDBMS	A
CO-02	Apply High-level language extension with Cursors and Triggers	A
CO-03	Apply Procedures and Functions	A
CO-04	Implement the design E-R model and Normalization	S

CO-05	Apply the design and implementation of various real time systems	A, S
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R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO- B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	M	N	N	N	M	L	M
CO-02	M	N	N	N	M	M	M
CO-03	M	N	N	N	S	N	M
CO-04	S	N	N	N	M	L	M
CO-05	L	M	N	N	M	M	L

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF EXPERIMENTS

1. Data Definition Language (DDL) commands in RDBMS.
2. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.
3. High-level language extension with Cursors.
4. High level language extension with Triggers
5. Procedures and Functions.
6. Embedded SQL.
7. Database design using E-R model and Normalization.
8. Design and implementation of Payroll Processing System.
9. Design and implementation of Banking System.
10. Design and implementation of Library Information System.

TOTAL: 45 PERIODS

PLATFORM NEEDED

- Oracle, Visual Basic

CS3276	OPERATING SYSTEMS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To understand and implement Shell Programming
- To analyze the process scheduling strategy

Course Outcome		Cognitive Skill
CO-01	Understand and apply the basic commands in shell programming.	U, A
CO-02	Execute the commands in UNIX operating system.	U, A
CO-03	Display and print the Gantt chart for FCFS, SJF. Compute average	U, An

	waiting, Turn around time.	
CO-04	Display and print the Gantt chart for priority, round robin scheduling.	U, An
CO-05	Implement producer consumer problem, memory management scheme 1, 2.	U, A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	S	M	N	S	S	L
CO-02	N	S	N	L	L	M	M
CO-03	M	N	L	S	N	L	L
CO-04	S	L	M	N	L	N	N
CO-05	N	L	S	M	N	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

LIST OF EXPERIMENTS

1. Shell programming
- Command syntax, write simple functions, Basic tests
2. Shell programming
- loops, Patterns, Expansions, Substitutions
3. Write programs using the following system calls of UNIX operating system:
Fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)
5. Write C programs to simulate UNIX commands like ls, grep, etc.
6. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
7. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time
8. Implement the Producer – Consumer problem using semaphores.
9. Implement some memory management schemes – I
10. Implement some memory management schemes – II

TOTAL: 30 PERIODS

PLATFORM NEEDED

- C/C++/JAVA/Equivalent compiler.
- LINUX/WINDOWS platform

SEMESTER - V

AI3202	DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

Subject Code: AI3202		Subject Name: Data Science	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Define the data science process	R	
CO-02	Understand different types of data description for data science process	U	
CO-03	Gain knowledge on relationships between data	R,U	
CO-04	Use the Python Libraries for Data Wrangling	U	
CO-05	Apply visualization Libraries in Python to interpret and explore data	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	N	N	N	M	L
CO-02	M	L	N	N	N	L	N
CO-03	M	M	N	N	M	M	L
CO-04	S	M	N	N	N	M	M
CO-05	M	M	N	N	N	M	L

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION

9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II: DESCRIBING DATA**9**

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III: DESCRIBING RELATIONSHIPS**9**

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations – regression towards the mean

UNIT IV: PYTHON LIBRARIES FOR DATA WRANGLING**9**

Basics of NumPy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V: DATA VISUALIZATION**9**

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V).

REFERENCES

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.

CS3210	ARTIFICIAL INTELLIGENCE AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Subject Code: CS3210		Subject Name: Artificial Intelligence and Applications
Course Outcome – COs At the end of the course students should be able to,		Cognitive Skill
CO-01	Discuss intelligent agents and environments	U
CO-02	Understand how to handle the search space.	U, A
CO-03	Apply knowledge engineering in first order logic.	U, A
CO-04	Analyze the different learning methods	An
CO-05	Use artificial intelligence in various fields.	A, E

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	L	N	L	S	S	M
CO-02	S	M	L	M	M	S	S
CO-03	S	S	M	M	L	S	S
CO-04	M	S	M	M	M	S	S
CO-05	L	M	L	M	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION

9

Introduction to AI - AI Applications - Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.

UNIT II: SEARCHING TECHNIQUES

9

Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.

UNIT III: KNOWLEDGE REPRESENTATION

9

First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward

chaining – backward chaining - Resolution - Knowledge representation -Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects

UNIT IV: LEARNING

9

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning.

UNIT V: APPLICATIONS

9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks- Probabilistic language processing - Probabilistic language models – Information retrieval – Information Extraction – Machine translation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2007.
3. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008

REFERENCES

1. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Second Edition, Tata McGraw-Hill, 2003.
2. George F. Luger, “Artificial Intelligence-Structures and Strategies for Complex Problem Solving”, Pearson Education / PHI, 2002.
3. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Second Edition, Harcourt Asia Pvt. Ltd., 2000.

CS3211	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

Subject Code: CS3211		Subject Name: Web Technologies
Course Outcome – COs At the end of the course students should be able to,		Cognitive Skill
CO-01	Construct a basic website using HTML and Cascading Style Sheets	U
CO-02	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	R,U
CO-03	Develop server side programs using Servlets and JSP.	A
CO-04	Construct simple web pages in PHP and to represent data in XML format.	R,A
CO-05	Develop interactive web applications.	An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	N	N	S	S	S
CO-02	M	M	N	N	M	M	M
CO-03	L	L	N	N	M	S	S
CO-04	M	S	N	N	L	M	M
CO-05	L	M	N	N	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0

9

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control 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. Bootstrap Framework

UNIT II: CLIENT SIDE PROGRAMMING

9

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.

UNIT III: SERVER SIDE PROGRAMMING

9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC.

UNIT IV: PHP AND XML**9**

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation, XSL.

UNIT V: INTRODUCTION TO ANGULAR AND WEB APPLICATIONS FRAMEWORKS**9**

Introduction to AngularJS, MVC Architecture, understanding ng attributes, Expressions and data binding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules, Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django- UI & UX.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Deitel and Deitel and Nieto, Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.
3. Angular 6 for Enterprise-Ready Web Applications, DoguhanUluca, 1st edition, Packt Publishing

REFERENCES

1. Stephen Wynkoop and John Burke “Running a Perfect Website”, QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009.
3. Gopalan N.P. and Akilandeswari J., “Web Technology”, Prentice Hall of India, 2011.
4. UttamK.Roy, “Web Technologies”, Oxford University Press, 2011.
5. Angular: Up and Running: Learning Angular, Step by Step, ShyamSeshadri, 1st edition, O'Reilly

AI3203	SCALABLE SYSTEMS FOR DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Teach the fundamental systems aspects of designing using Big Data platforms.
- Explore distributed program models and abstractions.
- Learn inter-process communication and collaboration algorithms.
- Familiarize the role of Hadoop in data science.
- Understand parallel mining agents and the role of Grid technologies.

Subject Code:AI3203		Subject Name: Scalable Systems for Data Science	
Course Outcome-COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the fundamentals of distributed system and protocols for distributed system.		R,U
CO-02	Conduct an in-depth examination of an existing distributed file system with an emphasis on basic methods of naming file system.		A
CO-03	Apply and analyze the concepts of network protocol.		A, An
CO-04	Distinguish distributed programming models for Big Data like Map Reduce, Stream processing and Graph processing.		E
CO-05	Design and develop applications on Big Data platforms and their optimizations on commodity clusters and Clouds. Scale data science algorithms and analytics using parallel data mining agents.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	L	N	N	N	N	M
CO-02	S	N	N	N	N	N	L
CO-03	S	N	N	S	N	N	M
CO-04	N	S	N	N	N	S	M
CO-05	M	N	N	M	N	N	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Introduction

9

Introduction to Distributed Systems, evolution, characteristics, design issues, user requirements, Client-Server model, distributed computing models: workstation model, workstation-server model, processor-pool model. Protocols for distributed systems -VMTP and FLIP.

Unit II: Distributed File System

9

Distributed file system: Components of DFS, design issues, interfaces, implementation, File Caching and Replication. Sun Network File System – architecture and implementation, Google File System. Naming- Namespace and contexts, Name services, Domain Name System, The Global Name Service

Unit III: Network Protocols

9

Network Protocols, Interprocess communication: Message Passing, Remote communication: RPC, RMI, Web Services, CORBA, Coordination algorithms, Leader Election, Bully Algorithm, Maxima Finding on a Ring

Unit IV: Hadoop Architecture**9**

Hadoop Architecture - Clusters, HDFS, YARN, Basic file system operations in HDFS, File permissions in HDFS, Functional Programming Model of MapReduce, Job Chaining, Submitting MapReduce job to YARN.

Unit V: Emerging Trends in Grid Computing**9**

Introduction to Grid computing, Grid Middleware, Grid architecture, Grid computing Applications, Cloud computing: Features of cloud computing, Architecture, Landscape, Future of Emerging Trends.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Sunita Mahajan, Seema Shah, Distributed Computing, Oxford University Press; Second edition (25 June 2013).
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed systems – Principles and Paradigms, Second Edition, 2007
3. George Coulouris, Jean Dellimore, Tim Kindberg and Gordan Blair, Distributed Systems – Concepts and design, Pearson Education Asia, Fifth Edition 2017, New Delhi.
4. Pradeep. K, Sinha, Distributed Operating Systems, PHI Edition, first Edition, 2012.

REFERENCES

1. Distributed Systems an Algorithmic Approach, Sukumar Ghosh, CRC Press, Second Edition 2014.
2. Techniques and Environments for Big Data Analysis: Parallel, Cloud, and Grid Computing, Studies in Big Data Vol 17, 2016.

MS3201	PROFESSIONAL AND BUSINESS ETHICS	L	T	P	C
		2	0	0	2

Course Description

The course on Professional and Business Ethics is designed to cultivate ethical awareness and moral and social values in BE students. It aims to help students recognize legal and ethical issues in business decision-making, enhance analytical problem-solving skills, and foster ethical decision-making abilities.

Course Objectives

1. To Recognize legal and ethical issues in business decision-making.
2. To Understand and apply ethical rules and constraints.
3. To Enhance analytical problem-solving skills and ethical decision-making abilities.

Course Outcomes

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

1. Explain the connection between ethics, morals, and values in the workplace.
2. Assess the ethical implications of business activities and competing demands on businesses.
3. Critically analyze real-world contexts and conduct research projects on topics related to business ethics.

UNIT I:HUMAN VALUES**6**

Morals, Values, and Ethics - Integrity and Work Ethic - Caring, Sharing, and Honesty - Commitment, Empathy, and Self-Confidence.

UNIT II:ENGINEERING ETHICS**6**

Senses of 'Engineering Ethics' and Moral Issues -Moral Autonomy and Ethical Theories - Models of Professional Roles.

UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION**6**

Engineering as Experimentation - Engineers as Responsible Experimenters - Codes of Ethics and Legal Perspectives.

UNIT IV: SAFETY, RESPONSIBILITIES, AND RIGHTS**6**

Safety, Risk, and Risk Assessment - Collegiality, Loyalty, and Respect for Authority - Professional and Employee Rights.

UNIT V: GLOBAL ISSUES**6**

Multinational Corporations and Environmental Ethics - Engineers as Managers, Consultants, and Expert Witnesses.

TOTAL: 30 PERIODS**TEXTBOOKS:**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering," McGraw-Hill, New York, Latest edition: 4th edition (2022).
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics," Prentice Hall of India, New Delhi, Latest edition: 2nd edition (2021).

REFERENCES:

1. Charles D. Fleddermann, "Engineering Ethics," Pearson Education/Prentice Hall, New Jersey, Latest edition: 4th edition (2022).
2. Charles E Harris, Michael S. Protchard, and Michael J Rabins, "Engineering Ethics - Concepts and Cases," Wadsworth Thompson Learning, United States, Latest edition: 2nd edition (2023).
3. John R Boatright, "Ethics and the Conduct of Business," Pearson Education, New Delhi, Latest edition: 8th edition (2021).
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers," Oxford University Press, Oxford, Latest edition: 2nd edition (2022).

AI3271	DATA SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

AIM

To understand and implement the Python and R libraries for Data Science.

OBJECTIVES

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.

- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python and R.

Subject Code: AI3271		Subject Name: Data Science Laboratory
Course Outcome – Cos		Cognitive Skill
At the end of the course students should be able to,		
CO-01	Make use of the python libraries for data science	U
CO-02	Make use of the basic Statistical and Probability measures for data science	R,U
CO-03	Perform descriptive analytics on the benchmark data sets	A
CO-04	Perform correlation and regression analytics on standard data sets	A,An
CO-05	Present and interpret data using visualization packages in Python/R.	A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	N	N	M	M	S
CO-02	M	M	N	N	M	M	M
CO-03	L	L	N	N	M	S	M
CO-04	L	S	N	N	L	M	M
CO-05	L	M	N	N	L	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays.
3. Working with Pandas data frames.
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the different types of data set.
5. Visualizing Geographic Data with Basemap
6. Apply Visualization effects and explore various plotting functions on UCI data sets.

- a) Normal curves
- b) Density and contour plots
- c) Correlation and scatter plots
- d) Histograms
- e) Three dimensional plotting
5. Correlation and covariance
6. Regression model
7. Multiple regression model
8. Regression model for prediction
9. Classification model
10. Clustering model

TOTAL:45 PERIODS

PLATFORM NEEDED: Python, R

CS3277	WEB TECHNOLOGIES LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- To understand different Internet Technologies
- To learn java-specific web services architecture
- To Develop web applications using frameworks

Subject Code: CS3277		Subject Name: Web Technologies Laboratory	
Course Outcome – COs			Cognitive Skill
The students will be able to,			
CO-01	Construct a basic website using HTML and Cascading Style Sheets	U,R	
CO-02	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.	R	
CO-03	Develop server side programs using Servlets and JSP.	A	
CO-04	Construct simple web pages in PHP and to represent data in XML format.	A, An	
CO-05	Develop interactive web applications.	A	

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO- A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	M	N	N	S	S	S
CO-02	M	M	N	N	M	M	M
CO-03	L	L	N	N	M	S	S
CO-04	M	S	N	N	L	M	M
CO-05	L	M	N	N	L	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Create a web page with the following using HTML.
 - a. To embed an image map in a web page.
 - b. To fix the hot spots.
 - c. Show all the related information when the hot spots are clicked.
2. Create a web page with all types of Cascading style sheets.
3. Client Side Scripts for Validating Web Form Controls using DHTML.
4. Program using PHP database functions.
5. Installation of Apache Tomcat web server.
6. Write programs in Java using Servlets:
 - a) To invoke servlets from HTML forms.
 - b) Session Tracking.
7. Write programs in Java to create three-tier applications using JSP and Databases
 - a) For conducting on-line examination.
 - b) For displaying student mark list. Assume that student information is available in a database which has been stored in a database server.
8. Programs using XML – Schema – XSLT/XSL.

TOTAL:45 PERIODS

PLATFORM NEEDED: JAVA, HTML

SEMESTER -VI

AI3204	APPLICATIONS OF NLP IN DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand text processing for extracting information.
- To understand language specific tasks and learning models.
- To explore artificial intelligence in understanding the semantics of text data.

Subject Code: AI3204		Subject Name: Applications of NLP in Data Science	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the mechanics of language - the sound system, word structure, sentence structure, and meaning	R, U	
CO-02	Understand and learn about basic NLP foundations techniques.	R, U	
CO-03	Apply text processing at syntactic, semantic, and pragmatic levels	U, A	
CO-04	Analyze text mining and manipulation techniques	U, An	
CO-05	Analyze entity recognition and relationship between entities to retrieve information from text	An	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	N	M	N	N	N	M	N
CO-02	N	S	N	N	N	M	N
CO-03	M	S	N	M	N	N	M
CO-04	N	N	N	S	N	S	N
CO-05	M	N	N	M	N	S	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

Introduction to Computational Linguistics - Word meaning - Distributional Semantics - Word Sense Disambiguation - Sequence Models - N-gram Language Models - Feedforward Neural Language Models - Word Embeddings

UNIT II: NATURAL LANGUAGE PROCESSING – FOUNDATION

9

Computational phonetics and speech processing - Analysis in the frequency domain and Spectrograms, Applications in the acoustic phonetic field, Speech recognition with HMM

and Deep Neural Networks, Spoken Dialogue Systems (ChatBots) - Tokenisation and Sentence splitting - Computational Morphology - Morphological operations, Static lexica, Two-level morphology - Computational Syntax - Part-of-speech tagging, Grammars for natural language, Natural language Parsing

UNIT III: INFORMATION EXTRACTION

9

Information Extraction from Text - Named Entity Recognition - Semantic Lexicon Induction – Relation Extraction-Paraphrases Inference Rules-Event Extraction-Opinion Extraction - Temporal Information Extraction - Open Information Extraction- - Knowledge Base Population - Narrative Event Chains and Script Learning - Knowledge graph augmented neural networks for Natural Language.

UNIT IV: MACHINE TRANSLATION

9

Machine Translation - Encoder-decoder models, beam search - Attention Models - Multilingual Models-Syntax, Trees, Parsing-Transition-based Dependency Parsing-Graph-based Dependency Parsing.

UNIT V: TEXT ANALYTICS

9

Deep Generative Models for Natural Language Data - Text Analytics - Information Extraction with AQL-Conversational AI.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Emily Bender, Linguistics Fundamentals for NLP, Morgan Claypool Publishers, 2013.
2. Jacob Eisenstein, Natural Language Processing, MIT Press, 2019.

REFERENCES

1. Dan Jurafsky, James H. Martin, Speech and Language Processing, Third edition, Prentice Hall, 2018.
2. Chris Manning, Hinrich Schuetze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

CS3214	CLOUD COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

Subject Code: CS3214		Subject Name: Cloud Computing Techniques	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the concepts of virtualization and virtual machines	U	
CO-02	Understand the various issues in cloud computing. Remember the concept and developing the model of cloud services and tools.	U, R	
CO-03	Experiment with virtualization of hardware resources and Docker.	R, U	
CO-04	Apply the cloud computing concept with suitable communication purpose.	A	
CO-05	Understand the security issues in the cloud environment.	U	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	L
CO-02	S	S	N	S	M	S	M
CO-03	S	M	N	S	L	S	N
CO-04	M	M	M	L	S	M	M
CO-05	S	S	N	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Cloud Architecture Models and Infrastructure

9

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

Unit II: Virtualization Basics

9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines – Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization

Unit III: Virtualization Infrastructure and Docker

9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource

Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

Unit IV: Programming Model

9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack - Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster

Unit V: Cloud Security

9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud – Cloud Security and Trust Management.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, “The Docker Book”, O’Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, “Cloud security. A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, 2010.

REFERENCES

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, SubraKumaraswamy, and ShahedLatif, “Cloud Security and Privacy: an enterprise perspective on risks and compliance”, O’Reilly Media, Inc., 2009.

CS3215	CYBER SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- The course also gives an exposure to the different types of mechanisms to sanitize the cyber space by adopting standardized operating procedures while transacting business/commerce online, and also to ensure security of information handled over the net.
- Introduction to the Cyber Laws and the IPC/Cr. PC equips the students with sufficient legal knowledge about deterrence in preventing cybercrimes.

Subject Code: CS3215		Subject Name: Cyber Security	
Course Outcome – Cos			Cognitive Skill
CO-01	Remember and understand the principles of computer organization and communicate effectively to discuss about the OS and architectures.		R, U
CO-02	Understand and identify the information security fundamentals and apply them in E-commerce.		U, A
CO-03	Remember and understand the security threats and test the programming bugs in computing systems.		R, U
CO-04	Explain the basics of cyber security, cyber crime and cyber law		R, U
CO-05	Understand various cyber crimes and cyber security.		U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO	PO-A	PO-B	PO- C	PO-D	PO- E	PO- F	PO-G
CO							
CO-01	N	L	M	L	M	S	L
CO-02	N	L	M	S	M	S	M
CO-03	S	L	M	L	L	M	S
CO-04	L	L	M	M	M	S	M
CO-05	S	S	M	M	L	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I COMPUTER ORGANIZATION & ARCHITECTURE AND OPERATING SYSTEMS

9

Computer Organization, Architecture, Operating Systems, Process Management, CPU Scheduling, I/O Memory Management, file systems and deadlocks. LAN, MAN, WAN, ISO/OSI seven layer architecture.

UNIT-II INFORMATION SECURITY FUNDAMENTALS

9

Background, Importance, statistics, national and international scenarios. Identification and authentication, confidentiality, privacy, integrity, non repudiation. Goals of security: prevention, detection and recovery. E-commerce security. Critical Infrastructure Protection.

UNIT-III SECURITY THREATS AND VULNERABILITIES

9

Overview of security threats, various kinds of threats; Authentication-weak passwords. Insecure internet connection- internet cookies, viruses and other infections. Security of hard drives, security of laptops; sniffers, backdoors and Trojans. Buffer

overflow and other programming bugs. Common attacks- DoS, man-in-the-middle, brute force attacks.

UNIT-IV CYBERSECURITY 9

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT-V CYBERCRIMES 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.
2. Bernadette H Schell, Clemens Martin, "Cyber Crime", ABC-CLIO Inc, California, 2004.
3. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
4. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.
5. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
6. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India, 2011.

REFERENCES:

1. Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley & Sons, Singapore, 2006.
2. Principles and Practices of Information Security by Michael E. Whiteman and Herbert J.
3. Mattord Cyber Laws by Aparna Viswanathan.
4. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005.

AI3272	NLP LABORATORY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To write, test, and debug simple Python programs for NLP.
- To implement virtual lab using python programs.
- Use functions for structuring named entities.
- Represent compound data using Python lists, tuples, and dictionaries.
- Develop mini project based on NLP application.

Subject Code: AI3272		Subject Name: NLP LABORATORY	
Course Outcome – Cos			Cognitive Skill
The students will be able to,			
CO-01	Understand the basics of preprocessing of text		U
CO-02	Implement prefixes and suffixes on a syntactic category of word		A
CO-03	Finding the probability distribution over word sequences		U
CO-04	Implementing chunking process and feature extraction from text.		An
CO-05	Implementation of Sentiment analysis		A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	L	N	M	S	M	S
CO-02	S	M	N	S	M	S	S
CO-03	S	S	N	M	L	S	S
CO-04	M	S	N	L	M	M	S
CO-05	M	S	N	L	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Preprocessing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming)
2. Morphological Analysis
3. N-gram model
4. POS tagging
5. Chunking
6. Named Entity Recognition
7. Feature Extraction from text
8. Sentiment Analysis with NLTK

TOTAL:45 PERIODS

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

CS3280	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES

- Understand the design challenges in the cloud.
- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker
- Develop and deploy services on the cloud and set up a cloud environment.

Subject Code: CS3280		Subject Name: Cloud Computing Laboratory	
Course Outcome – Cos			Cognitive Skill
The students will be able to,			
CO-01	Understand the installation of Hypervisors and its types. Also understand how to create virtual machines with guest OS.		U, A
CO-02	Develop and deploy services on the cloud and set up a cloud environment.		A, E
CO-03	Apply the Virtualization for real-world applications		A
CO-04	Experience Docker with virtualization of hardware resources		A, An
CO-05	Create cloud organization using simulator and open-source software's.		A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	L	M	S	S	S
CO-02	S	M	N	S	M	S	S
CO-03	M	S	N	S	L	M	S
CO-04	M	M	M	L	S	S	S
CO-05	S	S	N	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

LIST OF PROGRAMS

1. Install VirtualBox/VMware/ Equivalent open-source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Client-server communication between two virtual machine instances, execution of chat application.
3. Find a procedure to transfer the files from one virtual machine to another virtual machine.

4. Implementation of simple network protocols using open-source network controllers (like Open Daylight).
5. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open-Source cloud software's like Open stack, Eucalyptus, Open Nebula with Role-based access control
6. Creating and Executing Your First Container Using Docker.
7. Run a Container from Docker Hub
8. Implementation of various scheduling mechanisms using open-source cloud simulator.
9. Create a Cost-model for a web application using various services and do Cost-benefit analysis
10. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
11. Install Google App Engine. Create a hello world app and other simple web applications using python/java.

TOTAL:45 PERIODS

PLATFORM NEEDED VMware, Docker, Open Stack, Open Nebula, Eucalyptus, Oracle VirtualBox

SEMESTER VII

AI3205	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Vision and Introduction to IoT.
- Understand IoT Market perspective.
- Understand State of the Art – IoT protocols.
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Subject Code: AI3205		Subject Name: Internet of Things	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Remember and Understand the fundamentals of IoT.	R,U	
CO-02	Analyze the market perspective for IoT.	An	
CO-03	Evaluate the different IoT protocols.	E	
CO-04	Understand and design a PoC of an IoT system using Rasperry Pi/Arduino	U,A	
CO-05	Analyze applications of IoT in real time scenario	R,An	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO - A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	L	M	S	L	M	M	L
CO-02	L	S	L	L	M	S	S
CO-03	M	L	S	M	L	L	M
CO-04	S	L	L	S	M	M	L
CO-05	S	S	L	L	M	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: FUNDAMENTALS OF IoT

9

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit II: M2M TO IOT – A MARKET PERSPECTIVE

9

Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, **M2M to IoT-An Architectural Overview**– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit III: IOT PROTOCOLS

9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

Unit IV: BUILDING IoT WITH RASPBERRY PI & ARDUINO

9

Building IOT with RASPBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Unit V: CASE STUDIES AND REAL-WORLD APPLICATIONS

9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL : 45 PERIODS

TEXT BOOKS

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, First Edition, Academic Press, 2014.

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Things, Springer, 2011.
3. Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, —The Internet of Things – Key applications and Protocols, Wiley, 2012.
5. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, First Edition, VPT, 2014.
6. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, First Edition, A Press Publications, 2013.

MS3202	PRINCIPLES OF MANAGEMENT	L	T	P	C
		2	0	0	2

Objectives

- To introduce students to the basic concepts and functions of management.
- To understand the role and responsibilities of managers in various organizational settings.
- To develop an understanding of the planning, organizing, leading, and controlling functions of management.
- To examine the impact of management theories and practices on organizational performance.
- To equip students with the skills necessary to manage people and processes effectively in a technical environment.

Subject Code:MS3202		Subject Name: Principles of Management	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Define and explain the key concepts and functions of management.		R,U
CO-02	Analyze the roles and responsibilities of managers in different		An

	organizational contexts.	
CO-03	Evaluate the effectiveness of different management theories and practices.	E
CO-04	Apply planning, organizing, leading, and controlling principles to real-world scenarios.	U,A
CO-05	Demonstrate management skills necessary for leading teams and projects in a technical environment.	R,An

Unit I: Introduction to Management

7

Definition, nature, and importance of management - Functions of management: Planning, Organizing, Leading, Controlling - Roles and skills of managers - Evolution of management thought: Classical, Behavioral, and Modern theories - Scientific Management (Taylor) - Administrative Theory (Fayol) - Human Relations Movement (Mayo) - Contemporary approaches (Systems Theory, Contingency Theory)

Unit II: Planning

5

Nature and purpose of planning - Types of plans: Strategic, Tactical, Operational - Planning process and techniques - SWOT Analysis, SMART Goals, Scenario Planning - Decision making: Process, types, and tools- Rational Decision-Making Model - Bounded Rationality - Group Decision-Making Techniques (Brainstorming, Delphi Technique)

Unit III: Organizing

5

Organizational structure and design - Types of organizational structures: Functional, Divisional, Matrix, Network - Authority, responsibility, and delegation - Coordination and communication within organizations - Formal and Informal Communication Channels - Role of Technology in Organizational Communication (Emails, Video Conferencing, Collaborative Tools)

Unit IV: Leading

7

Leadership theories and styles - Trait Theory - Behavioral Theories (Ohio State Studies, Michigan Studies) - Contingency Theories (Fiedler's Model, Path-Goal Theory) - Transformational vs. Transactional Leadership - Motivation theories and practices, Maslow's Hierarchy of Needs, Herzberg's Two-Factor Theory, McClelland's Theory of Needs, Modern Approaches (Self-Determination Theory) -Group dynamics and team management - Stages of Team Development (Forming, Storming, Norming, Performing) - Managing Virtual Teams

Unit V: Controlling

6

Nature and purpose of control - Control process and techniques, Establishing Standards, Measuring Performance, Correcting Deviations - Types of control: Feed forward, Concurrent, Feedback - Quality control and management, Total Quality Management (TQM), Six Sigma, Lean Management, Use of Data Analytics in Quality Control

TOTAL: 30 PERIODS

Recommended Textbooks (Latest Editions)

1. Robbins, S. P., Coulter, M., & DeCenzo, D. A. (2020). *Fundamentals of Management* (11th ed.). Pearson.
2. Griffin, R. W. (2022). *Management: Principles and Practices* (12th ed.). Cengage Learning.
3. Jones, G. R., & George, J. M. (2021). *Essentials of Contemporary Management* (9th ed.). McGraw-Hill Education.

Reference Books (Latest Editions)

1. Daft, R. L. (2021). *Management* (14th ed.). Cengage Learning.
2. Bateman, T. S., & Snell, S. A. (2020). *Management: Leading & Collaborating in a Competitive World* (14th ed.). McGraw-Hill Education.
3. Schermerhorn, J. R. (2021). *Management* (14th ed.). Wiley.
4. Hill, C. W. L., Schilling, M. A., & Jones, G. R. (2020). *Strategic Management: Theory & Cases* (13th ed.). Cengage Learning.
5. Kinicki, A., & Williams, B. K. (2021). *Management: A Practical Introduction* (10th ed.). McGraw-Hill Education.

AI3273	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES

- To design and implement search strategies
- To implement game playing techniques
- To implement CSP techniques
- To develop systems with logical reasoning
- To develop systems with probabilistic reasoning

Subject Code: AI3273		Subject Name: Artificial Intelligence Laboratory	
Course Outcome – Cos			Cognitive Skill
CO-01	Design and implement search strategies		U
CO-02	Design and implement game playing techniques		An,U
CO-03	Design and implement search strategies		U
CO-04	Develop logical reasoning systems		An
CO-05	Develop probabilistic reasoning systems		E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

LIST OF PROGRAMS

1. Implement basic search strategies – 8-Puzzle, 8 - Queens problem, Cryptarithmic.
2. Implement A* and memory bounded A* algorithms
3. Implement Minimax algorithm for game playing (Alpha-Beta pruning)
4. Solve constraint satisfaction problems
5. Implement forward chaining, backward chaining, and resolution strategies
6. Implement Bayesian networks and perform inferences
7. Build decision trees and random forest
8. Build simple NN models

TOTAL: 30 PERIODS

PLATFORM NEEDED Python or Any high-level programming language.

SEMESTER VIII

CS3216	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand big data.
- To learn mapreduce analytics using Hadoop.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

Subject Code: CS3216		Subject Name: Big Data Analytics	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Identify the importance of Big Data and Hadoop		U
CO-02	Access and Process Data on Distributed File System		A
CO-03	Manage Job Execution in Hadoop Environment		A, An
CO-04	Develop Big Data Solutions by setting up Hadoop cluster		U
CO-05	Apply Big Data using Tools		A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	N	N	M	S	S
CO-02	S	S	N	N	M	M	M

CO-03	S	S	N	N	M	S	S
CO-04	M	S	N	N	M	S	S
CO-05	S	S	N	N	L	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION TO BIG DATA AND HADOOP

9

Introduction to Big Data Platform – Challenges of Conventional Systems – Intelligent data analysis Nature of Data - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools.

Unit II: HDFS

9

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce.

Unit III: HADOOP

9

History of Hadoop - The Hadoop Distributed File System – Components of Hadoop Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS- How Map Reduce Works-Anatomy of a Map Reduce Job run Failures-Job Scheduling-Shuffle and Sort – Task execution – Map Reduce Features

Unit IV: HADOOP CLUSTER

9

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation - Hadoop Configuration-Security in Hadoop - Administering Hadoop – HDFS - Monitoring-Maintenance

Unit V: APPLICATIONS

9

Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services – HiveQL – Querying Data in Hive - fundamentals of HBase and Zoo Keeper.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Tom White, “Hadoop: The Definitive Guide”, Third Edition, O’reilly Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis”, Springer, 2007.
2. Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press, 2013.
3. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Tom Plunkett, Mark Hornick, “Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media 2013, Oracle press.

ELECTIVE I

AI32A1	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

Subject Code: AI32A1		Subject Name: Knowledge Engineering	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the basics of Knowledge Engineering.	R,U	
CO-02	Apply methodologies and modelling for Agent Design and Development.	A	
CO-03	Design and develop ontologies.	An	
CO-04	Apply reasoning with ontologies and rules.	E	
CO-05	Understand learning and rule learning.	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	M	N	M	L	L
CO-02	S	M	M	M	L	M	S
CO-03	M	M	M	M	M	M	S
CO-04	M	M	M	M	M	L	S
CO-05	M	M	N	M	L	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: REASONING UNDER UNCERTAINTY

9

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning – Knowledge Engineering.

UNIT II: METHODOLOGY AND MODELING**9**

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

UNIT III: ONTOLOGIES – DESIGN AND DEVELOPMENT**9**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching. Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

UNIT IV: REASONING WITH ONTOLOGIES AND RULES**9**

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

UNIT V: LEARNING AND RULE LEARNING**9**

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9).

REFERENCES

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.
4. King , Knowledge Management and Organizational Learning , Springer, 2009.
5. Jay Liebowitz, Knowledge Management Learning from Knowledge Engineering, 1st Edition, 2001.

AI32A2	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide students with a theoretical as well as practical understanding of agile software development practices.

- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of agile development and testing techniques.
- To understand the benefits and pitfalls of working in an agile team.
- To understand agile development and testing.

Subject Code: AI32A2		Subject Name: Agile Methodologies	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the basics of agile methodologies.		R,U
CO-02	Ability to analyze various techniques for agile processes.		A
CO-03	Evaluate the agility and knowledge management.		An
CO-04	Analyze the agility and requirements engineering.		E
CO-05	Analyze the agility and quality assurance.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	N	L	M	M	M
CO-02	M	S	M	L	M	S	S
CO-03	M	S	M	L	M	S	S
CO-04	M	S	M	L	M	S	S
CO-05	M	S	M	L	N	S	S

S-Strong, M-Medium, L-Low,N-Not relevant

UNIT I: AGILE METHODOLOGY

9

Theories for Agile Management – Agile Software Development – Traditional Model Vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

UNIT II: AGILE PROCESSES

9

Lean Production – SCRUM – Crystal - Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products - Roles and Practices.

UNIT III: AGILITY AND KNOWLEDGE MANAGEMENT**9**

Agile Information Systems – Agile Decision Making - Earl'S Schools of KM – Institutional Knowledge Evolution Cycle – Development - Acquisition – Refinement – Distribution – Deployment - Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV: AGILITY AND REQUIREMENTS ENGINEERING**9**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment - Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V: AGILITY AND QUALITY ASSURANCE**9**

Causality - Causal Models - Structural Causal Identifiability - Learning Causal Models - Utilities and Decisions - Utility Curves - Utility Elicitation - Structured Decision Problems - Decision Trees - Influence Diagrams - Backward Induction - Computing Expected Utilities.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

REFERENCES

1. Craig Larman, “Agile and Iterative Development: A Manager's Guide”, Addison-Wesley, 2004.
2. Kevin C. Desouza, “Agile Information Systems: Conceptualization, Construction and Management”, Butterworth-Heinemann, 2007.

AI32A3	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing.

Subject Code: AI32A3		Subject Name: Soft Computing
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Understand the fundamentals of fuzzy logic operators and inference mechanisms	R,U
CO-02	Understand neural network architecture for AI applications such as classification and clustering	A
CO-03	Learn the functionality of Genetic Algorithms in Optimization problems	An
CO-04	Use hybrid techniques involving Neural networks and Fuzzy logic	E
CO-05	Apply soft computing techniques in real world applications	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	N	M	L	S	S
CO-02	M	S	N	M	M	S	M
CO-03	L	S	N	M	L	L	M
CO-04	L	M	N	M	S	M	S
CO-05	M	S	N	M	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 9

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.

UNIT II: NEURAL NETWORKS

9

Supervised Learning Neural Networks – Perceptrons - Backpropagation -Multilayer Perceptrons – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks

UNIT III: GENETIC ALGORITHMS

9

Chromosome Encoding Schemes -Population initialization and selection methods - Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function

UNIT IV: NEURO FUZZY MODELING

9

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modeling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum - Analysis of Adaptive Learning Capability.

UNIT V: APPLICATIONS**9**

Modeling a two input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Sa JANG, J.-S. R., SUN, C.-T., & MIZUTANI, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall, 1997.
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python.
3. With Case Studies and Applications from the Industry, Apress, 2020.

REFERENCES

1. RojKaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Samir Roy, UditChakraborty, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019.
5. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996

AI32A4	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence.
- To understand various types of analytics for Business Forecasting.
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

Subject Code: AI32A4 Subject Name: Business Analytics		
Course Outcome – Cos		Cognitive Skill
At the end of the course students should be able to,		
CO-01	Explain the real-world business problems and model with analytical solutions	R,U
CO-02	Identify the business processes for extracting Business Intelligence	A
CO-03	Apply predictive analytics for business fore-casting.	An
CO-04	Apply analytics for supply chain and logistics management	E
CO-05	Use analytics for marketing and sales.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	M	M	L	S
CO-02	S	S	S	M	M	S	S
CO-03	M	M	S	M	L	M	S
CO-04	M	L	S	M	S	M	L
CO-05	M	S	S	M	S	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO BUSINESS ANALYSIS**9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation–Interpretation–Deployment and Iteration

UNIT II: BUSINESS INTELLIGENCE**9**

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions

UNIT III: BUSINESS FORECASTING**9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT IV: HR AND SUPPLY CHAIN ANALYTICS**9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year.

UNIT V: MARKETING AND SALES ANALYTICS**9**

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process — Sales Planning —Analytics applications in Marketing and Sales -predictive analytics for customers' behaviour inmarketingandsales.

TOTAL: 45 PERIODS

TEXT BOOK

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016.
4. VSPRAO, Human Resource Management, 3rd Edition, Excel Books, 2010.

AI32A5	DATA WAREHOUSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the details of data warehouse Architecture
- To understand the OLAP Technology
- To understand the partitioning strategy
- To differentiate various schema
- To understand the roles of process manager & system manager.

Subject Code: AI32A5 Subject Name: Data Warehousing		
Course Outcome – COs At the end of the course students should be able to,		Cognitive Skill
CO-01	Design data warehouse architecture for various Problems.	R,U
CO-02	Apply the OLAP Technology.	A
CO-03	Introduce Python, Analyze the partitioning strategy with conditionals and loops.	An
CO-04	Critically analyze the differentiation of various schema for given problem.	E
CO-05	Frame roles of process manager & system manager.	A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	L	L	S	S
CO-02	S	S	S	L	L	M	S
CO-03	S	S	S	L	L	M	S
CO-04	S	S	S	L	L	L	S
CO-05	S	S	S	L	L	L	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION TO DATA WAREHOUSE

9

Data warehouse Introduction - Data warehouse components- operational database Vs data warehouse – Data warehouse Architecture – Three-tier Data Warehouse Architecture - Autonomous Data Warehouse- Autonomous Data Warehouse Vs Snowflake - Modern Data Warehouse.

UNIT II: ETL AND OLAP TECHNOLOGY

9

What is ETL – ETL Vs ELT – Types of Data warehouses - Data warehouse Design and Modeling - Delivery Process - Online Analytical Processing (OLAP) - Characteristics of OLAP - Online Transaction Processing (OLTP) Vs OLAP - OLAP operations- Types of OLAP- ROLAP Vs MOLAP Vs HOLAP.

UNIT III: META DATA, DATA MART AND PARTITION STRATEGY

9

Meta Data – Categories of Metadata – Role of Metadata – Metadata Repository – Challenges for Meta Management - Data Mart – Need of Data Mart- Cost Effective Data Mart- Designing Data Marts- Cost of Data Marts- Partitioning Strategy – Vertical partition – Normalization – Row Splitting – Horizontal Partition.

UNIT IV: DIMENSIONAL MODELING AND SCHEMA

9

Dimensional Modeling- Multi-Dimensional Data Modeling – Data Cube- Star Schema- Snowflake schema- Star Vs Snowflake schema- Fact constellation Schema- Schema Definition - Process Architecture- Types of Data Base Parallelism – Datawarehouse Tools.

UNIT V: SYSTEM & PROCESS MANAGERS

9

Data Warehousing System Managers: System Configuration Manager- System Scheduling Manager - System Event Manager - System Database Manager - System Backup Recovery Manager - Data Warehousing Process Managers: Load Manager – Warehouse Manager- Query Manager – Tuning – Testing.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, TataMcGraw – Hill Edition, Thirteenth Reprint 2008.
2. Ralph Kimball, “The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling”, Third edition, 2013.

REFERENCES

1. Paul Raj Ponniah, “Data warehousing fundamentals for IT Professionals”, 2012.
2. K.P. Soman, ShyamDiwakar and V. Ajay “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.

ELECTIVE II

AI32A6	ANN AND DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the biological neural network and to model equivalent neuron models.
- To understand the architecture, classification and various learning strategies in ANN.
- To understand the various perceptron models and issues of various feed forward and feedback neural networks.
- To teach paradigms and approaches of deep feed forward networks and deep belief networks.
- To teach various advanced techniques in Recurrent Neural Networks, BPTT, Natural language Processing, Regression and deep networks.

Subject Code: AI32A6		Subject Name: ANN and Deep Learning	
Course Outcome – Cos		Cognitive Skill	
At the end of the course students should be able to,			
CO-01	Understand the biological neural network and to model equivalent neuron models.	R,U	
CO-02	Ability to design the architecture, classification and various learning strategies in ANN.	A	
CO-03	Design and implement single feed forward networks.	An	
CO-04	Identify and apply appropriate deep learning models for analysing the data for a variety of problems.	E	
CO-05	Implement different deep learning algorithms	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	L	N	L	S	N
CO-02	S	L	L	M	L	M	N
CO-03	M	S	L	M	M	S	M
CO-04	S	S	L	M	M	S	S
CO-05	S	S	L	M	M	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO NEURAL NETWORKS

9

Introduction - Humans and Computers - Organization of the Brain - Biological Neuron - Biological and Artificial Neuron Models - Characteristics of ANN - McCulloch-Pitts Model - Historical Developments - Potential Applications of ANN.

UNIT II: ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS

9

Artificial Neuron Model - Operations of Artificial Neuron - Types of Neuron Activation Function - ANN Architectures - Classification Taxonomy of ANN –Connectivity - Learning Strategy (Supervised, Unsupervised, Reinforcement) - Learning Rules.

UNIT III: SINGLE LAYER FEED FORWARD NETWORKS

9

Introduction - Perceptron Models: Discrete - Continuous and Multi-Category - Training Algorithms: Discrete and Continuous Perceptron Networks – Limitations of the Perceptron Model.

UNIT IV : DEEP LEARNING ARCHITECTURES

9

Machine Learning and Deep Learning - Representation Learning - Width and Depth of Neural Networks - Learning Algorithms: Capacity - Over fitting - Under fitting - Bayesian Classification - Activation Functions: RELU – LRELU – ERELU - Unsupervised Training of Neural Networks - Restricted and Deep Boltzmann Machines - Auto Encoders.

Unit V: Advanced Neural Networks

9

Deep Feed forward Networks: Gradient based learning - Hidden Units - Architectural design – Back Propagation algorithms - Regularization for deep learning: Dataset Augmentation - Noise Robustness –Semi supervised learning - Multitask learning - Deep Belief networks -Generative Adversarial Networks by KerasMXnet.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ian Goodfellow, YoshuaBengio, and Aaron Courville, “Deep Learning”, First Edition, MIT Press, 2016.
2. Nikhil Buduma and Nicholas Lacascio, “Fundamentals of Deep Learning”, First Edition, O.Reilly, 2017.
3. LaureneFausett, "Fundamentals of Neural Networks", Pearson Education, 2004.
4. Simon Haykin, "Neural Networks- A Comprehensive Foundation", Pearson Education, 2003.

REFERENCES

1. Laura Graesser, Wah Loon Keng "Foundations of Deep Reinforcement Learning: Theory and Practice in Python" Addison-Wesley Professional -2020.
2. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.

3. Jon Krohn, Grant Beyleveld, AglaéBassens "Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence", 1st edition Addison-Wesley Professional 2019.
4. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networksusing MATLAB 6.0", TATA McGraw Hill, 2006.
5. S. Rajasekharan and G. A. Vijayalakshmipai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.

AI32A7	ARTIFICIAL INTELLIGENCE AND ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Teach the fundamental systems aspects of designing using Big Data platforms.
- Explore distributed program models and abstractions.
- Learn inter-process communication and collaboration algorithms.
- Familiarize the role of Hadoop in data science.
- Understand parallel mining agents and the role of Grid technologies.

Subject Code: AI32A7		Subject Name: Artificial Intelligence and Robotics	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Identify and apply suitable Intelligent agents for various AI applications. Design smart system using different informed search / uninformed search or heuristic approaches.		R,U
CO-02	Learn about planning and reasoning artificial intelligence in problem decomposition.		A
CO-03	Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem.		An
CO-04	Apply the suitable algorithms to solve AI problems.		E
CO-05	Students will be able to implement the interfacing between human and robotics.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	M	S	S	S
CO-02	M	S	S	N	S	S	N
CO-03	M	M	S	M	S	S	M
CO-04	M	M	S	S	M	S	N
CO-05	M	M	S	M	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION**9**

Artificial Intelligence: Introduction, Typical Applications. State Space Search: Depth Bounded DFS, Depth First Iterative Deepening. Heuristic Search: Heuristic Functions, Best First Search, Hill Climbing, Variable Neighborhood Descent, Beam Search, Tabu Search. Optimal Search: A * algorithm, Iterative Deepening A*, Recursive Best First Search, Pruning the CLOSED and OPEN Lists.

UNIT II: PROBLEM DECOMPOSITION AND PLANNING**9**

Problem Decomposition: Goal Trees, Rule Based Systems, Rule Based Expert Systems. Planning: STRIPS, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, A Unified Framework for Planning. Constraint Satisfaction: N-Queens, Constraint Propagation, Scene Labeling, Higher order and Directional Consistencies, Backtracking and Look ahead Strategies.

UNIT III: LOGIC AND REASONING**9**

Knowledge Based Reasoning: Agents, Facets of Knowledge. Logic and Inferences: Formal Logic, Propositional and First Order Logic, Resolution in Propositional and First Order Logic, Deductive Retrieval, Backward Chaining, Second order Logic. Knowledge Representation: Conceptual Dependency, Frames, Semantic nets.

UNIT IV: NATURAL LANGUAGE PROCESSING AND ANN**9**

Natural Language Processing: Introduction, Stages in natural language Processing, Application of NLP in Machine Translation, Information Retrieval and Big Data Information Retrieval. Learning: Supervised, Unsupervised and Reinforcement learning. Artificial Neural Networks (ANNs): Concept, Feed forward and Feedback ANNs, Error Back Propagation, Boltzmann Machine.

UNIT V: ROBOTICS**9**

Robotics: Fundamentals, path Planning for Point Robot, Sensing and mapping for Point Robot, Mobile Robot Hardware, Non-Visual Sensors like: Contact Sensors, Inertial Sensors, Infrared Sensors, Sonar, Radar, laser Rangefinders, Biological Sensing. Robot System Control: Horizontal and Vertical Decomposition, Hybrid Control Architectures, Middleware, High-Level Control, Human-Robot Interface.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013, ISBN: 978-1-25-902998-1.
2. Elaine Rich, Kevin Knight and Nair, "Artificial Intelligence", TMH, 2017, ISBN-978-0-07-008770-5, Electronic Print.
3. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third edition, Pearson, 2010 ISBN: 10: 0136042597.
4. Michael Jenkin, Gregory, "Computational Principles of Mobile Robotics", Cambridge University Press, 2010, ISBN: 978-0-52-187157-0.

REFERENCES

1. Nilsson Nils J, "Artificial Intelligence: A new Synthesis, Morgan Kaufmann

- Publishers Inc. San Francisco, CA, 1998, ISBN: 978-1-55-860467-4.
2. Patrick Henry Winston, “Artificial Intelligence”, Addison-Wesley Publishing Company, 1993, ISBN: 0-201-53377-4.

AI32A8	EMBEDDED SYSTEMS AND IOT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

Subject Code: AI32A8		Subject Name: Embedded Systems and IOT	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Explain the architecture of embedded processors.		R,U
CO-02	Write embedded C programs.		R, U
CO-03	Design simple embedded applications.		A
CO-04	Compare the communication models in IOT		A
CO-05	Design IoT applications using Arduino/Raspberry Pi /open platform.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	N	L	L	L
CO-02	M	S	M	M	M	M	L
CO-03	M	M	M	M	S	S	S
CO-04	M	M	M	M	S	L	M
CO-05	S	M	M	M	M	S	L

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I 8-BIT EMBEDDED PROCESSOR**9**

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING**9**

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING**9**

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – ArduinoToolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS**9**

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT**9**

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

TOTAL : 45 PERIODS**TEXTBOOKS**

1. Muhammed Ali Mazidi, Janice GillispieMazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems”, Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.

REFERENCES

1. Michael J. Pont, “Embedded C”, Pearson Education, 2007.
2. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design”, Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, “Arm System Developer's Guide”, Morgan Kauffman/ Elsevier, 2006.
4. ArshdeepBahga, Vijay Madiseti, “Internet of Things – A hands-on approach”, Universities Press, 2015

AI32A9	TEXT AND SPEECH ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand natural language processing basics
- Apply classification algorithms to text documents

- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

Subject Code: AI32A9		Subject Name: Text and Speech Analysis
Course Outcome – Cos		Cognitive Skill
At the end of the course students should be able to,		
CO-01	Explain existing and emerging deep learning architectures for text and speech processing	R,U
CO-02	Apply deep learning techniques for NLP tasks, language modelling and machine translation	A
CO-03	Explain coreference and coherence for text processing	U
CO-04	Build question-answering systems, chat bots and dialogue systems	A
CO-05	Apply deep learning models for building speech recognition and text-to-speech systems	A

S-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis
T-

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	M	M	M	S	S
CO-02	S	L	M	M	M	S	M
CO-03	M	M	M	M	S	L	L
CO-04	M	L	M	M	L	M	L
CO-05	L	S	M	M	M	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: NATURAL LANGUAGE BASICS

9

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

Unit II: TEXT CLASSIFICATION

9

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

Unit III: QUESTION ANSWERING AND DIALOGUE SYSTEMS

9

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems – evaluating dialogue systems

Unit IV: TEXT-TO-SPEECH SYNTHESIS**9**

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

Unit V: AUTOMATIC SPEECH RECOGNITION**9**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

REFERENCES

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress,2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O'REILLY.

AI32B1	WEB SERVICES AND API DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the types of webservices, resources, APIs and their architectures
- To analyze the webservice /API design patterns
- To understand the design principles and best practices
- To develop, deploy RESTful webservice API sin JAVA
- To understand the security concerns.

Subject Code: AI32B1		Subject Name: Web Services and API Design	
Course Outcome – COs		Cognitive Skill	
At the end of the course students should be able to,			
CO-01	Understand a suitable architecture for a given design problem.	U	
CO-02	Analyze the types of resources and suitable design patterns for development and deployment.	A	
CO-03	Introduce Python programs with conditionals and loops.	An, S	
CO-04	Deploy RESTful API webservices using JAVA.	E	
CO-05	Implement security best practices for preventing security attacks.	S	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	S	M	S	M	S	M
CO-02	S	M	S	S	M	S	S
CO-03	M	S	S	M	M	S	S
CO-04	M	S	S	M	M	S	S
CO-05	M	S	S	M	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION

9

Web Services -Building Blocks, Types; Service Oriented Architectures -Resource Oriented Architectures, API architectures, Micro Services and Architectures, HATEOAS, REST, URI, Code on Demand.

UNIT II: RESOURCES AND DESIGN PATTERNS

9

Resources -Identification, Resource Relations, Representations, Parameters, Types, Methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API Patterns.

UNIT III: RESTFUL API DESIGN PRINCIPLES

9

API Front End Design, API Back End Design, Identifier Design, Interaction Design With HTTP, Metadata Design, Representation Design, URI Design, REST Constraints, Best Practices.

UNIT IV: DEVELOPMENT AND DEPLOYMENT

9

Frameworks, Standard Languages, API Description Languages, Handover Points, Development and Deployment of RESTful Web Service Applications in Java, Microservice API, Best Practices.

UNIT V: DEVELOPMENT AND DEPLOYMENT

9

Frameworks, Standard Languages, API Description Languages, Handover Points, Development and Deployment of RESTful Web Service Applications in Java, Micro service API, Best Practices.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Matthias Biehl, "REST ful API Design, API University Series, 1st Edition, Create Space Independent Publishing Platform, 2016.
2. Mark Masse, "REST API Design Rulebook: Designing Consistent REST ful Web Service Interfaces", 1st Edition, O' Reilly, 2011.
3. Hari hara Subramanian, Pethuru Raj, "Hands-On REST ful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure REST ful web APIs", Packt Publishing, 2019.

REFERENCES

1. J J Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
2. Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building REST ful APIs using Java, 3rd Edition, Ingram Short Title, 2017.

Elective III

AI32B2	GAME THEORY FOR AI AND DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge about game theory for artificial intelligence domain
- This course aims to introduce multi-agent AI system.
- To learn various aspects of behavioral game theory that helps in different learning mechanisms.
- To gain knowledge about reinforcement Learning.
- To introduce how game theory can be used to produce novel and accurate data for data science problems.

Subject Code: AI32B2		Subject Name: Game Theory for AI and Data Science	
Course Outcome - COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand behavioral game theory for artificial intelligence domain	R, U	
CO-02	Ability to identify the concepts of game theory for learning techniques in artificial intelligence	R, U	
CO-03	Understand and apply behavioral game theory.	U, A	
CO-04	Understand and analyze reinforcement learning.	U, A	
CO-05	Implement game-theoretic solutions for AI and DS	A, An	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	N	N	N	N
CO-02	S	S	S	N	L	M	M
CO-03	S	S	S	S	N	S	M
CO-04	S	S	S	S	M	S	S
CO-05	S	S	S	M	N	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: INTRODUCTION-GAME THEORY

9

Introduction to Game Theory - Cooperative vs Non-Cooperative Games, Symmetric vs Asymmetric Games, Perfect vs Imperfect Information Games, Simultaneous vs Sequential Games, Zero-Sum vs Non-Zero-Sum Games, Nash Equilibrium, Inverse Game Theory Two-person cooperative games without transferable payoffs, N person cooperative games, Decisions under risk and uncertainty, Decisions in conflicts against p-intelligent players, Utility theory

UNIT II: MULTI-AGENT AI SYSTEMS

9

Multi-agent AI systems, Distributed Constraint Satisfaction - Defining distributed constraint satisfaction problems, Domain-pruning algorithms Heuristic search algorithms, Distributed Optimization - Distributed dynamic programming for path planning, Action selection in multiagent MDPs, Games with Sequential Actions: Reasoning and Computing with the Extensive Form, Learning Belief networks, Ontologies and Knowledge-based systems.

UNIT III: BEHAVIORAL GAME THEORY

9

Behavioral game theory: Dictator, Ultimatum and trust games – Methodological Variables, Demographic Variables, Descriptive Variables, Structural Variables, Mixed strategy equilibrium, Bargaining – Unstructured Bargaining, Structured Bargaining, Dominant solvable games - Simple Dominant solvable games, Beauty Contest Games, Games in which iterated reasoning decreases payoffs, Coordination games – Matching Games, Market Entry Games, Selecting selection principles, Signaling and reputation – Simple signaling games, Adaptive Dynamics.

UNIT IV: REINFORCEMENT LEARNING

9

Single-Agent Reinforcement Learning, Stateless Environments, Dynamics of Learning, Types of learning Reinforcement, evolutionary games and Markov games for multi-agent reinforcement learning, Swarm Intelligence and the Evolution of Personality Traits.

UNIT V: GAME THEORY FOR DATA SCIENCE

9

Game Theory for data science: Mechanisms for verifiable and unverifiable information, non-parametric mechanisms, prediction markets, decentralized machine learning.

TOTAL: 45 PERIODS

TEXT BOOKS

1. BoiFaltings, GoranRadanovic, Game Theory for Data Science: Eliciting Truthful Information, Morgan and claypool publishers, 2017.
2. YoavShoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press,2009
3. H. M. Schwartz, Multi-Agent Machine Learning: A Reinforcement Approach, Wiley publications, 2014.
4. PeterVrancx, Decentralized Reinforcement Learning in Markov Games, VUBPress, 2010.
5. Colin F. Camerer, Behavioral Game Theory: Experiments in Strategic Interaction, Princeton University Press, 2003.

AI32B3	UI AND UX DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To explore the various Tools used in UI & UX
- Creating a wireframe and prototype
- To understand the various Research Methods used in Design

Subject Code: AI32B3		Subject Name: UI and UX Design	
Course Outcome - COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Undersatnd the basic concepts of UI for user Applications		R, U
CO-02	Understand UI design of any product or application		U
CO-03	Understand UX Skills in product development		R, An
CO-04	To analyze Wireframing , prototyping and testing concepts		A, An
CO-05	To identify and analyze problem statements		E, S

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	S	S	L	L
CO-02	M	S	S	S	M	M	L
CO-03	L	S	S	S	S	M	S
CO-04	L	M	S	S	M	L	S
CO-05	L	M	S	S	L	L	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I FOUNDATIONS OF DESIGN

9

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking-Brainstorming and Game storming - Observational Empathy

UNIT II FOUNDATIONS OF UI DESIGN

9

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles Branding - Style Guides

UNIT III FOUNDATIONS OF UX DESIGN

9

Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals – Knowabout Business Goals

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING

9

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools- Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods -Synthesizing Test Findings - Prototype Iteration

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION

ARCHITECTURE

9

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture

TOTAL:45 PERIODS

TEXT BOOKS

1. Joel Marsh, “UX for Beginners”, O’Reilly , 2022
2. Jon Yablonski, “Laws of UX using Psychology to Design Better Product & Services” O’Reilly 2021

REFERENCES

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, “Designing Interface” 3 rd Edition , O’Reilly 2020
2. Steve Schoger, Adam Wathan “Refactoring UI”, 2018 114
3. Steve Krug, “Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile”, Third Edition, 2015

AI32B4	BIO-INSPIRED OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand fundamental topics in bio-inspired optimization techniques
- To Learn the collective systems such as ACO, PSO, and BCO
- To develop skills in biologically inspired algorithm design with an emphasis on solving real world problems
- To understand the most appropriate types of algorithms for different data analysis problems and to introduce some of the most appropriate implementation strategies.
- To implement the Bio-inspired technique with other traditional algorithms.

Subject Code: AI32B4		Subject Name: Bio-Inspired Optimization Techniques	
Course Outcome – COs At the end of the course students should be able to,			Cognitive Skill
CO-01	Familiarity with the basics of several biologically inspired optimization techniques.		R,U
CO-02	Familiarity with the basics of several biologically inspired computing paradigms.		A
CO-03	Ability to select an appropriate bio-inspired computing method and implement for any application and data set.		An
CO-04	Theoretical understanding of the differences between the major bio-inspired computing methods.		E
CO-05	Learn Other Swarm Intelligence algorithms and implement the Bio-inspired technique with other traditional algorithms.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	S	S	S	S	M
CO-02	S	M	S	S	S	S	S
CO-03	M	M	S	S	S	M	M
CO-04	M	M	S	S	S	S	M
CO-05	L	S	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION

9

Optimization Techniques: Introduction to Optimization Problems – Single and Multi-objective Optimization – Classical Techniques – Overview of various Optimization methods – Evolutionary Computing: Genetic Algorithm and Genetic Programming: Basic concept – encoding – representation – fitness function – Reproduction – differences between GA and Traditional optimization methods – Applications – Bio- inspired Computing (BIC): Motivation – Overview of BIC – usage of BIC – merits and demerits of BIC.

Unit II: SWARM INTELLIGENCE

9

Introduction – Biological foundations of Swarm Intelligence – Swarm Intelligence in Optimization – Ant Colonies: Ant Foraging Behavior – Towards Artificial Ants – Ant Colony Optimization (ACO) – S-ACO – Ant Colony Optimization Metaheuristic: Combinatorial Optimization – ACO Metaheuristic – Problem solving using ACO – Other Metaheuristics – Simulated annealing – Tabu Search – Local search methods – Scope of ACO algorithms.

Unit III: NATURAL TO ARTIFICIAL SYSTEMS**9**

Biological Nervous Systems – artificial neural networks – architecture – Learning Paradigms – unsupervised learning – supervised learning – reinforcement learning – evolution of neural networks – hybrid neural systems – Biological Inspirations in problem solving – Behavior of Social Insects: Foraging –Division of Labor – Task Allocation – Cemetery Organization and Brood Sorting – Nest Building – Cooperative transport.

Unit IV: SWARM ROBOTICS**9**

Foraging for food – Clustering of objects – Collective Prey retrieval – Scope of Swarm Robotics – Social Adaptation of Knowledge: Particle Swarm – Particle Swarm Optimization (PSO) – Particle 165 Swarms for Dynamic Optimization Problems – Artificial Bee Colony (ABC) Optimization biologically inspired algorithms in engineering.

Unit V: CASE STUDIES**9**

Other Swarm Intelligence algorithms: Fish Swarm – Bacteria foraging – Intelligent Water Drop Algorithms – Applications of biologically inspired algorithms in engineering. Case Studies: ACO and PSO for NP-hard problems – Routing problems – Assignment problems – Scheduling problems – Subset problems – Machine Learning Problems – Travelling Salesman problem.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES

1. Eric Bonabeau, Marco Dorigo, Guy Theraulaz, “Swarm Intelligence: From Natural to Artificial Systems”, Oxford University press, 2000.
2. Christian Blum, Daniel Merkle (Eds.), “Swarm Intelligence: Introduction and Applications”, Springer Verlag, 2008.
3. Leandro N De Castro, Fernando J Von Zuben, “Recent Developments in BiologicallyInspired Computing”, Idea Group Inc., 2005.
4. Albert Y.Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
5. C. Ebelhart et al., “Swarm Intelligence”, Morgan Kaufmann, 2001.

AI32B5	PROBABILISTIC GRAPHICAL MODELS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of probability theory.
- To understand the problems using graphical models.

- To design inference algorithms.
- To learn the structure of the graphical model from data.
- To make actions and decisions.

Subject Code: AI32B5		Subject Name: Probabilistic Graphical Models	
Course Outcomes-Cos			Cognitive Skill
CO-01	Understand the basics of probability theory.		U
CO-02	Implement the problems using graphical models.		S
CO-03	Design inference algorithms.		An
CO-04	Evaluate structure of the graphical model from data.		E
CO-05	Analyze the problems and make actions and decisions.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	L	S	L	L
CO-02	S	S	S	L	S	M	L
CO-03	S	M	S	L	S	M	L
CO-04	M	L	S	L	S	L	M
CO-05	S	S	S	L	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: FUNDAMENTALS

9

Fundamentals of Probability Theory - Views of Probability - Random Variables and Joint Distributions - Conditional Probability - Conditional Independence - Expectation and Variance - Probability Distributions - Conjugate Priors - Introduction to Exponential Family; Fundamentals of Graph Theory – Paths - Cliques – Subgraphs - Cycles and Loops.

UNIT II: GRAPHICAL MODELS

9

Introduction - Directed Models (Bayesian Network) - Undirected Models (Markov Random Fields) - Dynamic Models (Hidden Markov Model & Kalman Filters) and Factor Graph; Conditional Independence (Bayes Ball Theorem and D-separation) - Markov Blanket - Factorization (Hammersley-Clifford Theorem) - Equivalence (I-Maps & Perfect Maps) - Factor Graphs – Representation - Relation to Bayesian Network and Markov Random Field.

UNIT III: INFERENCE IN GRAPHICAL MODELS**9**

Exact Inference - Variable Elimination - Elimination Orderings - Relation to Dynamic Programming - Dealing with Evidence - Forward-Backward Algorithm - Viterbi Algorithm - Junction Tree Algorithm - Belief Propagation (Sum Product) - Approximate Inference - Variational Methods (Mean Field, Kikuchi & Bethe Approximation) - Expectation Propagation - Gaussian Belief Propagation.

UNIT IV: LEARNING IN GRAPHICAL MODELS**9**

Parameter Estimation - Expectation Maximization - Maximum Likelihood Estimation - Maximum Entropy – Pseudolikelihood - Bayesian Estimation - Conditional Likelihood - Structured Prediction - Learning with Approximate Inference - Learning with Latent Variables - Structure Learning - Structure Search - L1 priors.

UNIT V: ACTIONS AND DECISIONS**9**

Causality - Causal Models - Structural Causal Identifiability - Learning Causal Models - Utilities and Decisions - Utility Curves - Utility Elicitation - Structured Decision Problems - Decision Trees - Influence Diagrams - Backward Induction - Computing Expected Utilities.

TOTAL: 45 PERIODS**TEXT BOOK**

1. Koller, D. and Friedman N., Probabilistic Graphical Models: Principles and Techniques. MIT Press, 2009.

REFERENCES

1. Jensen, F. V. and Nielsen, T. D, Bayesian Networks and Decision Graphs. Information Science and Statistics. Springer, 2nd edition, 2010.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective. 4th Printing, MIT Press, 2013.
3. Barber, D. Bayesian Reasoning and Machine Learning. Cambridge University Press, 1st edition, 2014.

AI32B6	VISUAL EFFECTS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To get a basic idea on animation principles and techniques.
- To get exposure to CGI, color and light elements of VFX.
- To have a better understanding of basic special effects techniques.
- To have a knowledge of state of the art vfx techniques.
- To become familiar with popular compositing techniques.

Subject Code: AI32B6		Subject Name: Visual Effects	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	To implement animation in 2D / 3D following the principles and		A

	techniques	
CO-02	To use CGI, color and light elements in VFX applications	A
CO-03	To create special effects using any of the state of the art tools	A, An
CO-04	To apply popular visual effects techniques using advanced tools	U
CO-05	To use compositing tools for creating VFX for a variety of applications	An, E

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO \ CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	M	M	M	S	S
CO-02	S	M	L	L	M	S	M
CO-03	S	M	M	M	M	M	S
CO-04	S	S	M	M	M	M	S
CO-05	S	S	M	M	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: ANIMATION BASICS

9

VFX production pipeline, Principles of animation, Techniques: Keyframe, kinematics, Full animation, limited animation, Rotoscoping, stop motion, object animation, pixilation, rigging, shape keys, motion paths.

UNIT II: CGI, COLOR, LIGHT

9

CGI – virtual worlds, Photorealism, physical realism, function realism, 3D Modeling and Rendering: color - Color spaces, color depth, Color grading, color effects, HDRI, Light – Area and mesh lights, image based lights, PBR lights, photometric light, BRDF shading model.

UNIT III: SPECIAL EFFECTS

9

Special Effects – props, scaled models, animatronics, pyro techniques, Schüfftan process, Particle effects – wind, rain, fog, fire.

UNIT IV: VISUAL EFFECTS TECHNIQUES

9

Motion Capture, Matt Painting, Rigging, Front Projection. Rotoscoping, Match Moving – Tracking, camera reconstruction, planar tracking, Calibration, Point Cloud Projection, Ground plane determination, 3D Match Moving.

UNIT V: COMPOSITING

9

Compositing – chroma key, blue screen/green screen, background projection, alpha compositing, deep image compositing, multiple exposure, matting, VFX tools - Blender, Natron, GIMP.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Chris Roda, Real Time Visual Effects for the Technical Artist, CRC Press, 1st Edition, 2022.
2. Steve Wright, Digital Compositing for film and video, Routledge, 4th Edition, 2017.
3. John Gress, Digital Visual Effects and Compositing, New Riders Press, 1st Edition, 2014.

REFERENCES

1. Jon Gress, “Digital Visual Effects and Compositing”, New Riders Press, 1st Edition, 2014.
2. Robin Brinkman, The Art and Science of Digital Compositing: Techniques for Visual Effects, Animation and Motion Graphics”, Morgan Kauffman, 2008.
3. Luiz Velho, Bruno Madeira, “Introduction to Visual Effects A Computational Approach”, Routledge, 2023.
4. Jasmine Katatikarn, Michael Tanzillo, “Lighting for Animation: The art of visual storytelling ,Routledge, 1st Edition, 2016.
5. EranDinur, “The Complete guide to Photorealism, for Visual Effects, Visualization
6. Jeffrey A. Okun, Susan Zwerman, Christopher McKittrick, “ The VES Handbook of Visual Effects: Industry Standard VFX Practices and Procedures”, Third Edition, 2020.and Games”, Routledge, 1st Edition, 2022.

ELECTIVE IV

AI32B7	ANDROID WIRELESS APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To facilitate students to understand android SDK
- To help students to gain basic understanding of Android application development
- To understand how to work with various mobile application development frameworks
- To inculcate working knowledge of Android Studio development tool
- To learn the basic and important design concepts and issues of development of mobile applications.

Subject Code: AI32B7		Subject Name: Android Wireless Application Development	
Course Outcome – Cos			Cognitive Skill
CO-01	Identify various concepts of mobile programming that make it unique from programming for other platforms.		R, U
CO-02	Create, test and debug Android application by setting up Android development		U

CO-03	Demonstrate methods in storing, sharing and retrieving data in Android applications	A
CO-04	Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces	E
CO-05	Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	M	S	M	S
CO-02	L	M	S	S	L	M	M
CO-03	M	L	S	L	M	L	M
CO-04	M	S	S	M	S	S	S
CO-05	M	S	S	S	M	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I MOBILE PLATFORM AND APPLICATIONS 9

Mobile Device Operating Systems — Special Constraints & Requirements — Commercial Mobile Operating Systems — Software Development Kit: iOS, Android, BlackBerry, Windows Phone — MCommerce — Structure — Pros & Cons — Mobile Payment System — Security Issues.

UNIT II INTRODUCTION TO ANDROID 9

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application,Android Manifest file.

UNIT III ANDROID APPLICATION DESIGN ESSENTIAL 9

Anatomy of Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA 9

User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

UNIT V ANDROID APIs 9

Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL: 45 Periods

REFERENCES

1. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed.,2011
2. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.
3. Prasanth Kumar Pattnaik,Rajib Mall, “Fundamentals of Mobile Computing”, PHI LearningPvt.Ltd,New Delhi-2012
4. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010
5. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009
6. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
7. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197.

AI32B8	ETHICS IN AI	L	T	P	C
		3	0	0	3

OBJECTIVES

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

Subject Code: AI32B8		Subject Name: Ethics In AI	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Learn about morality and ethics in AI and also acquire the knowledge of real time application ethics, issues and its challenges.	R,U	
CO-02	Acquire the knowledge of real time application ethics, issues and its challenges.	An, U	
CO-03	Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	A,U	
CO-04	Understand the concepts of Roboethics and Morality with professional responsibilities	U	
CO-05	Learn about the societal issues in AI with National and International Strategies on AI	AN, E	

S- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	N	N	M	L	S
CO-02	M	L	N	N	M	L	L
CO-03	M	S	N	N	L	S	S
CO-04	S	L	N	N	M	L	S
CO-05	S	L	N	N	S	L	L

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I Introduction

9

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

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

UNIT III AI Standards And Regulation

9

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 Robo ethics: Social and Ethical Implication Of Robotics

9

Robot-Robo ethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology – Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Robo ethics Taxonomy.

UNIT V AI And Ethics- Challenges and Opportunities

9

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.

TOTAL : 45 PERIODS

TEXT BOOKS:

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.

REFERENCES:

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.mkksa.top/10.1007/978-3-540-30301-5_65
4. <https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/>
5. <https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/>

AI32B9	ANALYSIS OF LARGE SCALE SOCIAL NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge about the current web development and emergence of social web.
- To study about the modelling, aggregating and knowledge representation of semantic web.
- To appreciate the use of machine learning approaches for web content mining.
- To learn about the extraction and mining tools for social networks.
- To gain knowledge on web personalization and web visualization of social networks.

Subject Code: AI32B9		Subject Name: Analysis of Large Scale Social Networks	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Apply knowledge of current web development in the era of social web.		A
CO-02	Model, aggregate and represent knowledge for semantic web.		U
CO-03	Use machine learning approaches for web content mining.		E
CO-04	Design extraction and mining tools for social networks.		R, U, A
CO-05	Develop personalized web sites and visualization for social networks.		A

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	M	N	M	S
CO-02	N	L	N	N	L	L	N
CO-03	S	S	M	S	M	M	M
CO-04	S	M	M	L	L	M	S
CO-05	S	S	M	M	M	S	S

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: CLUSTERING AND CLASSIFICATION

9

Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers – Unsupervised Learning – K-means Clustering – Hierarchical Clustering – Partially Supervised Learning – Markov Models – Probability-Based Clustering – Vector Space Model.

Unit II: SOCIAL MEDIA MINING

9

Data Mining Essentials – Data Mining Algorithms - Web Content Mining – Latent Semantic Indexing – Automatic Topic Extraction – Opinion Mining and Sentiment Analysis – Document Sentiment Classification.

Unit III: EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS

9

Extracting Evolution of Web Community from a Series of Web Archive – Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection & Mining – Applications of Community Mining Algorithms – Tools for Detecting Communities – Social Network Infrastructure and Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities.

Unit IV : HUMAN BEHAVIOR ANALYSIS AND PRIVACY ISSUES

9

Understanding and Predicting Human Behavior for Social Communities – Use Data Management, Inference and Distribution – Enabling New Human Experiences – Reality Mining – Context Awareness – Privacy in Online Social Networks – Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons – Attack Spectrum and Countermeasures.

Unit V: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

9

Graph Theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing Online Social Networks – Visualizing Social Networks with Matrix-Based Representations – Node-Link Diagrams – Hybrid Representations – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks – Recommendation in Social Media: Challenges – Classical Recommendation Algorithms Recommendation Using Social Context – Evaluating Recommendations.

TOTAL: 45 Periods

TEXT BOOKS

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, “Deep Learning”, First Edition, MIT Press, 2016.
2. Peter Mika, “Social networks and the Semantic Web”, Springer, 2007.
3. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 2010.

REFERENCES

1. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, "Social Media Mining", Cambridge University Press, 2014.
2. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data- Centric Systems and Applications)", Springer; Second Edition, 2011.
3. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", Springer, 2011.

AI32C1	VIRTUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To understand the various functions of network virtualization
- To learn about storage virtualization
- To learn about the various tools in virtualization

Subject Code: AI32C1		Subject Name: Virtualization	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand and Analyze the virtualization concepts and Hypervisor	R, U	
CO-02	Apply the Virtualization for real-world applications	A	
CO-03	Understand the various functions and Network Virtualization	U, A	
CO-04	Understand and analyze the various functions of storage virtualization	U, An	
CO-05	Apply and implement the function of various tools of virtualization	An, E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	S	S	S	L	M	L
CO-02	S	M	S	S	M	N	M
CO-03	S	M	S	S	M	M	L
CO-04	L	L	S	S	S	L	M
CO-05	L	S	S	S	L	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO VIRTUALIZATION**9**

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization – partial virtualization - Paravirtualization-Types of Hypervisors

UNIT II SERVER AND DESKTOP VIRTUALIZATION**9**

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT III NETWORK VIRTUALIZATION**9**

Introduction to Network Virtualization – Advantages - Functions - Tools for Network Virtualization – VLAN - WAN Architecture - WAN Virtualization

UNIT IV STORAGE VIRTUALIZATION**9**

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID.

UNIT V VIRTUALIZATION TOOLS**9**

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
3. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APRESS,2005.

REFERENCES

1. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

AI32C2	ROBOTIC PROCESS AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.

- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

Subject Code: AI32C2		Subject Name: Robotic Process Automation
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Enunciate the key distinctions between RPA and existing automation techniques and platforms.	R,U
CO-02	Use UiPath to design control flows and work flows for the target process	A
CO-03	Implement recording, web scraping and process mining by automation	An
CO-04	Use UiPath Studio to detect, and handle exceptions in automation processes	E
CO-05	Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	M	S	S	S	S	M
CO-02	L	L	S	S	M	S	M
CO-03	M	S	S	S	S	S	M
CO-04	L	M	S	S	M	M	L
CO-05	S	S	S	S	L	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 9

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 IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE 9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

TOTAL : 45 PERIODS

TEXT BOOKS

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.

REFERENCES

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.

ELECTIVE V

AI32C3	HEALTH CARE ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

Subject Code: AI32C3		Subject Name: Health Care Analytics
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Use machine learning and deep learning algorithms for health data analysis	R,U
CO-02	Apply the data management techniques for healthcare data	A
CO-03	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications	An
CO-04	Design health data analytics for real time applications	E
CO-05	Design emergency care system using health data analysis	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	M	S	S
CO-02	S	L	S	S	M	L	L
CO-03	M	L	S	S	M	M	M
CO-04	M	M	S	S	S	L	S
CO-05	L	M	S	S	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: INTRODUCTION TO HEALTHCARE ANALYSIS

9

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach

UNIT II: ANALYTICS ON MACHINE LEARNING

9

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

UNIT III: HEALTH CARE MANAGEMENT

9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare

UNIT IV: HEALTHCARE AND DEEP LEARNING**9**

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT V: CASE STUDIES**9**

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT – Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis.

TOTAL : 45 PERIODS**REFERENCES**

1. Chandan K.Reddy, Charu C. Aggarwal, “Health Care data Analysis”, First edition, CRC, 2015.
2. Vikas Kumar, “Health Care Analysis Made Simple”, Packt Publishing, 2018.
3. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
4. Hui Jang, Eva K.Lee, “HealthCare Analysis : From Data to Knowledge to Healthcare Improvement”, First Edition, Wiley, 2016.
5. Kulkarni , Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, “Big Data Analytics in HealthCare”, Springer, 2020.

AI32C4	WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

Subject Code: AI32C4		Subject Name: Web Application Security	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understanding the basic concepts of web application security and the need for it	R, U	
CO-02	Be acquainted with the process for secure development and deployment of web applications	A	
CO-03	Acquire the skill to design and develop Secure Web Applications that use Secure APIs	A, An	
CO-04	Be able to get the importance of carrying out vulnerability assessment and penetration testing	E	
CO-05	Acquire the skill to think like a hacker and to use hackers tool sets	A, E	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	S	M	M	M
CO-02	M	M	S	S	M	S	M
CO-03	M	L	S	S	M	M	L
CO-04	S	S	S	S	S	M	S
CO-05	M	S	S	S	L	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

Unit I: Fundamentals of Web Application Security

9

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

Unit II: Secure Development and Deployment

9

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

Unit III: Secure API Development

9

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, securing service-to-service APIs: API Keys, OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

Unit IV: Vulnerability Assessment and Penetration Testing

9

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

Unit V: Hacking Techniques and Tools

9

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic

TOTAL: 45 PERIODS

TEXT BOOKS

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly

- Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw - Hill Companies
 3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

REFERENCES

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

AI32C5	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices

Subject Code: AI32C5		Subject Name: Digital And Mobile Forensics	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Have knowledge on digital forensics.		R,U
CO-02	Know about digital crime and investigations.		A
CO-03	Be forensic ready.		An
CO-04	Investigate, identify and extract digital evidence from iOS devices.		E
CO-05	Investigate, identify and extract digital evidence from Android devices.		A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	S	L	L	S
CO-02	S	S	S	S	M	M	S
CO-03	S	S	S	S	M	L	M
CO-04	S	L	S	S	S	S	M
CO-05	L	S	S	S	S	M	M

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION TO DIGITAL FORENSICS

9

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase

UNIT II DIGITAL CRIME AND INVESTIGATION

9

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence

UNIT III DIGITAL FORENSIC READINESS

9

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics

UNIT IV iOS FORENSICS

9

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud

UNIT V ANDROID FORENSICS

9

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling

TOTAL : 45 PERIODS

TEXT BOOKS

1. Andre Arnes, “Digital Forensics”, Wiley, 2018.
2. Chuck Easttom, “An In-depth Guide to Mobile Device Forensics”, First Edition, CRC Press, 2022.

REFERENCES

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

AI32C6	SOCIAL NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

To develop semantic web related simple applications

- To explain Privacy and Security issues in Social Networking
- To explain the data extraction and mining of social networks
- To discuss the prediction of human behavior in social communities
- To describe the Access Control, Privacy and Security management of social networks

Subject Code: AI32C6		Subject Name: Social Network Security	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Develop semantic web related simple applications	R,U	
CO-02	Address Privacy and Security issues in Social Networking	A	
CO-03	Analyze the data extraction and mining of social networks	An	
CO-04	Discuss the prediction of human behavior in social communities	E	
CO-05	Describe the applications of social networks	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	S	M	M	M
CO-02	M	M	S	S	M	S	M
CO-03	M	L	S	S	M	M	L
CO-04	S	S	S	S	S	M	S
CO-05	M	S	S	S	L	M	M

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I FUNDAMENTALS OF SOCIAL NETWORKING 9

Introduction to Semantic Web, Limitations of current Web, Development of Semantic Web, Emergence of the Social Web, Social Network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis, Historical overview of privacy and security, Major paradigms, for understanding privacy and security

Unit II SECURITY ISSUES IN SOCIAL NETWORKS 9

The evolution of privacy and security concerns with networked technologies, Contextual influences on privacy attitudes and behaviors, Anonymity in a networked world.

Unit III EXTRACTION AND MINING IN SOCIAL NETWORKING DATA 9

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Big data and Privacy.

Unit IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 9

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties

UNIT V ACCESS CONTROL, PRIVACY AND IDENTITY MANAGEMENT 9

Understand the access control requirements for Social Network, Enforcing Access Control Strategies, Authentication and Authorization, Roles-based Access Control, Host, storage and network access control options, Firewalls, Authentication, and Authorization in Social Network, Identity & Access Management, Single Sign-on, Identity Federation, Identity providers and service consumers, The role of Identity provisioning.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Peter Mika, "Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Application, First Edition, Springer, 2010.
3. Learning Neo4j 3.x – Second Edition By Jérôme Baton, Rik Van Bruggen, Packt publishing
4. David Easley, Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning about a Highly Connected World, First Edition, Cambridge University Press, 2010.

AI32C7	SECURITY AND PRIVACY IN CLOUD	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Introduce Cloud Computing terminology, definition & concepts.
- To understand the security design and architectural considerations for Cloud.
- To understand the Identity, Access control in Cloud.

- To follow best practices for Cloud security using various design patterns.
- To be able to monitor and audit cloud applications for security.

Subject Code: AI32C7		Subject Name: Security and Privacy in Cloud	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the cloud concepts and fundamentals.		U
CO-02	Explain the security challenges in the cloud.		R
CO-03	Define cloud policy and Identity and Access Management.		A
CO-04	Understand various risks and audit and monitoring mechanisms in the cloud.		U, A
CO-05	Define the various architectural and design considerations for security in the cloud.		A, An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	L	M	L	M	M
CO-02	L	L	L	M	M	M	L
CO-03	M	M	M	M	L	S	S
CO-04	S	M	S	M	M	S	M
CO-05	S	M	M	M	S	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I: FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non-repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II: SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT III: ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network

access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

UNIT IV: CLOUD SECURITY DESIGN PATTERNS

9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT V: MONITORING, AUDITING AND MANAGEMENT

9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Raj Kumar Buyya , James Broberg, andrzejGoscinski, “Cloud Computing:ll, Wiley 2013
2. Dave shackleford, “Virtualization Securityll, SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, “Cloud Security and Privacyll, OREILLY 2011.

REFERENCES

1. Mark C. Chu-Carroll “Code in the Cloud”, CRC Press, 2011.
Mastering Cloud Computing Foundations and Applications Programming
Rajkumar Buyya, Christian Vechhiola, S. ThamaraiSelvi, 2013.

ELECTIVE VI

AI32C8	COGNITIVE SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the theoretical background of cognition
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

Subject Code: AI32C8		Subject Name: Cognitive Science	
Course Outcome – Cos		Cognitive Skill	
At the end of the course students should be able to,			
CO-01	Understand the underlying theory behind cognition	R,U	
CO-02	Connect to the cognition elements computationally.	A	
CO-03	Implement mathematical functions through WebPPL.	An	
CO-04	Develop applications using cognitive inference model	E	
CO-05	Develop applications using cognitive learning model.	A	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	S	S	L	M	S
CO-02	M	M	S	S	M	M	L
CO-03	L	S	S	S	S	M	L
CO-04	M	L	S	S	M	S	L
CO-05	L	M	S	S	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 9

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory –Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 9

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 9

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

UNIT IV INFERENCE MODELS OF COGNITION 9

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence– Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 9

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Vijay V Raghavan,Venkat N.Gudivada, Venu Govindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015
3. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”,The MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind,Cambridge University Press 2020

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, <https://dippl.org/>.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, <https://probmods.org/>.

AI32C9	CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

Subject Code:AI32C9 Subject Name: Cryptocurrency and Blockchain Technologies		
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Understand the basics of Blockchain	R,U
CO-02	Learn Different protocols and consensus algorithms in Blockchain	A
CO-03	Learn the Blockchain implementation frameworks.	An
CO-04	Understand the Blockchain Applications.	E
CO-05	Evaluate the Hyperledger Fabric, Ethereum networks	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	S	L	M
CO-02	S	S	S	S	S	L	S
CO-03	S	S	S	S	S	M	S
CO-04	S	M	S	S	S	S	S
CO-05	S	S	S	S	S	L	M

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I	INTRODUCTION TO BLOCKCHAIN	9
Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree		
UNIT II	BITCOIN AND CRYPTOCURRENCY	9
A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay		
UNIT III	BITCOIN CONSENSUS	9
Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.		
UNIT IV	HYPERLEDGER FABRIC & ETHEREUM	9
Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity.		
UNIT V	BLOCKCHAIN APPLICATIONS	9
Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.		

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly,

REFERENCE

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

AI32E1	GENETIC ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of genetic algorithm
- To understand the need for genetic algorithm in problem solving
- To gain knowledge in genetic programming
- To understand the latest trends in machine learning

Subject Code: AI32E1		Subject Name: GENETIC ALGORITHMS	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the relations between the most important evolutionary algorithms presented in the course and other search and optimization techniques	R,U	
CO-02	Design new evolutionary operators, representations and fitness functions for specific practical and scientific applications	An	
CO-03	Learn about Genetic based machine learning and its applications	A	
CO-04	Analyze the different optimization based genetic algorithms	E	
CO-05	Know about various applications of genetic algorithm	U	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	L	N	L	S	L	M
CO-02	S	M	L	S	M	S	S
CO-03	S	S	M	M	L	S	S
CO-04	M	S	L	L	M	M	S
CO-05	M	S	L	L	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I INTRODUCTION TO GENETIC ALGORITHM

9

History of Evolutionary Computation-Biological Terminology-Search Spaces and Fitness Landscapes-Elements of Genetic Algorithm-A Simple Genetic Algorithm-Genetic Algorithm and Traditional Search Methods-Two Brief Examples-How do Genetic Algorithms Work-Hill Climbing-Simulated Annealing.

UNIT II GENETIC PROGRAMMING

9

Genetic Programming- Terminals as Function- Major steps of genetic programming, e.g., functional and terminal sets-Executable Program Structures-GP Population-Genetic Operators- initialisation, crossover, mutation, fitness evaluation- Search operators on trees-Automatically defined functions- Issues in genetic programming – Examples.

UNIT III GENETIC BASED MACHINE LEARNING

9

Genetic based Machine Learning-Classifer System-Rule and Message System- Apportionment of credit system-Genetic Algorithm-Applications of Genetic based Machine Learning.

UNIT IV OPTIMIZATION

9

Multi-Objective Genetic Algorithm (MOGA)-Genetic algorithms in search and optimization, GA based clustering Algorithm-Evolution programs to specific applications- Travelling Sales man Problem-Scheduling Problem-Timetable Problem-Partitioning Problem-Path Planning Problem in mobile robot environment.

UNIT V APPLICATIONS OF GENETIC ALGORITHM

9

The Rise of Genetic Algorithm – Genetic Algorithm Applications of Historical Interest – De Jong and Function Optimization – Improvement in Basic Technique – Current Applications of Genetic Algorithm.

TOTAL : 45 PERIODS

TEXT BOOKS

1. M. Mitchell, An introduction to genetic algorithms, MIT Press, 1996. Book 2
2. D E Goldberg, Genetic Algorithms in Search, Optimisation & Machine Learning, Addison-Wesley, 1989.

REFERENCES

1. Michalewicz, Genetic Algorithms + Data Structures = Evolution Programs (3rd edition), Springer-Verlag, Berlin, 1996.
2. Nordin, Peter, Robert E. Keller, and Frank D. Francone. *Genetic programming*. Ed. Wolfgang Banzhaf. Springer, 1998.

AI32E2	NANO COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Learn nano-computing challenges
- To be familiar with the imperfections.
- To be exposed to reliability evaluation strategies
- To learn nano scale quantum computing
- To understand Molecular Computing and Optimal Computing

Subject Code: AI32E2		Subject Name: Nano computing	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand and discuss nano-computing challenges.		U
CO-02	Remember and handle the imperfections		R, U
CO-03	Apply reliability evaluation strategies		U,A

CO-04	Apply nano scale quantum computing.	U
CO-05	Remember and utilize Molecular Computing and Optimal Computing	U

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	N	L	L	S	M
CO-02	L	M	L	L	L	S	S
CO-03	M	M	L	M	L	S	S
CO-04	S	S	M	M	M	S	S
CO-05	L	L	M	M	L	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I NANOCOMPUTING-PROSPECTS AND CHALLENGES 9

Introduction - History of Computing - Nanocomputing - Quantum Computers – Nanocomputing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nanocomputing: Digital Signals and Gates - Silicon Nanoelectronics - Carbon Nanotube Electronics - Carbon Nanotube Field-effect Transistors – Nanolithography.

UNIT II NANOCOMPUTING WITH IMPERFECTIONS 9

Introduction - Nanocomputing in the Presence of Defects and Faults - Defect Tolerance - Towards Quadrillion Transistor Logic Systems.

UNIT III RELIABILITY OF NANOCOMPUTING 9

Markov Random Fields - Reliability Evaluation Strategies - NANOLAB - NANOPRISM - Reliable Manufacturing and Behavior from Law of Large Numbers.

UNIT IV NANOSCALE QUANTUM COMPUTING 9

Quantum Computers - Hardware Challenges to Large Quantum Computers - Fabrication, Test, and Architectural Challenges - Quantum-dot Cellular Automata (QCA) - Computing with QCA - QCA Clocking - QCA Design Rules.

UNIT V QUANTUM INFORMATION SYSTEMS 9

Silicon Processors – Progress in photolithography – The Structure of microprocessors – Conventional generation platforms- Advanced platforms – Quantum information systems – DNA Computing – Memories and information storage systems.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd.,2008.

REFERENCES

1. Sandeep K. Shukla and R. Iris Bahar., Nano, Quantum and Molecular Computing, Kluwer Academic Publishers 2004.
2. Sahni V, Quantum Computing, McGraw Hill Education Asia Ltd. 2007.
3. Jean-Baptiste Waldner, Nanocomputers and Swarm Intelligence, John Wiley & Sons, Inc. 2008.

AI32E3	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

Subject Code: AI32E3		Subject Name: Data Exploration and Visualization	
Course Outcome – Cos			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Understand the fundamentals of exploratory data analysis.		R,U
CO-02	Implement the data visualization using Matplotlib.		An
CO-03	Perform univariate data exploration and analysis.		E
CO-04	Apply bivariate data exploration and analysis.		U,A
CO-05	Use Data exploration and visualization techniques for multivariate and time series data.		R,An

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO -A	PO -B	PO -C	PO -D	PO -E	PO -F	PO -G
CO-01	S	L	N	N	S	L	M
CO-02	S	M	N	N	M	S	S
CO-03	S	S	N	N	L	S	S
CO-04	M	S	N	N	M	M	S
CO-05	M	S	N	N	M	M	S

S-Strong, M-Medium,L-Low,N-Not relevant

UNIT I EXPLORATORY DATA ANALYSIS

9

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

UNIT II VISUALIZING USING MATPLOTLIB

9

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

UNIT III UNIVARIATE ANALYSIS

9

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

UNIT IV BIVARIATE ANALYSIS

9

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS

9

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit 2)
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, “Fundamentals of Data Visualization”, O’reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, “Interactive Data Visualization: Foundations, Techniques, and Applications”, 2nd Edition, CRC press, 2015.

OPEN ELECTIVE COURSES

AI32D1	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

- Understand the basic concepts of intelligent agents.
- Develop general-purpose problem-solving agents, logical reasoning agents, and agents that reason under uncertainty.
- Employ AI techniques to solve some of today's real world problems.

Subject Code: AI32D1		Subject Name: Fundamentals of Artificial Intelligence	
Course Outcome – COs			Cognitive Skill
At the end of the course students should be able to,			
CO-01	Explain autonomous agents that make effective decisions in fully informed, partially observable, and adversarial settings.	U	
CO-02	Choose appropriate algorithms for solving given AI problems	A	
CO-03	Design and implement logical reasoning agents	R, A	
CO-04	Design and implement agents that can reason under uncertainty	R, A	
CO-05	Understand the basic areas of artificial intelligence including problem solving, knowledge representation, reasoning, decision making, planning, perception and action.	U	

R-Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	L	L	M	L	M	M
CO-02	M	M	S	M	M	M	L
CO-03	M	M	M	M	M	S	S
CO-04	S	M	S	L	L	M	S
CO-05	M	M	L	L	M	M	S

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I: AI AGENTS

9

Introduction to AI – Agents and Environments – Concept of rationality – Nature of environments –Structure of agents – Problem solving agents–Search algorithms–Uninformed search strategies.

UNIT II: PROBLEM SOLVING**9**

Heuristic search strategies–heuristic functions - Local search and optimization problems – Local search in continuous space – Search with non-deterministic actions – Search in partially observable environments – Online search agents and unknown environments.

UNIT III: THEORY OF GAME PLAYING**9**

Game theory – Optimal decisions in games – Alpha-beta search – Monte-Carlo tree search –Stochastic games– Partially observable games.
Constraint Satisfaction Problems – Constraint propagation – Backtracking search for CSP – Local search for CSP– Structure of CSP.

UNIT IV: KNOWLEDGE BASED LOGICAL AGENTS**9**

Knowledge-based agents – Propositional logic – Propositional theorem proving – Propositional model checking– Agents based on propositional logic.
First-order logic – Syntax and semantics – Knowledge representation and engineering – Inferences in first-order logic–Forward chaining– Backward chaining–Resolution.

UNIT V: KNOWLEDGE REPRESENTATION**9**

Ontological engineering–Objects and categories–Events–Mental objects and Modal logic– Reasoning systems for categories – Reasoning with default information. Classical planning– Algorithms for classical planning–Heuristics for planning–Hierarchical planning–Non deterministic domains–Time, Schedule and Resources–Analysis.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education,2020.

REFERENCES

1. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education,2007.
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGrawHill,2008.
3. Patrick H. Winston, "Artificial Intelligence", Third edition, PearsonEdition,2006.
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
5. Dennis Rothman “Artificial Intelligence by Example : Develop machine intelligence from scratch using real artificial intelligence use cases”,2018.

AI32D2	DRONE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the basics of drone concepts
- To learn and understand the fundamentals of design, fabrication and programming of drone
- To impart the knowledge of an flying and operation of drone
- To know about the various applications of drone
- To understand the safety risks and guidelines of fly safely.

Subject Code: AI32D2 Subject Name: DRONE TECHNOLOGY		
Course Outcome – Cos At the end of the course students should be able to,		Cognitive Skill
CO-01	Know about a various type of drone technology, drone fabrication and programming.	R,U
CO-02	Execute the suitable operating procedures for functioning a drone.	A
CO-03	Select appropriate sensors and actuators for Drones.	An
CO-04	Develop a drone mechanism for specific applications.	E
CO-05	Createthe programs for various drones.	A

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	L	M	S	S	S	S	S
CO-02	L	M	S	S	S	S	S
CO-03	L	M	S	S	S	S	S
CO-04	L	M	S	S	S	S	S
CO-05	L	M	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: INTRODUCTION TO DRONE TECHNOLOGY

9

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability.

Unit II: DRONE DESIGN, FABRICATION AND PROGRAMMING

9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

Unit III: DRONE FLYING AND OPERATION

9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications.

Unit IV: DRONE COMMERCIAL APPLICATIONS**9**

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

Unit V:FUTURE DRONES AND SAFETY**9**

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms.

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016

REFERENCES

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”,Que Publishing, 2016
2. Završnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Securityand Surveillance”, Springer, 2018.

AI32D3	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES

To provide strong foundation for data science and application area related to information technology and understand the underlying core concepts and emerging technologies in data science.

Subject Code: AI32D3		Subject Name: INTRODUCTION TO DATA SCIENCE
Course Outcome – Cos		Cognitive Skill
CO-01	Explore the fundamental concepts of data science	R,U
CO-02	Understand data analysis techniques for applications handling large data.	E
CO-03	Understand various machine learning algorithms used in data science process.	U,An
CO-04	Understand various deep learning algorithms used in data science process.	U
CO-05	Visualize and present the inference using various tools	A

R- Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate,S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	M	M	S	S	N	L	L
CO-02	L	M	S	S	L	L	N
CO-03	M	S	S	S	L	L	L
CO-04	S	M	S	S	N	L	M
CO-05	L	L	S	S	N	L	N

S-Strong, M-Medium, L-Low, N-Not relevant

UNIT I INTRODUCTION

9

Definition – Big Data and Data Science Hype – Why data science – Getting Past the Hype – The Current Landscape – Who is Data Scientist? - Data Science Process Overview – Defining goals – Retrieving data – Data preparation – Data exploration – Data modeling – Presentation.

UNIT II BIG DATA

9

Problems when handling large data – General techniques for handling large data – Case study – Steps in big data – Distributing data storage and processing with Frameworks – Case study.

UNIT III MACHINE LEARNING

9

Machine learning – Modeling Process – Training model – Validating model – Predicting new observations – Supervised learning algorithms – Unsupervised learning algorithms.

UNIT IV DEEP LEARNING

9

Introduction – Deep Feedforward Networks – Regularization – Optimization of Deep Learning – Convolutional Networks – Recurrent and Recursive Nets – Applications of Deep Learning.

UNIT V DATA VISUALIZATION

9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL:45 PERIODS

TEXT BOOKS

1. Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, Manning Publications Co., First Edition, 2016
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning: with Applications in R , Springer, First Edition, 2013
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, First Edition, 2016
4. D J Patil, Hilary Mason, Mike Loukides, Ethics and Data Science, O' Reilly, First Edition, 2018

AI32D4	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

Subject Code: AI32D4		Subject Name: Quantum Computing	
Course Outcome – Cos At the end of the course students should be able to,			Cognitive Skill
CO-01	Understand the basics of quantum computing.	R, U	
CO-02	Understand the background of Quantum Mechanics.	U	
CO-03	Analyze the computation models.	An	
CO-04	Model the circuits using quantum computation. environments and frameworks.	A, E	
CO-05	Understand the quantum operations such as noise and error–correction.	R, U	

R-Remember,U-Understand,A-Apply,An-Analyze,E-Evaluate, S-Synthesis

Mapping of Course Outcome with Programme Outcome

PO CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G
CO-01	S	S	S	S	L	L	S
CO-02	M	S	S	S	M	M	M
CO-03	M	L	S	S	S	M	M
CO-04	S	S	S	S	M	S	M
CO-05	M	S	S	S	S	S	S

S-Strong, M-Medium,L-Low,N-Not relevant

Unit I: Quantum Computing Basic Concepts

9

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

Unit II: Quantum Gates and Circuits

9

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development
- Quantum error correction

Unit III: Quantum Algorithms**9**

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

Unit IV: Quantum Information Theory**9**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

Unit V: Quantum Cryptography**9**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekert 91

TOTAL : 45 PERIODS**TEXT BOOKS**

1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".

REFERENCES

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.