RAJALAKSHMI ENGINEERING COLLEGE (An Autonomous Institution Affiliated to Anna University, Chennai) Choice Based Credit System (CBCS) REGULATIONS – 2019 DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING CURRICULUM AND SYLLABUS

Vision

To promote highly Ethical and Innovative Computer Professionals through excellence in teaching, training and research.

Mission

- To produce globally competent professionals, motivated to learn the emerging technologies and to be innovative in solving real world problems.
- To promote research activities amongst the students and the members of faculty that could benefit the society.
- To impart moral and ethical values in their profession.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To equip students with essential background in computer science, basic electronics and applied mathematics.

PEO 2: To prepare students with fundamental knowledge in programming languages, and tools and enable them to develop applications.

PEO 3: To encourage the research abilities and innovative project development in the field of AI, ML, DL, networking, security, web development, Data Science and also emerging technologies for the cause of social benefit.

PEO 4: To develop professionally ethical individuals enhanced with analytical skills, communication skills and organizing ability to meet industry requirements.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge: Apply the knowledge of Mathematics, Science, Engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

A graduate of the Artificial Intelligence and Machine Learning Program will demonstrate

PSO 1: Foundation Skills: Ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, web design, AI, machine learning, deep learning, data science, and networking for efficient design of computer-based systems of varying complexity. Familiarity and practical competence with a broad range of programming language, tools and open source platforms.

PSO 2: Problem-Solving Skills: Ability to apply mathematical methodologies to solve computational task, model real world problem using appropriate AI and ML algorithms. To understand the standard practices and strategies in project development, using open-ended programming environments to deliver a quality product.

PSO 3: Successful Progression: Ability to apply knowledge in various domains to identify research gaps and to provide solution to new ideas, inculcate passion towards higher studies, creating innovative career paths to be an entrepreneur and evolve as an ethically social responsible AI and ML professional.

CURRICULUM

B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING Regulation 2019 | Total Credits: 166

		SEMESTER I							
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С	
THE	ORY COURS	ES							
1.	HS19151	Technical English	HS	3	2	1	0	3	
2.	MA19156	Linear Algebra and Calculus	BS	4	3	1	0	4	
LAB	LAB ORIENTED THEORY COURSES								
3.	PH19241	Physics for Information Science	BS	5	3	0	2	4	
4.	GE19141	Programming using C	ES	6	2	0	4	4	
5.	GE19122	Engineering Practices- Electrical and Electronics	ES	2	0	0	2	1	
NON	NON CREDIT COURSES								
6.	MC19102	Indian Constitution and Freedom Movement	MC	3	3	0	0	0	
			TOTAL	23	13	2	8	16	

		SEMESTER II							
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С	
THE	ORY COURS	ES							
1.	MA19254	Probability and Inferential Statistics	BS	4	3	1	0	4	
2.	GE19101	Engineering Graphics	ES	4	2	2	0	4	
LAB	ORIENTED	THEORY COURSES							
3.	EE19242	Basic Electrical and Electronics Engineering	ES	5	3	0	2	4	
4.	EC19243	Principles of Digital Electronics	ES	5	3	0	2	4	
5.	CS19241	Data Structures	PC	7	3	0	4	5	
LAB	ORATORY C	COURSES							
6.	GE19121	Engineering Practices-Civil and Mechanical	ES	2	0	0	2	1	
7.	CS19211	Python Programming Lab	PC	4	0	0	4	2	
NON	NON CREDIT COURSES								
8.	MC19101	Environmental Science and Engineering	MC	3	3	0	0	0	
			TOTAL	34	17	3	14	24	

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING | R2019

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		SEMESTER III								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
THE	THEORY COURSES									
1.	MA19356	Discrete Mathematics for AI	BS	4	3	1	0	4		
2.	GE19301	Life Science for Engineers	BS	3	3	0	0	3		
3.	AI19301	Computer System Architecture	PC	3	3	0	0	3		
LAB	ORIENTED	THEORY COURSES								
4.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4		
5.	AI19341	Principles of Artificial Intelligence	PC	5	3	0	2	4		
6.	AI19342	Object Oriented Programming using JAVA for AI	PC	7	3	0	4	5		
NON	NON CREDIT COURSES									
7.	MC19301	Essence of Indian Traditional Knowledge	MC	3	3	0	0	0		
			TOTAL	30	21	1	8	23		

		SEMESTER IV								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
THE	THEORY COURSES									
1.	MA19456	Optimization Techniques for AI	BS	4	3	1	0	4		
LAB	LAB ORIENTED THEORY COURSES									
2.	AI19441	Web Development	PC	4	2	0	2	3		
3.	AI19442	Fundamentals of Machine Learning	PC	5	3	0	2	4		
4.	CS19443	Database Management Systems	PC	7	3	0	4	5		
5.	IT19441	Operating System Design	PC	7	3	0	4	5		
EMP	EMPLOYABILITY ENHANCEMENT COURSES									
6.	GE19421	Soft Skills I	EEC	2	0	0	2	1		
			TOTAL	29	14	1	14	22		

		SEMESTER V						
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
THE	ORY COURS	SES						
1.		Professional Elective-I	PE	3	3	0	0	3
2.		Open Elective – I	OE	3	3	0	0	3
LAB	ORIENTED	THEORY COURSES						
3.	AI19541	Fundamentals of Deep Learning	PC	5	3	0	2	4
4.	AI19542	Data Science using R	PC	5	3	0	2	4
5.	CS19541	Computer Networks	PC	7	3	0	4	5
6.	CB19342	Computational Statistics	BS	5	3	0	2	4
LAB	ORATORY C	COURSES						
7.	AI19511	Mobile Application Development Laboratory for ML and DL Applications	PC	2	0	0	2	1
EMP	LOYABILIT	Y ENHANCEMENT COURSES						
8.	GE19521	Soft Skills II	EEC	2	0	0	2	1
			TOTAL	32	18	1	14	25

		SEMESTER V	Ί						
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С	
THE	ORY COUR	SES							
1.		Professional Elective-II	PE	3	3	0	0	3	
2.	BA19602	Fundamentals of Accounting	HS	3	3	0	0	3	
LAB	LAB ORIENTED THEORY COURSES								
3.	AI19641	Computer Vision and its Applications	PC	5	3	0	2	4	
4.	AI19642	Time Series Analysis and Forecasting	PC	5	3	0	2	4	
5.	AI19643	Foundations of Natural Language Processing	PC	5	3	0	2	4	
6.	AI19644	IoT Architecture and its Protocols	PC	5	3	0	2	4	
EMP	LOYABILI	TY ENHANCEMENT COURSES							
7.	AI19611	Mini Project	EEC	2	0	0	2	1	
8.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1	
			TOTAL	30	18	0	12	24	

		SEMESTER VII								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
THE	THEORY COURSES									
1.		Professional Elective-III	PE	3	3	0	0	3		
2.		Professional Elective-IV	PE	3	3	0	0	3		
3.		Professional Elective-V	PE	3	3	0	0	3		
4.	AI19701	Secure Systems Engineering	PC	3	3	0	0	3		
5.	AI19702	Social and Ethical Issues in AI	PC	1	1	0	0	1		
LAB	ORIENTED	THEORY COURSES								
6.	AI19741	Big Data Technology	PC	5	3	0	2	4		
LAB	LABORATORY COURSES									
7.	AI19711	Project-I	EEC	6	0	0	6	3		
			TOTAL	24	16	0	8	20		

	SEMESTER VIII									
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
THE	THEORY COURSES									
1.		Professional Elective-VI	PE	3	3	0	0	3		
2.		Open Elective-II	OE	3	3	0	0	3		
LABO	ORATORY C	OURSES								
3.	AI19811	Project-II	EEC	12	0	0	12	6		
			TOTAL	18	6	0	12	12		

TOTAL NO. OF CREDITS: 166

PROFESSIONAL ELECTIVES (PE)

		Elective – I						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AI19P51	Knowledge Representation and Reasoning	PE	4	2	0	2	3
2.	AI19P52	AI for Game Programming	PE	4	2	0	2	3
3.	AI19P53	Mobile Technology	PE	3	3	0	0	3
4.	CS19P12	Distributed Systems	PE	4	2	0	2	3

		Elective – II						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AI19P61	GPU Programming	PE	4	2	0	2	3
2.	AI19P62	Data Analysis and Data Mining	PE	4	2	0	2	3
3.	CS19P06	Human Computer Interaction	PE	4	2	0	2	3
4.	CS19P09	C# and .Net Programming	PE	4	2	0	2	3

	Elective – III									
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
1.	RO19P19	Introduction to AI Robotics	PE	4	2	0	2	3		
2.	AI19P71	Data Visualization using Python	PE	4	2	0	2	3		
3.	AI19P72	Innovation in Design Thinking for AI	PE	4	2	0	2	3		
4.	IT19P77	Computational Linguistics	PE	3	3	0	0	3		

		Elective – IV						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AI19P73	Foundations of Robotic Process Automation	PE	4	2	0	2	3
2.	AI19P74	Fuzzy Logic	PE	4	2	0	2	3
3.	IT19P76	Image processing & Vision Techniques	PE	3	3	0	0	3
4.	IT19P85	Social Networks	PE	3	3	0	0	3

	Elective – V									
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
1.	CS19642	Cryptography And Network Security	PE	4	2	0	2	3		
2.	AI19P75	Information Retrieval	PE	4	2	0	2	3		
3.	AI19P76	Supply Chain Analytics	PE	3	3	0	0	3		
4.	AI19P77	Hypothesis Testing	PE	4	2	0	2	3		

	Elective – VI									
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
1.	AI19P81	Network Analysis	PE	4	2	0	2	3		
2.	AI19P82	Business Intelligence and Analytics	PE	4	2	0	2	3		
3.	AI19P83	Quantum Cryptography and Coding	PE	3	3	0	0	3		
4.	IT19P84	Parallel Computing	PE	3	3	0	0	3		

OPEN ELECTIVE COURSES OFFERED BY AIML

SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	OAI1901	Artificial Intelligence and Neural Network	OE	3	3	0	0	3
2.	OAI1902	Introduction to Machine Learning	OE	4	2	0	2	3
3.	OAI1903	Introduction to Robotic Process Automation	OE	6	0	0	6	3

	B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING									
S NO	Course	Credits per Semester								Total Credita
5.NU	Category	Ι	II	III	IV	V	VI	VII	VIII	Total Credits
1	HS	3					3			6
2	BS	8	4	7	4	4				27
3	ES	5	13							18
4	PC		7	16	17	14	16	8		78
5	PE					3	3	9	3	18
6	OE					3			3	6
7	EEC				1	1	2	3	6	13
8	MC	0	0	0						0
	Total	16	24	23	22	25	24	20	12	166

SUMMARY OF ALL COURSES

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
HS19151	TECHNICAL ENGLISH	HS	2	1	0	3

Objectives:	
• To enable learners to acquire basic proficiency in English reading and listening.	
• To write in English precisely and effectively.	
• To speak flawlessly in all kinds of communicative contexts.	
	0
UNIT-I VOCABULARY BUILDING	y in English Aggusinten ag with
refixed and suffixed from foreign languages in English to form derivatives. Sum	in English – Acquaintance with
abbraviations Compound words abbraviation single word substitution Liste	ning: Listoning comprehension
listening to motivational spacehos, podcasts and poetry. Spacking: Short talks on ingit	dents place of visit admiring
nsterning to motivational speeches, podcasts and poetry. Speaking. Short taks on met	dents – place of visit – admining
UNIT-II BASIC WRITING SKILLS	9
Sentence structures – Use of phrases and clauses in sentences – nunctuation – coher	ence – Organizing principles of
paragraphs in documents – Techniques for writing precisely Reading & Writing – Fi	enece – Organizing principles of
reading and writing criticism – change of tense forms in short text or story – inferent	ial reading – rewrite or interpret
reading and writing entremin – enange of tense forms in short text of story – interent text \perp prepare questions based on the text Sneaking : Everyday situations \perp conver	sations and dialogues speaking
for and against	sations and dialogues, speaking
INIT-III GRAMMAR AND LANGUAGE DEVELOPMENT	9
Subject-verb agreement- Noun-pronoun agreement – Articles – Prepositions – Red	undancies Reading & Writing:
Read from innovation and ideas that changed the world newspaper column write	ing – Speaking Demonstrative
speaking practice using visual aids (charts, graphs, maps, pictures, etc.)	ing speaking. Demonstrative
UNIT-IV WRITING FOR FORMAL PRESENTATION	9
Nature and Style of sensible Writing – Describing – Defining – Classifying – Pro-	viding examples or evidence –
Writing introduction and conclusion. Reading & Writing – Read from Literary pieces	s – identify different parts text –
Difference between print and digital writing. Writing: Recommendations – Forewor	d – Review of book. Speaking-
Formal Presentations – Debate on social issues/taboos and solutions.	1 0
UNIT-V EXTENDED WRITING AND SPEAKING	9
Writing: Précis writing - Essay writing - workplace communication: Resume -	Business letters and emails -
Proposals. Speaking: Panel discussion - reporting an event - mock interview - Master	Ceremony.
Т	otal Contact Hours : 45
Course Outcomes:	
On completion of the course students will be able to	
 Discuss and respond to the listening content. 	
• Read and comprehend different texts and appreciate them.	
 Understand structures and techniques of precise writing. 	
Analyze different genres of communication and get familiarized with new word	1 1 .
	s, phrases, and sentence
structures.	s, phrases, and sentence

Te	xt Bo	ook	(5	;):		
4	1			6	E	

 1
 English for Technologists & Engineers, Orient BlackSwan Publications, Chennai, 2012.

1 Meenakshi Ra	aman & Sangeeta Sharma, Technical Communication, Oxford University Press.
2 Bushan Kuma	ar, Effective Communication Skills, Khanna Publishing House, Delhi.
3 Pushplata, Sa	njay Kumar, Communication Skills, Oxford University Press.
4 Michael Swar	n, Practical English Usage, Oxford University Press, 1995.
5 F.T. Wood, R	emedial English Grammar, Macmillan, 2007.
6 William Zins	ser, On Writing Well, Harper Resource Book, 2001.
7 Liz Hamp-Ly	ons and Ben Heasly, Study Writing, Cambridge University Press, 2006.
8 Exercises in S	Spoken English, Parts I-III, CIEFL, Hyderabad, Oxford University Press.

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
HS19151.1	1	-	-	-	-	-	1	-	2	3	1	3	-	2	-
HS19151.2	-	3	-	2	-	-	-	-	-	2	1	1	2	-	-
HS19151.3	-	-	-	1	-	-	-	-	-	3	-	-	2	-	-
HS19151.4	-	1	-	1	-	-	-	-	-	3	-	2	3	-	1
HS19151.5	1	1	1	1	1	1	1	1	2	3	1	1	1	-	-
AVERAGE	1.0	1.7	1.0	1.3	1.0	1.0	1.0	1.0	2.0	2.8	1.0	1.8	2.0	2.0	1.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	P	С
MA19156	LINEAR ALGEBRA AND CALCULUS	BS	3	1	0	4

Objectives:

To gain knowledge in using matrix algebra techniques and the concepts of basis and dimension in vector spaces. • To understand the techniques of calculus those are applied in the Engineering problems. •

MATRICES AND QUADRATIC FORMS UNIT-I

Symmetric and skew - symmetric matrices, Hermitian matrix, Unitary matrix and Orthogonal matrices - Eigen values and Eigen vectors - Cayley - Hamilton theorem (statement only) and applications - Similarity transformation -Orthogonal transformation and quadratic forms to canonical forms - Nature of quadratic forms. 12

UNIT-II VECTOR SPACES

Vector spaces - Subspaces - Linear combinations and system of Linear equations - Linear independence and Linear dependence - Bases and Dimensions - Linear Transformation - Matrix representation of Linear Transformation -Null space, Range and dimension theorem.

UNIT-III INNER PRODUCT SPACES

Inner product and norms - Gram Schmidt orthonormalization process - Modified Gram Schmidt orthonormalization process - QR Factorization-Singular value decomposition.

UNIT-IV DIFFERENTIAL CALCULUS- FUNCTIONS OF SEV	ERAL VARIABLES	12			
Partial differentiation - Homogeneous functions and Euler's theorem	- Total derivative - Change of varial	oles –			
Jacobians - Partial differentiation of implicit functions - Taylor's series for functions of two variables - Maxim					
minima of functions of two variables - Lagrange's method of undetermined multipliers.					
		10			

MULTIPLE INTEGRAL UNIT-V Double integrals - Change of order of integration - Double integrals in polar coordinates - Area enclosed by plane curves - Triple integrals - Volume of solids - Change of variables in double and triple integrals. 60

Total Contact Hours

12

12

Co	Course Outcomes:								
On	completion of the course students will be able to:								
•	• Apply the concept of Eigen values and eigen vectors, diagonalization of a matrix for solving problems.								
•	Use concepts of basis and dimension in vector spaces in solving problems.								
•	Construct orthonormal basis using inner products and decompose matrices.								
•	Analyze, sketch and study the properties of different curves and to handle functions of several variables and problems of maxima and minima.								
•	Evaluate surface area and volume using multiple integrals.								

Text Book(s):								
1	Grewal B.S., Higher Engineering Mathematics, 44th Edition, Khanna Publishers, New Delhi, 2015.							
2	Gilbert Strang, Introduction to linear algebra, 6th Edition, Wellesley Publishers, 2016							

Ref	Reference Books(s):								
1	Friedberg, A.H., Insel, A.J. and Spence, L., Elementary Linear Algebra, a matrix approach, 2 nd edition, Pearson, 2019.								
2	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, 10th Edition, New Delhi, 2016.								
3	Bali, N.P. and Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications Pvt. Ltd., New Delhi, 2006.								
4	T Veerarajan, Engineering Mathematics –I, McGraw Hill Education, 2018								
5	Ramana. B.V., Higher Engineering Mathematics, McGraw Hill Education Pvt. Ltd, New Delhi, 2016.								

PO/PSO CO	PO 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
MA19156.1	3	3	2	2	2	1	-	-	-	-	1	2	2	3	2
MA19156.2	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.3	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
MA19156.4	3	3	2	2	3	1	-	-	-	-	1	2	2	3	2
MA19156.5	3	3	1	2	1	1	-	-	-	-	1	2	1	2	2
Average	3	3	1.9	2	2	1	-	-	-	-	1	2	2.2	2.8	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
PH19241	PHYSICS FOR INFORMATION SCIENCE	BS	3	0	2	4

Objectives:								
•	To understand the principles of laser and fibre optics in engineering and technology.							
•	To understand the advanced concept of quantum theory and applications.							
•	To study the properties and applications of semiconducting, magnetic, superconducting and optical materials.							

UNIT-I QUANTUM PHYSICS

Introduction- Quantum free electron theory-De Broglie's concept-Schrodinger wave equation-Time independent and time dependent equations-Physical significance of wave function – Particle in a one dimensional box – electrons in metals – degenerate states – Fermi – Dirac statistics – Density of energy states – Size dependence of Fermi energy – Quantum confinement – Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure – Band gap of nanomaterials.

UNIT-II SEMICONDUCTOR PHYSICS

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap – semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors – Variation of carrier concentration with temperature – variation of Fermi level with temperature and impurity concentration – Carrier transport in Semiconductor: random motion, drift, mobility and diffusion – Hall effect.

UNIT-III OPTICAL PROPERTIES OF MATERIALS

Classification of optical materials – carrier generation and recombination processes – Absorption emission and scattering of light in metals, insulators and semiconductors (concepts only) – photo current in a P-N diode – Photo transistor-solar cell – LED – Organic LED- Optical data storage techniques-Non Linear Optical materials-properties and applications.

UNIT-IV LASERS AND FIBRE OPTICS

Lasers: Population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Semiconductor lasers: homojunction and heterojunction- Applications. Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, and mode) –Double crucible method-splicing technique- losses associated with optical fibers –Fiber optic communication system – fiber optic sensors: pressure and displacement.

UNIT-V MAGNETIC AND SUPERCONDUCTING MATERIALS

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility –Magnetic material classification: diamagnetism – paramagnetism – ferromagnetism – antiferromagnetism – ferromagnetism – Domain Theory- M versus H 15ehavior – Hard and soft magnetic materials – examples and uses–Magnetic principle in computer data storage – Magnetic hard disc (GMR sensor). Introduction of Superconductivity, Properties of Superconductors, BCS theory (Qualitative), Type-I and Type II Superconductors –Magnetic Levitation-SQUIDS- An overview of High temperature superconductors.

Contact Hours : 45

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	List of Experiments (Any 10 experiments)							
1	Determine the wavelength and angle of divergence of laser beam and numerical aperture using fiber cable.							
2	Determine the wavelength of spectrum by using spectrometer.							
3	Determine of refractive index of a given prism by using spectrometer.							
4	Determine specific resistance of the material of given wires using metre bridge.							
5	Verify Ohm's law – series and parallel.							
6	Determine the value of Planck's constant using photo electric effect.							
7	Determine the band gap of given semiconductor.							
8	Determination of Hall coefficient of semiconducting materials.							
9	Study the magnetic field produced by current carrying coils by using Helmoltz coil.							
10	Study the resonance frequency in series connected LCR circuits.							
11	Determine the wavelength of given source by using Newton's ring Experiment.							

12	2 Determine the thickness of the given specimen by using air wedge method.									
	Cont	act Hours	:	30						
	Total	l Contact Hours	:	75						
Coi	urse Outcomes:									
On	completion of the course, the students will be able to:									
•	Apply the concepts of electron transport in nanodevices.									
•	Analyze the physics of semiconductor devices									
•	Analyze the properties of optical materials for optoelectronic applications.									
•	Use the concepts of Laser and Fiber optics in communication.									
•	Use the properties of magnetic and superconducting materials in data storage de	evices.								

ТСЛІ	Book(s):
1 1	Bhattacharya, D.K. & Poonam, T. Engineering Physics, Oxford University Press, 2015.
2 J	Jasprit Singh, Semiconductor Devices: Basic Principles, Wiley 2012.
3 1	Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
4]	Kittel, C. Introduction to Solid State Physics, Wiley, 2005.

Ref	Reference Books(s):							
1	Garcia, N. & Damask, A., Physics for Computer Science Students, Springer Verlag, 2012.							
2	Hanson, G.W. Fundamentals of Nanoelectronics, Pearson Education, 2009.							
3	Rogers, B., Adams, J. & Pennathur, S. Nanotechnology: Understanding Small Systems, CRC Press, 2014.							
4	S. O. Pillai, Solid state physics, New Age International, 2015.							
5	Serway, R.A. & Jewett, J.W, Physics for Scientists and Engineers, Cengage Learning.							

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO	PO 7	PO 8	PO 9	PO	PO	PO	PSO 1	PSO 2	PSO 3
СО	1	2	5	-	5	0	7	0	,	10	11	12	1	2	
PH19241.1	3	3	2	2	2	1	-	1	1	2	1	2	1	1	2
PH19241.2	3	3	3	2	3	1	1	-	1	2	1	2	1	1	2
PH19241.3	3	3	3	2	3	1	1	-	1	2	1	2	1	1	1
PH19241 .4	3	3	2	2	3	1	1	-	1	2	1	2	1	-	1
PH19241 .5	3	3	2	2	3	1	1	-	1	2	1	2	1	1	1
Average	3.0	3.0	2.4	2.0	2.8	1.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	1.0	1.4

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
GE19141	PROGRAMMING USING C	ES	2	0	4	4

Ob	Objectives:				
٠	To develop simple algorithms for arithmetic and logical problems.				
٠	To develop C Programs using basic programming constructs				
٠	To develop C programs using arrays and strings				
٠	To develop applications in C using functions, pointers and structures				
٠	To do input/output and file handling in C				

UNIT-I GENERAL PROBLEM SOLVING CONCEPTS	6			
Computer - components of a computer system-Algorithm and Flowchart for problem solving with Sequential Logic				
Structure, Decisions and Loops.				
UNIT-II C LANGUAGE – TYPES OF OPERATOR AND EXPRESSIONS	6			
Introduction- C Structure- syntax and constructs of ANSI C - Variable Names, Data Type and Sizes, Con	stants,			
Declarations - Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment	it and			
Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Ord	ler of			
Evaluation, proper variable naming and Hungarian Notation.				
UNIT-III I/O AND CONTROL FLOW	6			
Standard I/O, Formatted Output - Printf, Variable-length argument lists- Formatted Input - Scanf, Statemen	ts and			
Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, GoTo Labels.				
UNIT-IV FUNCTIONS AND PROGRAM STRUCTURE	6			
Basics of functions, parameter passing and returning type, External, Auto, Local, Static, Register Variables,	Scope			
Rules, Block structure, Initialisation, Recursion, C Pre-processor, Standard Library Functions and return types.				
UNIT-V POINTERS, ARRAYS AND STRUCTURES	6			
Pointers and addresses, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Po	ointers			
and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional arrays, Strings, Initialisation of Pointer A	arrays,			
Command line arguments, Pointers to functions, complicated declarations. Basic Structures, Structures and Fund	ctions,			
Array of structures, Pointer of Structures, Self-referential Structures, Table look up, Typedef, Unions, Bit-field	s, File			
Access –Error Handling, Line I/O, Miscellaneous Functions.				
Contact Hours :	30			

	List of Experiments	
1	Algorithm and flowcharts of small problems like GCD.	
	Structured code writing with:	
2	Small but tricky codes	
3	Proper parameter passing	
4	Command line Arguments	
5	Variable parameter	
6	Pointer to functions	
7	User defined header	
8	Make file utility	
9	Multi file program and user defined libraries	
10	Interesting substring matching / searching programs	
11	Parsing related assignments	
	Contact Hours : 60)
	Total Contact Hours : 90)

Co	Course Outcomes:					
On	On completion of the course, the students will be able to					
•	Formulate simple algorithms for arithmetic and logical problems.					
٠	Implement conditional branching, iteration and recursion.					
•	Decompose a problem into functions and synthesize a complete program using divide and conquer approach.					

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING | R2019

•	Use arrays, pointers and structures to formulate algorithms and programs.
•	Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Te	Text Books:					
1	Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Pearson Education India; 2 nd Edition, 2015.					
2	Byron Gottfried, Programming with C. Second Edition, Schaum Outline Series, 1996.					

Reference Books:

- 1 Herbert Schildt, C: The Complete Reference, Fourth Edition, McGraw Hill, 2017.
- 2 YashavantKanetkar, Let Us C, BPB Publications, 15th Edition, 2016.

We	Web links for virtual lab:				
1	https://www.tutorialspoint.com/compile_c_online.php				
2	https://www.codechef.com/ide				
3	https://www.jdoodle.com/c-online-compiler				
4	https://rextester.com/l/c_online_compiler_gcc				

<u>CO – PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
GE19141.1	1	2	2	2	1	-	-	-	1	2	1	1	2	3	-
GE19141.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.3	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
GE19141.4	2	2	3	2	1	-	-	-	1	-	2	1	2	2	2
GE19141.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	2
Average	1.4	1.6	2.2	1.6	1.0	-	-	-	1.0	2.0	1.4	1.0	2.0	2.2	2.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	Т	Р	С
GE19122	ENGINEERING PRACTICES – ELECTRICAL AND ELECTRONICS	ES	0	0	2	1

Ob	Objectives:				
•	To provide hands on experience on various basic engineering practices in Electrical Engineering.				
•	To impart hands on experience on various basic engineering practices in Electronics Engineering.				

	List of Experiments
A.]	ELECTRICAL ENGINEERING PRACTICE
1	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2	Fluorescent lamp wiring.
3	Stair case wiring.
4	Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5	Measurement of resistance to earth of electrical equipment.
B. I	ELECTRONICS ENGINEERING PRACTICE
1	Study of Electronic components and equipment's - Resistor, colour coding, measurement of AC signal parameter
1	(peak-peak, RMS period, frequency) using CRO.
2	Study of logic gates AND, OR, XOR and NOT.
3	Generation of Clock Signal.
4	Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5	Measurement of ripple factor of HWR and FWR.
	Total Contact Hours : 30
Cou	irse Outcomes:
On	completion of the course, the students will be able to
•	Fabricate electrical and electronic circuits
•	Formulate the house wiring
•	Design the AC-DC converter using diode and passive components
•	Design the AC-DC converter using those and passive components

RE	FERENCE
1	Bawa H.S., Workshop Practice, Tata McGraw – Hill Publishing Company Limited, 2007.
2	Jeyachandran K., Natarajan S. &Balasubramanian S., A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.
3	Jeyapoovan T., Saravanapandian M. & Pranitha S., Engineering Practices Lab Manual, Vikas Publishing House Pvt.Ltd, 2006.
4	Rajendra Prasad A. &Sarma P.M.M.S., Workshop Practice, SreeSai Publication, 2002.

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
GE19122.1	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
GE19122.2	3	3	3	3	2	2	2	-	2	1	3	3	-	-	-
GE19122.3	3	3	3	3	3	1	1	-	2	1	3	3	-	-	-
Average	3	3	3	3	2.67	1.33	1.33	-	2	1	3	3	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	P	С
MC19102	INDIAN CONSTITUTION AND FREEDOM MOVEMENT	MC	3	0	0	0

Object	tives:
٠	To inculcate the values enshrined in the Indian constitution
٠	To create a sense of responsible and active citizenship
٠	To know about Constitutional and Non- Constitutional bodies
٠	To understand sacrifices made by the freedom fighters

UNIT-I **INTRODUCTION** 9 Historical Background - Constituent Assembly of India - Philosophical foundations of the Indian Constitution -Preamble - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties - Citizenship -Constitutional Remedies for citizens. Constitution meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy. STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT UNIT-II Union Government - Structures of the Union Government and Functions - President - Vice President - Prime Minister - Cabinet - Parliament - Supreme Court of India - Judicial Review. UNIT-III | STRUCTURE AND FUNCTION OF STATE GOVERNMENT AND LOCALBODY State Government - Structure and Functions - Governor - Chief Minister - Cabinet - State Legislature - Judicial System in States - High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayat Raj: Introduction, Elected officials and their roles, ,Village level: Role of Elected and Appointed officials, UNIT-IV CONSTITUTIONAL FUNCTIONS AND BODIES Indian Federal System - Center - State Relations - President's Rule - Constitutional Functionaries - Assessment of working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and other Constitutional bodies-. NITI Aayog, Lokpal, National Development Council and other Non -Constitutional bodies. UNIT-V **INDIAN FREEDOM MOVEMENT** British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Rule-Rise of Nationalism in India-Indian Freedom Struggle under Mahatma Gandhi-Non- Cooperation Movement-Civil Disobedience Movement- Quit India Movement-British Official response to National movement- Independence of India Act 1947-Freedom and Partition. **Total Contact Hours** : 45

Co	urse Outcomes:
On	completion of the course, the students will be able to
•	Understand the functions of the Indian government
•	Understand and abide the rules of the Indian constitution.
•	Gain knowledge on functions of state Government and Local bodies
•	Gain Knowledge on constitution functions and role of constitutional bodies and non-constitutional bodies
	Understand the sacrifices made by freedom fighters during freedom movement

Tex	xt Book(s):
1	Durga Das Basu, Introduction to the Constitution of India, Lexis Nexis, New Delhi., 21st edition, 2013.
2	BipanChandra, History of Modern India, Orient Black Swan, 2009.
3	Bipan Chandra, India's Struggle for Independence, Penguin Books, 2016.
4	Maciver and Page, Society: An Introduction Analysis, MacMilan India Ltd., New Delhi.2 nd edition, 2014.
5	P K Agarwal and K N Chaturvedi, PrabhatPrakashan Constitution of India, New Delhi, 1st edition, 2017.

Reference Books(s) / Web links:

1 Sharma, Brij Kishore, Introduction to the Constitution of India, Prentice Hall of India, New Delhi.

PO/PSO	PO	PO	РО	РО	PO	PO	PO	PO	PO	PO	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
MC19102.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
MC19102.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	-
Average	-	-	-	-	-	1.0	1.0	3.0	2.0	-	-	1.0	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER II

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С					
MA19254	PROBABILITY AND INFERENTIAL STATISTICS	BS	3	1	0	4					
		·									
Objectives:											
To provide	the required mathematical support in real life problems.										
 To gain kn 	owledge of sampling techniques and use testing of hypothesis for parameter	estimation.									
UNIT-I ONE – DIMENSIONAL RANDOM VARIABLE											
Probability- C	Conditional Probability- Bayes Theorem-Discrete and continuous rando	m variables	– N	/lon	nen	its –					
Moment gene	rating function –Binomial, Poisson, Geometric, Uniform, Exponential, a	ind Normal,C	hi-s	qua	re,	t, F					
distributions.											
UNIT-II TWO – DIMENSIONAL RANDOM VARIABLES											
Joint distributi	ons – Marginal and conditional distributions – Covariance – Correlation an	dLinear regre	ssio	1- N	⁄Iul	ltiple					
correlation and	I multiple regression–Applications of Central Limit Theorem.										
UNIT-III S	SAMPLING AND ESTIMATION THEORY				Т	12					
Random samp	ling. Sampling from finite and infinite populations. Estimates and sta	ndard error	sam	plir	ıg	with					
replacement an	nd sampling without replacement), Sampling distribution of sample mean,	stratified rand	om	sam	pli	ing –					
Point estimation	on, criteria for good estimates (un-biasedness, consistency), Methods of est	imation inclu	ding	ma	ixir	mum					
likelihood esti	mation.		-								
UNIT-IV	TESTING OF HYPOTHESIS					12					
Statistical hyp	othesis – Large sample test based on Normal distribution for single mean	n and differen	ice (of n	nea	ıns –					
Tests based of	n t, F and Chi-square test for single sample standard deviation. Chi-squa	re tests for in	idep	end	enc	ce of					
attributes and	goodness of fit.		1								
UNIT-V	NON PARAMETRIC TESTS					12					
Sign test, Wi	coxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Sm	irnov test. S	pear	mai	ı's	and					
Kendall's test.											
	Total	Contact Ho	ırs	:	:	60					
				\bot	\bot						
Course Outco	mes:										

On	completion of course students will be able to
•	Apply the basic concepts of probability, one dimensional and two dimensional Random Variables.
•	Apply the concept of correlation and regression in real life situation.
•	Apply the concept of sampling distribution and estimation theory in forecasting.
•	Use the concepts of Testing of Hypothesis for industrial problems.
•	Use the concepts of Non Parametric Testing for Non-Normal Populations.

Text	Book (s):
1	Veerarajan T, 'Probability and Statistics, Random Processes and Queueing Theory', First edition, McGrawHill,2018.
2	I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 8th Edition, 2015

Refe	rence Books(s):
1	Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2 nd
1	Edition, John Wiley and Sons, 2008.
2	Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2 nd Edition, Wiley India Pvt. Ltd.,
2	Bangalore, 2012.
3	D.C. Montgomery & E.Peck, Introduction to Linear Regression Analysis, 5th Edition, 2012.
4	A. Goon, M. Gupta and B. Dasgupta, Fundamentals of Statistics, vol. I & II, World Press, 2016
5	A.M. Mood, F.A. Graybilland D.C. Boes, Introduction to the Theory of Statistics, McGraw Hill Education.

PO/PSO	РО	РО	РО	РО	РО	РО	РО	PO	РО	РО	РО	РО	PSO	PSO	PSO	
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
MA19254.1	3	3	2	2	1	1	-	-	-	-	1	2	1	2	1	
MA19254.2	3	3	2	2	1	1	-	-	-	-	1	2	1	2	1	
MA19254.3	3	3	2	2	2	1	1	-	-	-	2	2	2	3	2	
MA19254.4	3	3	2	3	2	1	1	-	-	-	2	2	2	3	2	
MA19254.5	3	3	2	3	2	1	1	-	-	-	2	2	2	3	2	
Average	3	3	2	1.4	1.6	1	0.6	-	-	-	1.6	2	1.6	2.6	1.6	

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
GE19101	ENGINEERING GRAPHICS	ES	2	2	0	4

Ob	Objectives:				
۲	To understand the importance of the drawing in engineering applications				
٠	To develop graphic skills for communication of concepts, ideas and design of engineering products				
٠	To expose them to existing national standards related to technical drawings				
۲	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				
•	To expose them to existing national standards related to technical drawings 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				

CONCEPTS AND CONVENTIONS (Not for Examination)	1						
Importance of graphics in Engineering Applications-Use of drafting Instruments-BIS conventions and specifications-							
Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.							
UNIT-IPLANECURVES AND FREE HAND SKETCH11							
Curves used in engineering practices: Conics-Construction of ellipse, parabola and hyperbola by eccentri	icity						
method- Construction of cycloids, Construction of involutes of square and circle drawing of tangents and norma	al to						
the above curves. Visualization concepts and Free Hand sketching: Visualization principles -Representation of Th	hree						
Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects							
UNIT-II PROJECTION OFPOINTS, LINESAND PLANESURFACE	12						
Orthographic projection- principles-Principal planes- projection of points. First angle projection - Projection	n of						
straight lines inclined to both the principal planes - Determination of true lengths and true inclinations	s by						
rotating line method- Projection of planes (polygonal and circular surfaces) inclined to both the principal planes	es by						
rotating object method.							
UNIT-III PROJECTIONOFSOLIDS	12						
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the princ	cipal						
planes by rotating object method.							
UNIT-IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENTOF SURFACES	12						
Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal plane	anes						
and perpendicular to the other – obtaining true shape of the section. Development of lateral surfaces of simple	and						
sectioned solids – Prisms, pyramids, cylinders and cones.							
UNIT-V ISOMETRIC AND PERSPECTIVEPROJECTIONS 12							
Principles of isometric projection-isometric scale-Isometric projections of simple solids and truncated solids - Prisms,							
pyramids, cylinders and cones. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray							
method.							
Total Contact Hours :	60						

Cou	Course Outcomes:					
On	On completion of the course, the students will be able to					
•	Construct different plane curves and free hand sketching of multiple views from pictorial objects.					
•	Comprehend the theory of projection and to draw the basic views related to projection of points, lines and planes					
•	Draw the projection of solids in different views					
•	Draw the projection of Sectioned solids and development of surfaces of solids					
•	• Visualize and prepare Isometric and Perspective view of simple solids					

Text Book (s):

162	At DOOK (S):
1	Bhatt N.D. and Panchal V.M., Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2	Natrajan K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2017.

Re	Reference Books(s):				
1	Varghese P I., Engineering Graphics, McGraw Hill Education (I) Pvt.Ltd. 2013.				
2	Venugopal K. and PrabhuRaja V., Engineering Graphics, New Age International (P) Limited, 2008.				
3	Gopalakrishna K.R., Engineering Drawing, (Vol. I&II combined), Subhas Stores, Bangalore, 2017.				
4	Basant Agarwal and Agarwal C.M., Engineering Drawing, McGraw Hill, New Delhi, 2018.				

PO/PSO	PO 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
0															
GE19101.1	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.2	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.3	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.4	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
GE19101.5	2	-	-	-	-	-	-	-	-	1	-	2	-	-	-
Average	2.0	-	-	-	-	-	-	-	-	1.0	-	2.0	-	-	-

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
EE19242	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	ES	3	0	2	4

Ob	Objectives:				
۲	To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.				
۲	To impart knowledge on the phenomenon of resonance in RC, RL and RLC series and parallel circuits.				
•	To provide knowledge on the principles of electrical machines and electronic devices.				
۲	To learn the concepts of different types of electrical measuring instruments and transducers.				
	To teach methods of experimentally analyzing electrical circuits, electrical machines, electronic devices and				
•	transducers.				

UNIT-I D	OC CIRCUITS	9		
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of				
simple circuits	with dc excitation. Superposition, Thevenin and Norton Theorems.			
UNIT-II A	AC CIRCUITS	9		
Representation	of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive p	ower,		
apparent power	r, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combin	ations		
(series and par	rallel), resonance. Three phase balanced circuits, voltage and current relations in star and	delta		
connections				
UNIT-III E	LECTRICAL MACHINES	9		
Construction, H	Principles of operation and characteristics of; DC machines, Transformers (single and three p	hase),		
Synchronous m	nachines, three phase and single-phase induction motors.			
UNIT-IV E	ELECTRONIC DEVICES & CIRCUITS	9		
Types of Mater	rials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse I	Bias –		
Semiconductor	Diodes -Bipolar Junction Transistor - Characteristics -Field Effect Transistors - Transistor Bias	sing –		
Introduction to	operational Amplifier –Inverting Amplifier –Non Inverting Amplifier.			
UNIT-V M	AEASUREMENTS & INSTRUMENTATION	9		
Introduction to transducers - Classification of Transducers: Resistive, Inductive, Capacitive, Thermoelectric,				
piezoelectric, photoelectric, Hall effect - Classification of instruments - PMMC and MI Ammeters and Voltmeters -				
Multimeter – Digital Storage Oscilloscope.				
	Contact Hours :	45		

	List of Experiments				
1	Verification of Kirchhoff's Laws.				
2	Load test on DC Shunt Motor.				
3	Load test on Single phase Transformer.				
4	Load test on Single phase Induction motor.				
5	Characteristics of P-N junction Diode.				
6	Half wave and Full wave Rectifiers.				
7	Characteristics of CE based NPN Transistor.				
8	Inverting and Non- Inverting Op-Amp circuits.				
9	Characteristics of LVDT, RTD and Thermistor.				
	Contact Hours : 30				
	Total Contact Hours : 75				

Course Outcomes:				
On	On completion of the course, the students will be able to			
•	Analyse DC and AC circuits and apply circuit theorems.			
•	Realize series and parallel resonant circuits.			

- Understand the principles of electrical machines.
- Understand the principles of different types of electronic devices, electrical measuring instruments and transducers.
- Experimentally analyze the electric circuits, electrical machines, electronic devices, and transducers.

Te	Text Book(s):				
1	J.B.Gupta, Fundamentals of Electrical Engineering and Electronics, S.K.Kataria& Sons Publications, 2002.				
2	D P Kothari and I.J Nagarath, Basic Electrical and Electronics Engineering, McGraw Hill Education (India)				
	Private Limited, Third Reprint,2016				
3	Thereja .B.L., Fundamentals of Electrical Engineering and Electronics, S. Chand & Co. Ltd., 2008				

Ref	ference Books(s):											
1	Del Toro, Electrical Engineering Fundamentals, Pearson Education, New Delhi, 2007											
2	John Bird, Electrical Circuit Theory and Technology, Elsevier, First Indian Edition, 2006											
3	Allan S Moris, Measurement and Instrumentation Principles, Elsevier, First Indian Edition, 2006											
4	Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall of India, 2006											
5	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel, Basic Electrical Engineering, McGraw Hill											
5	Education(India) Private Limited, 2009											

PO/PSO	РО	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
EE19242.1	2	2	2	3	3	2	1	-	-	-	-	3	2	2	2
EE19242.2	1	2	2	3	2	2	3	-	-	-	-	-	1	-	1
EE19242.3	2	3	2	1	2	2	2	-	2	-	-	1	2	2	2
EE19242.4	3	3	2	3	1	2	2	-	-	-	2	2	2	1	2
EE19242.5	3	3	2	2	2	1	2	1	2	1	2	1	2	3	2
Average	2.2	2.6	2.0	2.4	2.0	1.8	2.0	1.0	2.0	1.0	2.0	1.8	1.8	2.0	1.8

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
EC19243	PRINCIPLES OF DIGITAL ELECTRONICS	ES	3	0	2	4

Ob	jectives:
٠	To learn the basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions
٠	To understand the design of various Combinational circuits.
٠	To extrapolate the design of Synchronous Sequential circuits using Flip-Flops.
٠	To know the design procedure of Asynchronous Sequential circuits and its problems.
	To understand the concept of Programmable Logic Devices for the design of digital circuits and Familiar with
•	Verilog HDL.

UNIT-I **BOOLEAN ALGEBRA AND LOGIC GATES**

Fundamentals: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expression, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS).

Minimization Techniques: Minimization of Boolean expressions using Boolean Laws, Karnaugh map, Quine McCluskey method of minimization, don't care conditions.

Logic Gates: NAND- NOR implementations.

UNIT-II COMBINATIONAL CIRCUITS

Half adder, Full Adder, Half subtractor, Full subtractor, Carry Look Ahead adder, Parallel Binary Adder/Subtractor, BCD adder, Binary Multiplier, Parity generator, Parity checker, Magnitude Comparator, Encoder, Decoder, Multiplexer-Logic function implementation, Demultiplexer. Code converter- Binary to Gray and Gray to Binary

UNIT-III SYNCHRONOUS SEQUENTIAL CIRCUITS

Memory elements: Latches, Flip-flops: RS, JK, D, T, Master-Slave, Triggering of Flip Flops, Realization of one flip flop using other flip flop.

Design: Synchronous and Asynchronous counters - Up/Down counter, Modulo-N counter. Shift Registers - SISO, SIPO, PISO, PIPO, Universal Shift Registers. Shift Register Counters - Ring counter, Shift counter. Design of synchronous sequential circuits using Moore and Mealy model

UNIT-IV ASYNCHRONOUS SEQUENTIAL CIRCUITS

Design and analysis of asynchronous sequential circuits using Fundamental and pulse mode, Problems in Asynchronous sequential Circuits- Races, Cycles and Hazards. 0

UNIT-V PROGRAMMABLE LOGIC DEVICES

Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA), Implementation of Combinational Logic Circuits using PROM, PLA, PAL. Implementation of basic combinational circuits using Verilog HDL. 45

Contact Hours •

Q

9

	List of Experiments									
1	1 Implementation of Binary to Gray and Gray to Binary code converters									
2	Logic function implementation of Multiplexer and De-multiplexer using logic gates.									
3	Implementation of SISO, SIPO, PISO and PIPO shift registers using Flip- Flop.									
4	Design and Implementation of 4-bit Asynchronous and BCD Synchronous counters.									
5	5 Implementation of Adder and Subtractor using Verilog HDL.									
LIS	LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS									
	✤ IC Trainer Kit – 15 Nos									
	Bread Boards – 15 Nos									
	 Ics each 50 Nos – 7400,7402, 7404, 7486, 7408, 7432, 7411, 74151, 74150, 7474, 7476 									
	System with HDL									
	Contact Hours : 30									
	Total Contact Hours : 75									

Course	e Outcomes:								
On con	npletion of the course, the students will be able to								
Si	implify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization								
te	techniques.								
• D	esign and Implement Combinational circuits.								
• C	onstruct Synchronous Sequential circuits using Flip-Flops.								
• D	esign Asynchronous Sequential circuits and analyse its problems.								
• In	nplement digital circuits using Programmable Logic Devices and Familiar with Verilog HDL.								
Text B	looks:								

IUA	A DOORS:
1	Morris Mano & Michael D Ciletti, "Digital Design: With an Introduction to Verilog HDL, 5th Edition, Pearson
	Education ,2013.

2	Charles H Roth "Fundamentals of Logic Design" 7 th Edition Thomson Learning 20	14
-	Charles Hittom. Tandamentals of Logic Design , 7 Datton, Thomson Leanning, 20	T 1.

Reference Books:

1	John F. Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
2	John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3	Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications", 6th Edition, TMH, 2006.
4	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
5	Donald D.Givone, "Digital Principles and Design", TMH, 2003.

We	Web links for virtual lab:						
1	http://vlabs.iitkgp.ernet.in/dec/#						

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
EC19243.1	2	2	1	2	2	-	-	-	-	-	-	1	1	2	-
EC19243.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
EC19243.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.2	1.2	1.8	1.2	1.2	-	-	-	-	-	-	1.6	1.6	2.0	-

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
CS19241	DATA STRUCTURES	PC	3	0	4	5

Ob	jectives:	
٠	ives: To apply the concepts of List ADT in the applications of various linear and nonlinear data structures. To demonstrate the understanding of stacks, queues and their applications. To analyze the concepts of tree data structure. To understand the implementation of graphs and their applications.	
•	To demonstrate the understanding of stacks, queues and their applications.	
•	To analyze the concepts of tree data structure.	
•	To understand the implementation of graphs and their applications.	
•	To be able to incorporate various searching and sorting techniques in real time scenarios.	

UNIT-I	LINEAR DATA STRUCTURES – LIST	9
Abstract Da	ta Types (ADTs) – List ADT – array-based implementation – linked list implementation — singly I	inked
lists- circula	rly linked lists- doubly-linked lists - applications of lists -Polynomial Manipulation - All oper	ations
(Insertion, D	Deletion, Merge, Traversal).	
UNIT-II	LINEAR DATA STRUCTURES – STACKS, QUEUES	9
Stack ADT	- Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expre	ession
– Queue AD	T – Operations – Circular Queue – DEQUE – applications of queues.	
UNIT-III	NON LINEAR DATA STRUCTURES – TREES	9
Tree Termin	ologies- Binary Tree-Representation-Tree traversals - Expression trees - Binary Search Tree-AVL	Trees
-Splay Tree	s – Binary Heap – Applications.	
UNIT-IV	NON LINEAR DATA STRUCTURES – GRAPHS	9
Graph Term	inologies - Representation of Graph - Types of graph - Breadth-first traversal - Depth-first trave	rsal –
Topological	Sort – Shortest path – Dijikstra's Algorithm – Minimum Spanning Tree- Prim's Algorithm.	
UNIT-V	SEARCHING, SORTING AND HASHING TECHNIQUES	9
Searching- I	Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort -	Quick
sort – Merge	e Sort. Hashing- Hash Functions - Collision resolution strategies- Separate Chaining - Open Addres	sing –
Rehashing.		
	Contact Hours :	45

Array implementation of Stack and Queue ADTs Array implementation of List ADT inked list implementation of List Stack and Queue ADTs								
Array implementation of List ADT inked list implementation of List Stack and Queue ADTs								
inked list implementation of List Stack and Queue ADTs								
mixed list implementation of Elist; Stack and Quede AD 15								
Applications of List, Stack and Queue ADTs								
Implementation of Binary Trees and operations of Binary Trees								
mplementation of Binary Search Trees								
mplementation of AVL Trees								
mplementation of Heaps using Priority Queues								
Traph representation and Traversal algorithms								
Applications of Graphs								
mplementation of searching and sorting algorithms								
Iashing –any two collision techniques								
Contact Hours :	60							
Total Contact Hours :	105							
	Inked fist implementation of List, Stack and Queue ADTs pplications of List, Stack and Queue ADTs inplementation of Binary Trees and operations of Binary Trees inplementation of Binary Search Trees inplementation of AVL Trees inplementation of Heaps using Priority Queues raph representation and Traversal algorithms inplementation of searching and sorting algorithms ashing –any two collision techniques Contact Hours : Total Contact Hours :							

Course Outcomes:

On completion of the course, the students will be able to

•	Analyze the various data structure concepts.
•	Implement Stacks and Queue concepts for solving real-world problems.
•	Analyze and structure the linear data structure using tree concepts.
•	Critically Analyse various non-linear data structures algorithms.
•	Apply different Sorting, Searching and Hashing algorithms.

Tey	Text Books:							
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2 nd Edition, Pearson Education, 2002.							
2	ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.							

Ref	ference Books:									
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest and Clifford Stein, Introduction to Algorithms,									
I	Second Edition, McGraw Hill, 2002.									
2	Aho, Hopcroft and Ullman, Data Structures and Algorithms, Pearson Education, 1983.									
3	Stephen G. Kochan, Programming in C, 3 rd edition, Pearson Education.									
4	Ellis Horowitz, SartajSahni and Susan Anderson Freed,Fundamentals of Data Structures in C, 2 nd Edition,									
4	University Press, 2008.									

Web links for virtual lab (if any)1http://vlabs.iitb.ac.in/vlab/labscse.html

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CS19241.1	1	2	1	2	1	-	-	-	-	-	-	1	1	2	-
CS19241.2	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.3	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.4	1	1	2	1	1	-	-	-	-	-	-	2	2	2	-
CS19241.5	1	1	2	1	1	-	-	-	-	-	-	1	1	2	-
Average	1.0	1.2	1.8	1.2	1.0	-	-	-	-	-	-	1.6	1.6	2.0	-

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	Т	Р	С
GE19121	ENGINEERING PRACTICES – CIVIL & MECHANICAL	ES	0	0	2	1

Objectives:

• To provide exposure to the students with hands on experience on various basic engineering practices in Civil and Mechanical Engineering.

	List of Experiments								
CIVII	L ENGINEERING PRACTICE								
1	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in								
1.	household fittings.								
2.	Preparation of basic plumbing line sketches for wash basins, water heaters, etc.								
3.	Hands-on-exercise: Basic pipe connections –Pipe connections with different joining components.								
Carpe	entry Works:								
4.	Study of joints in roofs, doors, windows and furniture.								
5.	Hands-on-exercise: Woodwork, joints by sawing, planning and chiseling.								
MEC	HANICAL ENGINEERING PRACTICE								
6.	Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.								
7.	Gas welding practice.								
Basic	Machining:								
8.	Simple Turning and Taper turning								
9.	Drilling Practice								
Sheet	Metal Work:								
10.	Forming & Bending:								
11.	Model making – Trays and funnels								
12.	Different type of joints.								
Mach	ine Assembly Practice:								
13.	Study of centrifugal pump								
14.	Study of air conditioner								
	Total Contact Hours : 30								

Course Outcomes:

On	completion of the course, the students will be able to								
	Perform plumbing activities for residential and industrial buildings considering safety aspects while gaining clear								
•	understanding on pipeline location and functions of joints like valves, taps, couplings, unions, reducers, elbows,								
	etc.								
	Perform wood working carpentry activities like sawing, planning, cutting, etc. while having clear understanding of								
•	the joints in roofs, doors, windows and furniture.								
	Produce joints like L joint, T joint, Lap joint, Butt joint, etc. through arc welding process while acquiring in depth								
•	knowledge in the principle of operation of welding and other accessories								
	Perform operations like Turning, Step turning, Taper turning, etc. in lathe and Drilling operation in drilling								
•	machine								
	Perform sheet metal operations like Forming, Bending, etc. and fabricating models like Trays, funnels, etc.								

PO/PSO	РО	РО	РО	РО	РО	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
GE19121.1	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.2	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.3	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.4	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
GE19121.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Average	-	-	-	-	-	-	-	1.0	1.0	-	-	-	-	-	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	Т	Р	С
CS19211	PYTHON PROGRAMMING LAB	PC	0	0	4	2

Ob	Objectives:				
•	Learn the Python Environment using interactive and script mode				
•	Implement Python programs with conditionals and loops.				
•	Use functions for structuring Python programs.				
•	Represent compound data using Python lists, tuples and dictionaries.				
	Read and write data from/to files in Python.				

	List of Experiments
1	Implement simple python programs using interactive and script mode.
2	Develop python programs using id() and type() functions
3	Implement range() function in python
4	Implement various control statements in python.
5	Develop python programs to perform various string operations like concatenation, slicing, Indexing.
6	Demonstrate string functions using python.
7	Implement user defined functions using python.
8	Develop python programs to perform operations on list
9	Implement dictionary and set in python
10	Develop programs to work with Tuples.
11	Create programs to solve problems using various data structures in python.
12	Implement python program to perform file operations.
13	Implement python programs using modules and packages.
14	Mini Project
	Total Contact Hours : 60

Co	urse Outcomes:
On	completion of the course, the students will be able to
•	Run Python Programs at interactive and script mode.
٠	Implement Python programs with conditionals and loops.
٠	Develop Python programs stepwise by defining functions and calling them.
٠	Use Python lists, tuples and dictionaries for representing compound data.
•	Read and write data from/to files in Python

We	Web links for virtual lab			
1	https://www.python.org/shell/			
2	https://www.tutorialspoint.com/execute_python_online.php			
3	https://www.onlinegdb.com/			

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CS19211.1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
CS19211.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.3	2	2	3	2	1	-	-	-	1	-	2	1	2	2	-
CS19211.4	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
CS19211.5	2	2	3	2	1	-	-	-	-	-	2	1	2	2	-
Average	1.5	1.5	2.3	1.5	1.0	-	-	-	1.0	-	1.5	1.0	1.8	1.8	-

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
MC19101	ENVIROMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0

Objectives:

• To understand the importance of natural resources, pollution control and waste management.

• To provide the students awareness on the current social issues and environmental legislations.

UNIT-I NATURAL RESOURCES 0 Environment -definition - scope and importance - forest resources -use and overexploitation -water resources -use and over utilization - dams - benefits and problems - water conservation -energy resources - growing energy needs renewable and non-renewableenergy sources - use of alternate energy sources - land resources - land degradation role of an individual in conservation of natural resources UNIT-II ENVIRONMENTAL POLLUTION Definition - causes, effects and control measures of air pollution -chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, and ozone depletion- noise pollution -mitigation procedures control of particulate and gaseous emission (Control of SO2, NOX, CO and HC). Water pollution - definition-causeseffects of water pollutants-marine pollution-thermal pollution-radioactive pollution-control of water pollution by physical, chemical and biological processes-waste water treatment-primary, secondary and tertiary treatment. Soil pollution: definition-causes-effects and control of soil pollution. UNIT-III | SOLID WASTE MANAGEMENT Solid wastes - sources and classification of solid wastes -solid waste management options - sanitary landfill, recycling, composting, incineration, energy recovery options from wastes. Hazardous waste -definition -sources of hazardous waste-classification (biomedical waste, radioactive waste, chemical waste, household hazardous waste)characteristics of hazardous waste ignitability (flammable) reactivity, corrosivity, toxicity -effects of hazardous waste -case study- Bhopal gas tragedy - disposal of hazardous waste-recycling, neutralization, incineration, pyrolysis, secured landfill - E-waste management -definition-sources-effects -electronic waste recycling technology. UNIT-IV SOCIAL ISSUES AND THE ENVIRONMENT Sustainable development -- concept, components and strategies -- social impact of growing human population and affluence, food security, hunger, poverty, malnutrition, famine - consumerism and waste products - environment and human health - role of information technology in environment and human health - disaster management- floods, earthquake, cyclone and landslide. TOOLS FOR ENVIRONMENTAL MANAGEMENT UNIT-V Environmental impact assessment (EIA) structure --strategies for risk assessment--EIS-environmental audit-ISO 14000-precautionary principle and polluter pays principle- constitutional provisions- - pollution control boards and pollution control acts- environmental protection act1986- role of non-government organizations- international conventions and protocols. **Total Contact Hours** : 45

Co	urse Outcomes:
On	completion of the course, the students will be able to
•	Be conversant to utilize resources in a sustainable manner.
•	Find ways to protect the environment and play proactive roles.
•	Apply the strategies to handle different wastes
٠	Develop and improve the standard of better living.
•	Be conversant with tools of EIA and environmental legislation.

Tex	Text Book(s):						
1	Benny Joseph, "Environmental Science and Engineering", 2 nd edition, Tata McGraw-Hill, New Delhi, 2008.						
2	Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2ndedition, Pearson Education, 2004.						
Ref	Reference Books(s):						
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1	Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd, New Delhi, 2007.						
2	ErachBharucha, "Textbook of Environmental Studies", 3rd edition, Universities Press, 2015.						
3	G. Tyler Miller and Scott E. Spoolman, "Environmental Science", 15thedition, CengageLearning India, 2014.						
4	Rajagopalan, R, "Environmental Studies-From Crisis to Cure", 3rdedition, Oxford UniversityPress, 2015.						
5	De. A.K., "Environmental Chemistry", New Age International, New Delhi, 1996.						
6	K. D. Wager, "Environmental Management", W. B. Saunders Co., USA, 1998.						

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
MC19101.1	3	2	3	2	1	3	3	2	1	1	1	1	1	1	1
MC19101.2	3	3	3	2	2	3	3	3	2	1	2	2	1	2	2
MC19101.3	3	3	3	2	2	3	3	3	2	1	2	1	1	2	1
MC19101.4	3	3	3	2	2	3	3	2	2	1	2	2	1	2	2
MC19101.5	2	2	3	1	1	3	3	1	1	2	1	1	1	1	1
Average	2.8	2.6	3.0	1.8	1.6	3.0	3.0	2.2	1.6	1.2	1.6	1.4	1.0	1.6	1.4

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

SEMESTER III

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
MA19356	DISCRETE MATHEMATICS FOR AI	BS	3	1	0	4

Ob	Dbjectives:			
۲	To extend student's Logical and Mathematical maturity and ability to deal with abstraction.			
•	To study various enumeration methods using principle of counting.			
•	To understand various algebraic structures.			
•	To obtain knowledge of discrete structures involving graphs.			
•	To obtain knowledge of discrete structures involving trees.			

UNIT-I MATHEMATICAL LOGIC

Propositional calculus – propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility – natural deduction system and axiom system; Soundness and completeness.

UNIT-II COMBINATORICS

Basic counting sum and product, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

UNIT-III STRUCTURED SETS

Set, relation – Algebraic System : Groups, Semi groups, monoid, homomorphism, cosets, Ring and Field (definition), Relation, Equivalence relations, Poset, Lattices, Hasse diagram, Boolean algebra.

UNIT-IV GRAPH THEORY

Introduction – Graph Terminologies – Types of Graphs – Sub Graph- Multi Graph – Regular Graph – Isomorphism – Isomorphic Graphs – Sub-graph – Euler graph – Hamiltonian Graph – Related problems.

UNIT-V TREES

Trees – Properties- Distance and Centres – Types – Rooted Tree – Tree Enumeration Labeled Tree – Unlabeled Tree – Spanning Tree – Fundamental Circuits- Cut Sets – Properties – Fundamental Circuit and Cut-set- Connectivity-Separability – Related problems.

Total Contact Hours

: 60

12

12

12

12

12

Course Outcomes:

On completion of the course, the students will be able to

- Apply the concepts of logic to test the validity of a program and to arrive at inferences on logical structures.
- Use the counting principles in implementing various programmes.
 Analyze sets with operations and conclude the properties about the structures.
 Handle a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
 Apply suitable graph model and algorithm for solving applications.

Text Book(s):

1

Digital Logic & Computer Design, M. Morris Mano, Pearson India Educations Services Pvt. Ltd 2016.

Ref	Cerence Books(s):
1	Introduction to linear algebra. Gilbert Strang Fifth Edition (2016).
2	Introductory Combinatorics, R. A. Brualdi, Fifth Edition, Pearson Education Inc. (2010).
3	Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood
3	Cliffs Dover edition, (2016).
4	Introduction to Mathematical Logic, (Sixth Edition), E. Mendelsohn, CRC press Taylor & Francis group, (2015).
5	Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London, Fifth Printing,
Э	(1982).
6	Mathematical Logic for Computer Science, L. Zhongwan, World Scientific Publishing Co. Pte. Ltd., Singapore,
U	(1998).
7	Topics in Algebra, I. N. Herstein, John Wiley and Sons, (1975).

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
MA19356.1	3	3	2	3	-	-	-	-	-	-	-	2	3	3	2
MA19356.2	3	3	2	3	-	-	-	-	-	-	-	2	3	3	2
MA19356.3	3	3	2	3	-	-	-	-	-	-	-	2	2	3	1
MA19356.4	3	3	3	3	2	-	-	-	-	-	2	2	3	3	1
MA19356.5	3	3	3	3	2	-	-	-	-	-	2	2	3	3	2
Average	3	3	2.4	3	2	-	-	-	-	-	2	2	2.8	3	1.6

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	P	С
GE19301	LIFE SCIENCE FOR ENGINEERS	BS	3	0	0	3

Objectives: •

Broad objective of this course is to give an introduction of life science to engineering students. The course helps students to familiarize with human physiology, life style diseases and their management and basic diagnostic aspects. •

UNIT-I	OVERVIEW OF CELLS AND TISSUES		9
Introductio vital organ	n to Bacteria, virus, fungi and animal cells. Organisation of cells into	tissues and organs. Functions o	of
UNIT-II	HEALTH AND NUTRITION		9
Balanced c amino acid Significanc	liet, Importance of RDA, BMR, and diet related diseases. Role of a s, Essential fatty acids in diet. Water and its significance for human has of exercise and yoga.	ntioxidants PUFA, DHA, Essen health. Physical and Mental heal	ntial lth —
UNIT-III	UNHEALTHY PRACTICES AND THEIR IMPACT ON HEA	LTH	9
Drug induction	ed toxicity, Unhealthy practices – Drug abuse/Narcotics/Smoking/Al ic gadgets.	cohol/Self-medication/Undue u	sage
UNIT-IV	COMMON DISEASES AND LIFESTYLE DISORDERS		9
Prevention Lifestyle d and manag	and management of food, water and airborne illness (Common cold isorders – obesity, diabetes, stroke, heart attack, ulcer, renal calculi, ement.	l, dehydration, food poisoning cancer, AIDS, hepatitis- preven	etc). Ition
UNIT-V	DIAGNOSTIC TESTS AND THEIR RELEVENCE		9
Normal ran	ge of biochemical parameters, significance of organ function tests, or	gan donation.	
		Total Contact Hours :	45
			<u> </u>

Co	urse Outcomes:				
On	On completion of the course, the students will be able to				
٠	Classify the living organisms and relate the functions of vital organs				
•	Demonstrate the importance of balanced diet and plan methods for healthy living				
٠	Analyse the hazards of unhealthy practices and take preventive measures				
٠	Categorise the various life style disorders and recommend ways to manage the common diseases				
•	Evaluate and interpret biochemical parameters and their significance				

Te	xt Book(s):
1	Carol D. Tamparo PhD CMA-A (AAMA), Marcia (Marti) A. Lewis EdD RN CMA-AC (AAMA), "Diseases of human body, F.A Davis Company, 2011.
2	Textbook of Medical Biochemistry, Chatterjea and Rana shindae Jaypee Brothers Medical Publishers, 2011.

Re	ference Books(s):
1	ArthurT.Johnson, "Biology for Engineers", CRC Press, Taylor and Francis, 2011.
2	Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, "Cell Biology and Genetics", Cengage Learning, 2008.

We	b link:
1	https://nptel.ac.in/courses/122103039/

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	P O	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO3
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	1303
GE19301.1	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.2	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.3	3	1	2	2	2	3	1	3	1	2	1	3	3	1	2
GE19301.4	3	1	2	2	2	3	1	1	1	2	1	3	3	1	2
GE19301.5	3	1	2	2	3	3	1	1	1	2	1	3	3	1	2
Average	3	1	2	2	2.2	3	1	1.4	1	2	1	3	3	1	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Medarata (Medium) 3: Substant

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Theory Courses)	Category	L	Т	Р	С
AI19301	COMPUTER SYSTEM ARCHITECTURE	PC	3	0	0	3

Ob	jectives:
•	To understand the structure, function and characteristics of computer systems.
•	To familiarize the students with arithmetic and logic unit and implementation of fixed point and floating-point arithmetic operations.
•	To make the students quantitatively evaluate simple computer designs and their sub-modules.
•	To explain the function of each element of a memory hierarchy.
•	To expose and make the students to learn about the memory system design and different ways of communicating with I/O devices and standard I/O interfaces.

UNIT-I INTRODUCTION

Introduction -RISC - CISC, Eight ideas - Components of a computer system - Technology - Performance - Power wall -Instructions - Operations & Operands, Representing instructions, Logical operations - Instructions for decision making- Addressing Modes. Case Study: Evolution of Intel x86 architecture.

ARITHMETIC AND LOGIC UNIT UNIT-II

Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. Q

UNIT-III CONTROL UNIT

Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Pipelining- Basic concepts - Data hazards - Instruction hazards- Data path and control considerations. Hardwired and micro programmed control: micro programme sequencing, concept of horizontal and vertical microprogramming. 9

UNIT-IV MEMORY SYSTEM

Basic concepts - Semiconductor RAM - ROM - Speed - Size and cost - Cache memories - Improving cache performance -Associative memories - Secondary storage devices - Memory management requirements - Introduction to Virtual Memory. Case Study: RAID

I/O ORGANIZATION UNIT-V

Accessing I/O devices - Programmed Input/output - Interrupts - Direct Memory Access - Buses - Interface circuits -Standard I/O Interfaces (PCI, SCSI, and USB), I/O devices and processors 45

Contact Hours : 9

9

0

Co	Course Outcomes:							
On	On completion of the course, the students will be able to							
•	Comprehend the basic structure and operation of digital computer system.							
•	Understand the design of the various functional units and components of computers							
•	Understand the Hazards and to design and analyse the pipelined control units.							
•	Evaluate performance of memory systems.							
•	Understand the IO devices organization.							

Te	xt Books:
1	Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.
2	David A. Patterson and John L. Hennessey, "Computer organization and design', Morgan Kauffman / Elsevier, Fifth edition, 2014.

Ret	ference Books:
1	William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition,
I	Pearson Education
2	John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.
2	V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education,
3	2004.
4	Govindarajalu, "Computer Architecture and Organization, Design Principles and Applications", first edition, Tata
4	McGraw Hill, New Delhi, 2005.

<u>CO – PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	РО 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19301.1	2	2	1	1	-	-	1	-	-	-	-	-	2	2	2
AI19301.2	3	3	1	2	-	-	-	-	2	-	1	-	1	1	2
AI19301.3	2	2	3	1	2	1	2	-	-	-	2	-	2	2	1
AI19301.4	2	2	2	1	2	2	2	-	-	-	2	1	2	2	2
AI19301.5	2	2	3	1	2	2	2	-	-	-	2	-	2	3	2
Average	2.2	2.2	2	1.2	2	1.6	1.75	-	2	-	1.75	1	1.8	2	1.8

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
CS19341	DESIGN AND ANALYSIS OF ALGORITHMS	PC	3	0	2	4

Ob	jectives: The student should be made to
٠	Learn and understand the algorithm analysis techniques and complexity notations
•	Become familiar with the different algorithm design techniques for effective problem solving in computing.
٠	Learn to apply the design techniques in solving various kinds of problems in an efficient way.
٠	Understand the limitations of Algorithm power.
	Solve variety of problems using different design techniques

•	DOIVE	variety	orp	noorems	using	uniterent	ucorgi	coming	ues

UNIT-I INTRODUCTION AND ANALYSIS OF ALGORITHMS 9 Introduction –Algorithm Specification –Important Problem types- Performance Analysis: Space Complexity – Time Time Complexity – Asymptotic Notations – Using Limits for Comparing Orders of Growth – Basic Efficiency Classes Solving Recurrence Relations: Substitution methods and Master Theorem Method UNIT-II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force: Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem – Divide

and Conquer Method: Analysis of Binary Search, Merge sort and Quick sort Algorithms, Integer Multiplication-Finding Minimum and Maximum.

 UNIT-III
 GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING
 9

 Greedy Method – Minimum Spanning Trees: Kruskals Algorithm– Fractional Knapsack – Huffman Codes – Dynamic
 9

Programming: General Method – String Editing – 0/1 Knapsack – Travelling Salesman Problem.

UNIT-IV BACKTRACKING AND BRANCH & BOUND

 $\begin{array}{l} Backtracking: \mbox{ General Method} - 8 \mbox{ Queen's Problem} - Sum of Subsets Problem - Graph Colouring - Hamiltonian Circuit Problem - Branch and Bound: LC branch and bound - 0/1 Knapsack - Travelling Salesman Problem. \end{array}$

UNIT-V STRING MATCHING AND NP COMPLETE & NP HARD

String Matching: Naive String Matching – Rabin Karp – Knuth Morris Pratt – NP Complete and NP Hard Problems: Basic Concepts – Non Deterministic Algorithms – Class of NP Complete and NP Hard – Approximation Algorithms :: Travelling Salesman problem.

Contact Hours : 45

9

9

	List of Experiments
1	Finding Time Complexity of algorithms.
2	Design and implement algorithms using Brute Force Technique.
3	Design and implement algorithms using Divide and Conquer Technique.
4	Design and implement algorithms using Greedy Technique.
5	Design and implement algorithms using Dynamic Programming.
6	Design and implement algorithms using Backtracking.
7	Design and implement algorithms using Branch and Bound.
8	Implement String Matching algorithms.
	Contact Hours : 30
	Total Contact Hours : 75

Co	urse Outcomes:
On	completion of the course, the students will be able to
	Analyze the time and space complexity of various algorithms and compare algorithms with respect to
	Complexities.
	Decide and apply Brute Force and Divide and Conquer design strategies to Synthesize algorithms for
•	appropriate computing problems.
	Apply Greedy and Dynamic Programming techniques to Synthesize algorithms for appropriate computing
•	problems.
•	Apply Backtracking and Branch and Bound techniques to Synthesize algorithms for appropriate computing

	problems.
٠	Apply string matching algorithms in vital applications.

Tey	Text Books:					
1	AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.					
2	Ellis Horowitz, Shani, SanguthevarRajasekaran, "Computer Algorithms" Universities Press, Second Edition 2008.					

Ref	ference Books:
1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms",
	Third Edition, PHI Learning Private Limited, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education,
2	Reprint 2006.
3	Donald E. Knuth, "The Art of Computer Programming", Volumes 1& 3 Pearson Education, 2009.
4	Sara Baase Allen Van Gelder, "Computer Algorithms – Introduction to Analysis" Pearson Education Asia, 2010
5	Droomey R. G. "How to solve it by Computer", Pearson Education, 2006.

We	Web links for virtual lab:		
1	https://www.geeksforgeeks.org/fundamentals-of-algorithms/		
2	https://www.hackerrank.com/domains/algorithms		

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CS19341.1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	2
CS19341.2	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.3	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.4	2	3	2	2	-	-	-	-	-	-	-	1	3	3	1
CS19341.5	1	2	2	2	-	-	-	I	I	-	-	1	3	3	1
Average	2	2.8	2	2	-	-	-	-	-	-	-	1	3	2.8	1.2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	T	P	С
AI19341	PRINCIPLES OF ARTIFICIAL INTELLIGENCE	PC	3	0	2	4

Ob	Objectives:			
٠	Understand the various characteristics of a problem solving agent			
٠	Learn about the different strategies involved in problem solving			
٠	Learn about solving problems with various constraints.			
٠	Apply A.I to various applications like expert systems etc.			
٠	Understand the different models of learning			

UNIT-I	Introduction to Artificial intelligence and Problem-Solving Agent	9				
Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of						
environment	, structure of agents, goal-based agents, utility-based agents, learning agents. Defining the problem	em as				
state space s	earch, production system, problem characteristics, issues in the design of search programs.					
UNIT-II	Search techniques	9				
Problem sol	ving agents, searching for solutions; uniform search strategies: breadth first search, depth first s	earch,				
depth limite	d search, bidirectional search, comparing uniform search strategies. Heuristic search strategies G	ireedy				
best-first sea	arch, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimiz	zation				
problems: H	ill climbing search, simulated annealing search, local beam search.					
UNIT-III	Constraint satisfaction problems and Game Theory	9				
Local search	for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in g	ames,				
the minimax	search procedure, alpha-beta pruning, additional refinements, iterative deepening.					
UNIT-IV Knowledge & reasoning 9						
Statistical R	easoning: Probability and Bays' Theorem, Certainty Factors and Rule-Base Systems, Bayesian Netw	vorks,				
Dempster-Sl	nafer Theory, Fuzzy Logic. AI for knowledge representation, rule-based knowledge represent	tation,				
procedural a	nd declarative knowledge, Logic programming, Forward and backward reasoning.					
UNIT-V	Introduction to Machine Learning	9				
Exploring s	ub-discipline of AI: Machine Learning, Supervised learning, Unsupervised learning, Reinforce	ement				
learning, Classification problems, Regression problems, Clustering problems, Introduction to neural networks and						
deep learnin	g.					
	Contact Hours :	45				

		List of Experiments					
1	Programs on Problem Solving						
	a.	Write a program to solve 8 Queens problem					
	b.	Solve any problem using depth first search					
	c.	Implement MINIMAX algorithm					
	d.	Implement A* algorithm					
2	Progr	ams on Decision Making and Knowledge Representation					
	a.	Introduction to PROLOG					
	b.	Implementation of Unification and Resolution Algorithm					
	с.	Implementation of Backward Chaining					
	d.	Implementation of Forward Chaining					
3	Progr	ams on Planning and Learning					
	a.	Implementation of Blocks World program					
	b.	Implementing a fuzzy inference system					
	c. Implementing Artificial Neural Networks for an application using python						
	d. Implementation of Decision Tree						
	e.	Implementation of K-mean algorithm					
			Contact Hours	:	30		
		1	Cotal Contact Hours	:	75		

Lab Specifications:

- The lab can be implemented using Python or C.
- Knowledge representation experiments can be performed using a PROLOG TOOL.

Course Outcomes:

|--|

- Basic knowledge representation, problem solving, and learning methods of artificial intelligence.
- Provide the apt agent strategy to solve a given problem
- Represent a problem using first order and predicate logic
- Design applications like expert systems and chat-bot.
- Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem

Te	Text Books:						
1	S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition,						
	2015.						
2	Nils J. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978-						
	1558605350.						

Re	Reference Books:				
1	Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed., 2017.				
2	Introduction to Artificial Intelligence & Expert Systems, Patterson, Pearson, 1st ed. 2015				
3	Logic & Prolog Programming, Saroj Kaushik, New Age International, Ist edition, 2002.				
4	Expert Systems: Principles and Programming, 11 March 1998. Edition: 4th. ISBN: 9788131501672				

<u>CO – PO – PSO matrices of course</u>

PO/PSO	РО	РО	PO	PO	РО	РО	PO	PO	РО	РО	РО	РО	PSO	PSO	PSO 3
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	5
AI19341.1	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.2	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.3	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.4	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.5	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	2.0	2.0	2.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
Subject Code						
AI19342	OBJECT ORIENTED PROGRAMMING USING JAVA FOR AI	PC	3	0	4	5

Ob	jectives:
٠	To understand Object Oriented Programming concepts and characteristics of Java
٠	To know the principles of classes, abstraction and inheritance
٠	To create packages, define exceptions and use strings
٠	To use I/O streams in applications
٠	To build simple programs using collection and regular expression

UNIT-I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS	9
Introduction to Object Oriented Programming - Basic concepts of OOP - An overview of Java - Java Archite	cture –
Data Types – Variables- Arrays- Operators – Control Statements – Command Line Arguments.	
UNIT-II CLASSES AND INHERITANCE	9
Defining Classes in Java: Methods, Constructors, Garbage Collection – Access Specifiers – Method Overloa	ding –
Inheritance: Super keyword, this keyword, Method Overriding, Abstract Classes - Static Members - Final Meth	od and
Class.	
UNIT-III PACKAGES, EXCEPTION HANDLING AND STRINGS	9
Packages – Interfaces – Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built-in Exce	ptions,
User defined Exceptions – Strings – String Buffer.	
UNIT-IV I/O	9
Input / Output Basics - Streams - Byte streams and Character streams - Reading and Writing Console - Readi	ng and
Writing Files.	
UNIT-V COLLECTIONS AND REGULAR EXPRESSION	9
Generic Programming - Generic Classes - Generic Methods - Collection Interfaces - Collection Classes. R	egular
Expression-Classes-Pattern, matcher-Interfaces – Regex Character Classes – Regex Quantifier-Meta charcters.	
Contact Hours :	45

	List of Experiments
1	Simple programs using command line arguments.
2	Programs using control structures.
3	Programs using arrays.
4	Programs using Programs using classes and objects.
5	Programs using inheritance and interfaces.
6	Programs using packages and abstract class.
7	Programs to handle different types of exceptions.
8	Programs using strings and string buffer.
9	Programs using I/O streams.
10	Programs using files.
11	Programs using collections.
12	Program to validate MAC address using regular expression.
13	Program to validate Indian driving license number using regular expression.
14	Program to check whether two convex regular polygons have same center or not.
15	Program to check if an URL is valid or not using pattern matching.
	Contact Hours:60
	Total Contact Hours:105

Cou	urse Outcomes:
On	completion of the course, the students will be able to
•	Understand the use of the Object Oriented Programming concepts.
•	Know about the concepts of Abstract, Static and final classes.

- Understand the concept of packages, exceptions and strings
- Understand I/O streams in applications.
- Apply the collection and regular expression in real world applications.

Tey	xt Books:
1	Herbert Schildt, -Java The complete referencel, 9th Edition, McGraw Hill Education, 2014.
2	Patrick Niemeyer, Daniel Leuck -Learning Java, 4th Edition, O'Reilly Media, June 2013
3	Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentals, 9th Edition, Prentice Hall, 2013.

Ref	ference Books:
1	Paul Deitel, Harvey Deitel, —Java SE 8 for programmersl, 3rd Edition, Pearson, 2015.
2	Steven Holzner, —Java 2 Black book ^{II} , Dreamtech press, 2011.
3	Timothy Budd, —Understanding Object-oriented programming with Javal, Updated Edition, Pearson Education,
3	2000.
4	SCJP Sun Certified Programmer for Java 6 Study Guide. McGrawHill, 6 th edition.

CO - PO – PSO matrices of course

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
СО					-	-		-	-	-					
AI19342.1	2	2	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.2	3	1	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.3	3	2	2	-	1	-	-	-	-	-	-	1	2	2	2
AI19342.4	3	2	2	-	1	-	-	-	-	-	-	2	3	3	3
AI19342.5	3	2	2	3	1	-	-	-	1	1	3	2	3	3	3
Average	2.8	1.8	1.6	0.6	1	-	-	-	0.2	0.2	0.6	1.4	2.4	2.4	2.4

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
MC19301	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	3	0	0	0

Objectives:							
This c	purse aims at imparting basic principles of thought process, reasoning and inference. Sustainability	is the					
core of Indian traditional knowledge system connecting society and nature. Holistic life style of yogic science							
• and wi	sdom are important in modern society with rapid technological advancements and societal disruption	s. The					
course	mainly focuses on introduction to Indian knowledge system, Indian perspective of modern science	, basic					
princip	les of Yoga and holistic healthcare system, Indian philosophical, linguistic and artistic traditions.						
Pedagogy:	Problem based learning, group discussions, collaborative mini projects.						
UNIT-I	Introduction to Indian Knowledge System	6					
Basic struct	ture of the Indian Knowledge System –Veda – Upaveda - Ayurveda, Dhanurveda- Gandharva	iveda,					
Sthapathyay	eda and Arthasasthra. Vedanga (Six forms of Veda) – Shiksha, Kalpa, Nirukta, Vvakarana, Jvothish	a and					
Chandas- Fo	bur Shasthras - Dharmashastra, Mimamsa, Purana and Tharkashastra						
UNIT-II	Modern Science and Yoga	6					
Madam Cai		1 -1					
Indian Vnor	uled as System the science of Voge different styles of Voge types of Vogessene Dreneyer M	id the					
Maditation	when by stelling the science of foga-different styles of foga – types of fogaasana, Pranayani, when the set of	udras,					
Meditation	echniques and their health benefits – Yoga and honstic healthcare – Case studies.						
UNIT-III	Indian Philosophical Tradition	0					
Sarvadharsh	an/Sadhdharshan - Six systems (dharshans) of Indian philosophy - Nyaya, Vaisheshika, Sankhya, T	Yoga,					
Vedanta-Ot	ner systems- Chavarka, Jain (Jainism), Boudh (Buddhism) – Case Studies.						
UNIT-IV	Indian Linguistic Tradition	6					
Introduction	to Linguistics in ancient India – history – Phonetics and Phonology – Morphology – Synta:	x and					
Semantics-O	Case Studies.						
UNIT-V	Indian Artistic Tradition	6					
Introduction	to traditional Indian art forms - Chitrakala (Painting), Murthikala / Shilpakala (Sculptures), Vaasth	ukala,					

Sthaapathya kala (Architecture), Sangeeth (Music), Nruthya (Dance) and Sahithya (Literature) – Case Studies.

		Total Contact Hours	:	30
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Co	Course Outcomes:							
On	On completion of the course, the students will be able to							
٠	Understand basic structure of the Indian Knowledge System							
٠	• Apply the basic knowledge of modern science and Indian knowledge system in practice							
٠	Understand the importance Indian Philosophical tradition							
٠	Appreciate the Indian Linguistic Tradition.							
	Understand the concepts of traditional Indian art forms							

Tex	xt Book(s):
1	V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5 th Edition, 2014.
2	Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan.
3	Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan.
4	Fritzof Capra, Tao of Physics.
5	Fritzof Capra, The Wave of life.

Ref	Reference Books(s):								
1	VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad,								
I	Arnakulam.								
2	Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata.								
3	GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016.								
4	RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakashan, Delhi 2016.								

<u>CO - PO – PSO matrices of course</u>

PO/PSO	PO	PO	РО	PO	РО	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
MC19301.1	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.2	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.3	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.4	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
MC19301.5	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1
Average	-	-	-	-	-	1	1	3	2	-	-	1	-	-	1

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation : "-"

SEMESTER IV

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
MA19456	OPTIMIZATION TECHNIQUES FOR AI	BS	3	1	0	4

Ob	Objectives:						
•	To learn the concepts of operations research applied in decision making.						
•	To develop optimisation techniques applied to transportation models.						
•	To understand multistage dynamic programming.						
•	To obtain knowledge of solving problems using non linear programming.						
•	To understand the concepts of project scheduling and critical path.						

UNIT-I	INTRODUCTION TO LINEAR PROGRAMMING		12							
Convex sets	, Convex function, Linear Programming-formulation, solution by gra	aphical and simplex methods, I	rimal							
- Penalty, Two Phase, Principles of Duality.										
UNIT-II	LINEAR PROGRAMMING EXTENSIONS		12							
Transportation Models (Minimising and Maximising Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution										
Assignment Models (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by										
Hungarian.	Fravelling Salesman problem.		. 							
UNIT-III	INTEGER PROGRAMMING		12							
Cutting plan	algorithm - Branch and bound methods, Multistage (Dynamic) prog	ramming.								
UNIT-IV	NON – LINEAR PROGRAMMING		12							
Unconstrain Lagrangian	ed external problems, Newton – Ralphson method – Equality method – Kuhn – Tucker conditions – Simple problems.	constraints – Jacobean meth-	ods –							
UNIT-V	PROJECT SCHEDULING		12							
Network dia	gram representation - Critical path method - Time charts and resource	ce leveling – PERT.								
		Total Contact Hours :	60							

Co	Course Outcomes:								
On	completion of the course, the students will be able to								
•	Solve optimization problems using simplex method.								
•	Analyze problems involving materials and workforce using transportation and assignment models.								
٠	Apply integer programming and linear programming to solve real-life applications.								
•	Apply unconstrained optimisation to problems with non linear objective functions.								
•	Use PERT and CPM for problems in project management								

Tex	Text Book(s):											
-	Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, Seventh	Edition,	Third Indian									
1	Reprint 2004.											
2	S. Boyd and L. Vandenberghe, Convex optimization, Cambridge University press,2004	ŀ.										

Reference Books(s):									
Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.									
G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.									
Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.									
Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.									
Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case	studies								
e	rence Books(s): Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008. G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004. Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case								

<u>CO - PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	PO	РО	РО	PO	РО	РО	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
MA19456.1	3	3	2	3	1	-	-	-	-	-	-	2	3	2	1
MA19456.2	3	3	2	3	1	-	-	-	-	-	-	2	2	2	1
MA19456.3	3	3	2	3	1	-	-	-	-	-	-	2	3	2	2
MA19456.4	3	3	2	3	1	-	-	-	-	-	-	2	2	2	2
MA19456.5	3	3	2	3	1	-	-	-	-	-	-	2	2	2	3
Average	3	3	2	3	1	-	-	-	-	-	-	2	2.4	2	1.8

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
AI19441	WEB DEVELOPMENT	PC	2	0	2	3

Ob	Objectives:				
٠	To understand and practice Embedded Dynamic Client-side Scripting.				
٠	To understand Server-side Programming Language.				
•	To implement manipulation of DOM events.				
٠	To learn basic architecture of Angular and React JS.				

UNIT-I WWW and JAVASCRIPT

WWW: Internet technologies Overview – Internet Standards & Protocols - HTTP. **JAVASCRIPT:** Introduction to Scripting - Data types and Variables - Operators, Expressions and Statements - Functions -Arrays - Objects - Document Object Model - Event Handling – JSON.

UNIT-II SERVLETS

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

UNIT-III PHP

PHP: Variables – Conditions, Branches, Loops - Arrays & Strings - Regular Expressions - Date and Time Functions - Integer and Float Functions - User-Defined Functions - Program control - Form Processing - Cookies - Database Connectivity.

UNIT-IV JQUERY

JQUERY: Introduction to jQuery – Selectors – Elements: Manipulations, Changing and Setting elements – Event Models: Event handlers – Animations & Effects – Functions – Plugins.

UNIT-V ANGULAR 10 and REACTJS 16

ANGULAR 10: TypeScript 3.8 – Node.js 14 - Angular Web Application - Components - Data Binding - Directives - Pipes - Service - Event Binding – Forms. **REACTJS 16:** React Features- ReactJS Vs React native-React JSX-components-state-props-lifecycle-events-forms-router-animation-table.

Contact Hours : 30

6

6

6

6

6

	List of Experiments
1	Create a web page to embed a map along with hot spot, frames & links.
2	Create a web page using an embedded, external and inline CSS file.
3	Create an online job registration page along with java script validations.
4	Develop web page for Library Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.
5	Develop web page for Banking Management System using Servlet and JavaScript program that will validate the controls in the forms you have created for the application and access a data from database.
6	Create a program to implement the concepts of AJAX for web page login process.
7	Develop a Simple game using jQuery.
8	Write a PHP program for Employee Details, which includes EmpID, Name, Designation, Salary, DOJ, etc., to connect with the database and execute queries to retrieve and update data. Also, prepare the report for single and group of employees based on the end user needs.
9	Create an online application in any of the web application like PHP for Tourism management like the available trip details in season based. Type of mode, Concession details for passengers and Booking / Cancelling tickets.
10	Design a web page application using Angular 9

11	Design a registration page along with event handling using Angular 9
12	Design user interface using ReactJS
	MINI-PROJECT (Suggested Domains): a) Inventory Control System
	b) Railway Reservation System
	c) Library Management System
	d) Banking System
	e) Exam Registration
10	f) Stock maintenance system.
13	g) Online course reservation system
	h) E-ticketing
	i) Software personnel management system
	j) Credit card processing
	k) e-book management system
	1) Recruitment system
	m) Foreign trading system
	n) Student Information System
	Contact Hours : 30
	Total Contact Hours : 60

Co	Course Outcomes:			
On	completion of the course, the students will be able to			
•	Design and implement dynamic web page with validation and event handling by applying Java Script.			
•	Design and implement Server-side Programming using Servlet			
•	Design and implement Server-side Programming using PHP			
•	Design and implement client side webpage using jQuery.			
•	Learn and design web application using Angular and React JS			

- How To
ck.io, 2020.
on, 2020.
-

Re	Reference Books:					
1	Jeffrey C and Jackson, Web Technologies A Computer Science Perspective, Pearson Education, 2011.					
2	Bear Bibeault and Yehuda Katz, jQuery in Action, 2008.					
3	Gopalan N.P. and Akilandeswari J., Web Technology, Prentice Hall of India, 2011.					
4	UttamK.Roy, Web Technologies, Oxford University Press, 2011.					

CO - P	'O – PSO	matrices	of	course

PO/PSO CO	РО 1	PO 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19441.1	2	2	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19441.2	3	1	1	-	1	-	-	-	-	-	-	1	2	2	2
AI19441.3	3	2	2	-	1	-	-	-	-	-	-	1	2	2	2
AI19441.4	3	2	2	-	1	-	-	-	-	-	-	2	3	3	3
AI19441.5	3	2	2	-	1	-	-	-	-	-	-	2	3	3	3
Average	2.8	1.8	1.6	-	1	-	-	-	-	-	-	1.4	2.4	2.4	2.4

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
AI19442	FUNDAMENTALS OF MACHINE LEARNING	PC	3	0	2	4

Ob	Objectives:				
•	To know the fundamentals of machine learning.				
٠	Be exposed to linear models.				
•	Be familiar with basic machine learning algorithms with classification.				
٠	To understand machine learning algorithms with clustering.				
•	To learn and apply reinforcement learning techniques.				

UNIT-I FOUNDATIONS OF LEARNING 8 Components of learning – learning models – geometric models – probabilistic models – logical models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning - feasibility of learning - error and noise - training versus testing - theory of generalization - generalization bound approximation generalization trade off - bias and variance - learning curve. UNIT-II LINEAR MODELS Linear classification - univariate linear regression - bivariate regression - multivariate linear regression - regularized regression - Logistic regression. Naïve Baye's - Discriminant Functions -Probabilistic Generative Models Probabilistic Discriminative Models - Bayesian Logistic Regression. UNIT-III SUPERVISED LEARNING 10 Perceptron: - multilayer neural networks - back propagation - learning neural networks structures - support vector machines: - soft margin SVM - going beyond linearity - generalization and over fitting - regularization - validation. Decision trees: Training and Visualizing a Decision Tree - Making Predictions - Estimating Class Probabilities - The CART Training Algorithm - Computational Complexity - Gini Impurity or Entropy - Ensemble methods: Bagging-Boosting- Boosting AdaBoost - Gradient Boosting - Xg boost. UNIT-IV UNSUPERVISED LEARNING Clustering: Nearest neighbor models - K-means - clustering around medoids - silhouttes - hierarchical clustering k-d trees. Dimensionality Reduction: - Linear Discriminant Analysis - Principal Component Analysis - Factor Analysis - Independent Component Analysis. **REINFORCEMENT LEARNING** UNIT-V 8 Passive reinforcement learning - direct utility estimation - adaptive dynamic programming - temporal-difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control. **Contact Hours** : 45

	List of Experiments
1	A python program to implement univariate regression, bivariate regression and multivariate regression.
2	A python program to implement Simple linear regression using Least Square Method
3	A python program to implement logistic model.
4	A python program to implement single layer perceptron.
5	A python program to implement multi layer perceptron with back propagation.
6	A python program to do face recognition using SVM classifier.
7	A python program to implement decision tree.
8	A python program to implement boosting.
9	A python program to implement KNN and K-means.
10	A python program to implement dimensionality reduction – PCA.
11	Mini project – develop a simple application using tensorflow / keras.
	Contact Hours : 30
	Total Contact Hours : 75

Co	Course Outcomes:				
On	On completion of the course, the students will be able to				
•	Understand fundamentals of machine learning.				
٠	Apply the linear models for tuning parameters.				
٠	Understand and explore the machine learning algorithms with classification.				
٠	Apply machine learning algorithms with clustering and feature extraction.				
٠	Apply reinforcement learning techniques for various applications.				

Te	xt Books:									
1	Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd									
Edition. September 21019, Reilly Media, Inc., ISBN: 9781492032649.										
2	Stephen Marsland, —Machine Learning – An Algorithmic Perspectivel, Second Edition, Chapman and Hall/CRC									
2	Machine Learning and Pattern Recognition Series, 2014.									
2	Shai Shalev-Shwartz and Shai Ben-David," Understanding Machine Learning: From Theory to Algorithms",									
3	Cambridge University Press 2014.									

Ref	ference Books:
1	Alex Smola and S.V.N. Vishwanathan," Introduction to Machine Learning", Cambridge University Press 2008.
2	Andreas C. Müller and Sarah Guido," Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, Inc,2016.
3	S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.
4	C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.

Web links for virtual lab:

1 https://www.coursera.org/lecture/python-machine-learning/introduction-4f2So

2 https://nptel.ac.in/courses/106/106/106106139/

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19442.1	3	3	2	-	-	-	-	-	1	-	-	-	3	1	-
AI19442.2	3	3	3	2	-	2	-	-	-	-	-	2	2	3	-
AI19442.3	3	3	3	2	3	-	-	2	2	-	-	-	-	3	-
AI19442.4	3	3	3	-	3	1	-	1	1	-	1	2	2	-	-
AI19442.5	3	3	2	3	2	-	-	1	3	-	3	3	3	3	1
Average	3	3	2.6	1.4	1.4	0.6	-	0.6	0.8	-	0.6	1.4	2	2	0.2

CO - PO – PSO matrices of course

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
CS19443	DATABASE MANAGEMENT SYSTEMS	PC	3	0	4	5

Ob	jectives:
•	To understand the role of a database management system, relational data model and successfully apply logical database design principles, including E-R diagrams.
۲	To Construct simple and moderately advanced database queries using Structured Query Language (SQL).
	To know the importance of functional dependency and normalization, and what role it plays in the database
	design process.
	To familiarize with the concepts of a database transaction including concurrency control, backup and recovery,
•	and data object locking and handling deadlocks.
•	To work with the foundation for NoSQL technologies

UNIT-I INTRODUCTION TO DATABASE SYSTEMS

Introduction – Purpose of Database Systems - View of Data –Database Architecture - Relational Databases – Database Schema – Keys – Codd's Rule – Relational Algebra – Data Models – Entity Relationship Model – Constraints – Entity Relationship Diagram - Design Issues of ER Model – Extended ER Features – Mapping ER Model to Relational Model.

UNIT-II SQL AND QUERY PROCESSING

SQL: Data Definition – Domain types – Structure of SQL Queries - Modifications of the database – Set Operations – Aggregate Functions – Null Values – Nested Sub queries – Complex Queries – Views – Joined relations – Complex Queries – PL/SQL: Functions, Procedures, Triggers, Cursors -Embedded SQL – Query Processing – Heuristics for Query Optimization.

UNIT-III DEPENDENCIES AND NORMAL FORMS

Motivation for Normal Forms – Functional dependencies – Armstrong's Axioms for Functional Dependencies – Closure for a set of Functional Dependencies – Definitions of 1NF-2NF-3NF and BCNF – Multivalued Dependency 4NF - Joint Dependency- 5NF.

UNIT-IV TRANSACTIONS

 Transaction Concept – State – ACID Properties – Concurrency control - Serializability – Recoverability – Locking based protocols – Timestamp Based Protocol - Deadlock handling.

 UNIT-V
 NOSQL DATABASE
 10

 Introduction to NoSQL - CAP Theorem – Data Models - Key-Value Databases - Document Databases - Column Family Stores – Graph Databases – Working of NOSQL Using MONGODB/CASSANDRA.
 10

Contact Hours :

10

10

8

7

45

	List of Experiments
	Introduction to SQL : DDL, DML, DCL, TCL. SQL clause : SELECT FROM WHERE
1	GROUPBY, HAVING, ORDERBY
	Using SQLite/MySQL/Oracle
2	Creation of Views, Synonyms, Sequence, Indexes, Save point.
3	Creating an Employee database to set various constraints and subqueries.
4	Optimize a SQL query construct considering time complexity.
5	Write a PL/SQL block to specify constraints by accepting input from the user.
6	Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling.
7	Implementation of PL/SQL Function.
8	Implementation of PL/SQL Cursor.
9	Implementation of PL/SQL Trigger, Packages.
10	Implementation of NoSQL basic commands using Cassandra/Mongo DB.
11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation, Indexes in NoSQL.
	MINI PROJECT
13	Database Connectivity with Front End
	Tools(Python/C/C++/JAVA)and Back End

Tools(MySQL/SQLite/CASSANDRA/MONGO DB)								
For any problem selected, write the ER Diagram, apply ER mapping rules,	normalize the relations, and f	ollo	W					
the application development process.								
Make sure that the application should have five or more tables, at least one	trigger and one stored proced	ure,						
using suitable frontend tool.								
Indicative areas include								
a) Inventory Control System.								
b) Material Requirement Processing.								
c) Hospital Management System.								
d) Railway Reservation System.								
e) Personal Information System.								
f) Web Based User Identification System.								
g) Timetable Management System.								
Hotel Management System i)Library Management System.								
	Contact Hours	:	60					
	Total Contact Hours	:	105					

Co	Course Outcomes:							
On	On completion of the course, the students will be able to							
٠	Understand the use of the Relational model, ER diagrams.							
•	Apply SQL Queries to define and manipulate the database.							
٠	Comprehend the concept of normalization and apply as a case study.							
•	Know concurrency control and recovery mechanisms.							
٠	Relate the different models of NoSQL databases.							

Tex	Text Books:								
1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Sixth Edition, Tata Mc Graw Hill, 2011.								
2	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.								

Ref	ference Books:
1	Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education,
	2016.
2	C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson
2	Education, 2006.
3	Atul Kahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl," Oracle PL/SQL Programming", 6th edition, Publisher: O'Reill 2014.
5	Kristina Chodorow, Shannon Bradshaw, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, 2019.

We	Web links for virtual lab:							
1	https://livesql.oracle.com/apex							
2	https://www.jdoodle.com/online-mongodb-terminal/							

CO - PO - PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO3
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	1305
CS19443.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
CS19443.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
CS19443.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
CS19443.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
CS19443.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2	2	2.2	2.8	2.3	-	-	-	1.6	1	2	1.3	1.4	1.8	1.7

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
IT19441	OPERATING SYSTEM DESIGN	PC	3	0	4	5

Ob	jectives:
٠	To study the basic concepts and functions of operating systems.
٠	To learn about Processes, Threads, Scheduling algorithms and Deadlocks.
٠	To study various Memory Management schemes.
•	To learn I/O Management and File Systems.
•	To learn the basics of Distributed operating systems.

UNIT-I INTRODUCTION

Operating Systems Overview — OS Structure and Operations –Virtualization - System Calls – Types of System Calls-System Programs-System Boot Process – BIOS – POST- Bootstrap Loader.

UNIT-II PROCESS MANAGEMENT	10				
Process Concepts- Process Scheduling - Operations - Interprocess Communication- Threads Overview -	· CPU				
Scheduling - FCFS - SJF - Priority - RR - Multilevel Queue Scheduling - Multilevel Feedback Queue - F	rocess				
Synchronization - Critical Section Problem - Peterson's Solution - Synchronization Hardware - Semaphores- G	Classic				
Problems of Synchronization - Monitors - Deadlocks - Characterization-Prevention - Avoidance - Detec	tion –				
Recovery.					
UNIT-III MEMORY MANAGEMENT	9				
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Structure of a page table - Segment	ation -				
Virtual Memory - Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames - Thrashing	•				
UNIT-IV I/O MANAGEMENT	9				
File System -Concepts - Access Methods- Directory Structure - Mounting - Protection - File System Implementation	ation –				
Directory Implementation - Allocation Methods - Free-Space Management - Mass Storage Structure -	- Disk				
Scheduling - Disk Management - Swap-Space Management.					
UNIT-V DISTRIBUTED OPERATING SYSTEMS	8				
Introduction to Distributed Systems: Distributed systems: Goals Hardware Concepts Software - c	lesign-				
Communication distributed systems: Layered Protocol: ATM Networks client server model - remote procedure call -					
group communication.					
	4.5				

Contact Hours : 45

9

	List of Experiments		
1	Installation and Configuration of Linux in a Virtual Machine.		
2	Basic Linux commands.		
3	Shell Scripting.		
4	System calls based Programs.		
5	Inter-process Communication using Shared Memory.		
6	Scheduling algorithms.		
7	Producer Consumer Problem Solution using Semaphore.		
8	Deadlock Avoidance algorithm.		
9	Contiguous Memory Allocation.		
10	Page Replacement Algorithms.		
11	File Allocation Strategy.		
12	Study on Customization of Linux Kernel		
	Contact Hours :	60)
	Total Contact Hours :	10	5

Co	ourse Outcomes:
On	completion of the course, the students will be able to
٠	Explain the concepts and structures of Operating Systems.
•	Design various Scheduling algorithms and methods to avoid Deadlock.

•	Compare and contrast various memory management schemes.
٠	Summarize the concepts of I/O management and design a prototype file system.
	Describe the concepts of Distributed operating systems.

Te	xt Books:
1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, Ninth Edition, John

1 Wiley and Sons Inc., 2012.

Re	ference Books:							
1	NikolayElenkov, "Android Security Internals : An In-Depth Guide to Android's Security Architecture, No Starch							
	Press,2015.							
2	William Stallings, "Operating Systems – Internals and Design Principles", 7th Edition, Pearson, 2013.							
3	Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.							
4	Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education", 1996.							
5	D M Dhamdhere, "Operating Systems: A Concept-Based Approach", Second Edition, Tata McGraw-Hill							
5	Education, 2007.							
6	Andrew S.Tanenbaum: Distributed Operating System, Prentice Hall International Inc.							
0	1995.							

<u>CO - PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	DSO3
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	1305
IT19441.1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
IT19441.2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
IT19441.3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
IT19441.4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
IT19441.5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Average	2	2	1.6	1	2.2	-	1	1	1.4	2	2	2	2.6	2.6	1.6

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
GE19421	SOFT SKILLS I	EEC	0	0	2	1

Ob	jectives:
٠	To help students break out of shyness.
٠	To build confidence.
٠	To enhance English communication skills.
٠	To encourage students' creative thinking to help them frame their own opinions.

Learning and Teaching Strategy:

The program is completely student centric where the focus is on activities led by students which include role plays, discussions, debates other games as well. These activities would be supplemented by interactive use of technology and brief trainer input.

Week	Activity Name	Description	Objective
1	Introduction	The trainer and the college facilitator talk to the students about the course and in turn the students introduce themselves.	To set expectations about the course and the students are made aware of the rules and regulations involved in this program
2	If I ruled the world	This is a quick and useful game by getting students to form a circle and provide their point of view. Each student then repeats what the other has said and comes up with their own opinion.	The aim of this activity is to for students to get to know each other and also develop their listening skills as well as learning how to agree and disagree politely.
3	Picture Narrating	This activity is based on several sequential pictures. Students are asked to tell the story taking place in the sequential pictures by paying attention to the criteria provided by the teacher as a rubric. Rubrics can include the vocabulary or structures they need to use while narrating.	The aim of this activity is to make the students develop creative way of thinking.
4	Brainstorming	On a given topic, students can produce ideas in a limited time. Depending on the context, either individual or group brainstorming is effective and learners generate ideas quickly and freely. The good characteristics of brainstorming are that the students are not criticized for their ideas so students will be open to sharing new ideas.	The activity aims at making the students speak freely without the fear of being criticized. It also encourages students to come up with their own opinions.
5	Debate	Is competition necessary in regards to the learning process?	The aim of this activity is to develop the students ability to debate and think out of the box
6	Short Talks	Here the students are given topics for which they take one minute to prepare and two minutes to speak. They can write down points but can't read them out they can only use it as a reference.	The activity aims at breaking the students' shyness and encouraging them to standup in front of the class and speak. It also aims at creating awareness that they are restricted for time so they only speak points that are relevant and important.

7	Debate	Will posting students' grades on bulletin boards publicly motivate them to perform better or is it humiliating?	This activity aims at enhancing the students unbiased thought process when it comes to exams and grades as well as develop their skills to debate.
8	The art of diplomacy	The facilitator proceeds to share multiple concepts of conversation and helps the participants to identify the various methods of being diplomatic and how do deal with misinformation.	The aim of the lesson is to provide an opportunity for the participants to learn about body language and choosing the appropriate words for conversation.
9	Debate	Are humans too dependent on computers?	The aim of this activity is to test the students debating skills and thought process with a topic that affects everybody in daily life.
10	Story Completion	The teacher starts to tell a story but after 2 sentences he/she asks students to work in groups to create the rest of the story which includes the plot and the ending.	This activity aims at building their narrating skills as well as their creativity and ability to work in a team.
11	Role play debate	Students scrutinize different points of view or perspectives related to an issue. For example, a debate about the question "Should students be required to wear uniforms at school?" might yield a range of opinions. Those might include views expressed by a student (or perhaps two students – one representing each side of the issue), a parent, a school principal, a police officer, a teacher, the owner of a clothing store, and others.	The aim of this activity is to get students to speak based on other people's perspective instead of their own. The students take the role of various characters and debate accordingly.
12	I Couldn't Disagree More	This is a game where students practice rebuttal techniques where one student provides a thought or an idea and the other students starts with the phrase I couldn't disagree more and continues with his opinion	The aim of this activity is to improve general communication skills and confidence.
13	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits	The aim is to do both give feedback to students as well as obtain feedback on the course from them.

Cou	Course Outcomes:									
•	Students should be able to be more confident.									
•	Students should be able to speak in front of a large audience.									
•	Students should be able to be better creative thinkers.									
•	Students should be able to be spontaneous.									
•	Students should be able to know the importance of communicating in English.									

RO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
CO2	1	-	-	-	-	-	1	-	1	3	1	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	1
Average	0.2	0	0	0	0.4	0	0.2	0	0.4	3	0.2	0.4	0	0	0.2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER V

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
AI19541	FUNDAMENTALS OF DEEP LEARNING	PC	3	0	2	4

Ob	Objectives:							
•	To introduce the different activation functions.							
•	To familiarize various Training Techniques.							
•	To learn about Convolutional Neural Network.							
•	To introduce the different models of Deep Learning.							
٠	To familiarize generative deep learning.							

UNIT-I IN	TRODUCTION TO DEEP LEARNING		9					
Perceptrons to Neural Networks - Activation Function - Calculating Multidimensional Arrays - Implementing a Three								
Layer Neural Ne	etwork - Designing the Output Layer - Identity Function and Softmax	Function - Handwritte	n Digit					
Recognition. Net	ural Network Training: Learning from Data – Loss Function. CHAPTE	R – 3 & 4 (T1)						
UNIT-II TR	AINING TECHNIQUES		9					
Numerical Differentiation - Gradient - Implementing a Training Algorithm - Stochastic Gradient Descent -								
Momentum - Ac	daGrad – Adam – Initial Weight Values – Regularization – Validating	Hyper parameters. CHA	PTER					
- 4 & 6 (T1)								
UNIT-III CC	ONVOLUTIONAL NEURAL NETWORKS		9					
Overall Architec	ture – The convolution layer – The pooling layer – Implementing the C	onvolution and Pooling	Layers					
- Implementing	a CNN – Visualizing a CNN – Typical CNNs. CHAPTER – 7 (T1)	-	-					
UNIT-IV AC	CELERATING DEEP LEARNING MODELS		9					
Making a Netw	ork Deeper – ImageNet – VGG – GoogLeNet – ResNet – Accelerati	ng Deep Learning – Pi	actical					
Uses of Deep Le	arning – The Future of Deep Learning. CHAPTER – 8 (T1)							
UNIT-V GE	ENERATIVE DEEP LEARNING AND BEST PRACTICES		9					
Generative dee	p learning: Text generation – Deep dream – Neural style transfe	er – Generating image	s with					
variational autoencoders - Introduction to Generative Adversarial Networks. Best practices for the real world:								
Hyperparameter	Hyperparameter optimization - Model ensembling - Scaling up model training. CHAPTER – 12 & 13 (T2)							
		Contact Hours :	45					

List of	List of Experiments										
1.	Implement handwritten digits classification.										
2.	Implement classification model using ImageNet database.										
3.	Study of different frameworks on deep learning (Tensor flow, Keras, PyTorch).										
4.	Implement basic convolutional neural network model for classification using Dogs vs. Cats dataset.										
5.	Implement VGG-16 model for classification using Dogs vs. Cats dataset.										
6.	Implement object recognition using YOLO.										
7.	Implement time series analysis for temperature forecasting using jena weather dataset.										
8.	Implement text processing model using TextVectorization layer for IMDB movie reviews dataset.										
9.	Generate MNIST image using generative adversarial networks.										
	Contact Hours	:	30								
	Total Contact Hours · 75										

Co	Course Outcomes:								
On	On completion of the course, the students will be able to								
٠	Explain the basic concepts of activation function.								
٠	Apply various training techniques.								
٠	Implement convolutional neural network.								

•	Develop different Deep Learning models.
•	Construct deep generative model for various applications.

Tey	Text Books:									
1	Koki Saitoh, "Deep Learning from the Basics - Python and Deep Learning: Theory and Implementation", 2021 Packt Publishing.									
2	François Chollet, "Deep Learning with Python" Second Edition, Manning (ISBN 9781617296864).									

Ref	Reference Books:									
1	Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000.									
2	Satish Kumar, "Neural Networks, A Classroom Approach", Tata McGraw -Hill, 2007.									
3	Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.									

Web link:

1. https://www.manning.com/books/deep-learning-with-python-second-edition

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	PO 1	РО 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AT19541 1	3	3	2	2	1			1				1	3	3	1
/11/041.1	5	,	2	2	1			1				1	5	5	1
AI19541.2	3	3	2	2	2	-	I	2	I	I	-	1	3	3	2
AI19541.3	3	3	3	2	2	-	-	2	-	-	-	1	3	3	1
AI19541.4	3	3	3	2	3	1	1	2	1	1	-	1	3	3	3
AI19541.5	3	3	3	2	3	1	1	2	1	1	-	1	3	3	3
Average	3	3	2.6	2	2.2	1	1	1.8	1	1	-	1	3	3	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
AI19542	DATA SCIENCE USING R	PC	3	0	2	4

Ob	jectives:
٠	To analyze data by applying basic data science techniques.
٠	To understand basic constructs of R.
٠	To learn and applying basic classification techniques.
٠	To learn various black box techniques of classification, market basket analysis and clustering.
•	To evaluate performance of the models.

UNIT-I R DATA STRUCTURES

 Introduction – Managing and understanding data – Console input and output – Data Types – operators – Functions - R

 Data Structures – Vectors – Factors –Lists – Data Frames – Matrices and arrays – import and export files – Exploring and understanding data – Visualization – Categorical variables exploration – Relations between variables. (T1: Chapter – 1 & 2)

 UNIT-II
 CLASSIFICATION METHODS

 9
 Classification – Lazy Learner - K-Nearest Neighbor – diagnosing breast cancer with kNN algorithm – Probabilistic Learner – Naïve Bayes – filtering mobile phone spam with naïve bayes algorithm – Divide and Conquer - Decision Trees and Rules – Understanding decision trees – identifying risky bank loan using C5.0 – Understanding classification rules –.identifying poisonous mushrooms with rule learners. (T1: Chapter – 3, 4 & 5)

 UNIT-III
 PECRESSION AND BLACK BOX METHODS

 UNIT-III
 REGRESSION AND BLACK BOX METHODS
 9

 Forecasting
 numerical data – Understanding regression – predicting medical expenses using linear regression –

 Understanding regression trees and model trees – estimating the quality of wines with regression trees and model trees –

 - Neural
 Networks and SVM – Understanding neural networks – modeling the strength of concrete with ANNs –

 Understanding Support Vector Machines – performance OCR with SVMs. (T1: Chapter – 6 & 7)

 UNIT-IV
 PATTERNS AND CLUSTERING
 9

 Finding Patterns – Market Basket Analysis using Association Rules – Understanding association rules – identifying frequently purchased groceries with association rules – Finding groups of data – Clustering with K-Means – Understanding clustering – Finding teen market segment using k-means clustering. (T1: Chapter – 8 & 9)

 UNIT-V
 EVALUATING MODEL PERFORMANCE
 9

 Measuring performance for classifier – Beyond Accuracy – Kappa – Sensitivity and Specificity – Precision and recall – F-Measure – Visualization with ROC Curve – Estimate future performance – Improving Model Performance with meta learners. (T1: Chapter – 10 & 11)

Contact Hours : 45

9

List of	Experiments
1.	Basics of R – data types, vectors, factors, list and data frames.
2.	Program to implement Breast Cancer with kNN.
3.	Program to implement Filtering Mobile phone spam using Naïve Bayes
4.	Program to implement Risky Bank Loans using Decision Trees
5.	Program to implement Predict medical Expense with Linear Regression.
6.	Program to implement Modeling strength of concrete.
7.	Program to implement Identification of frequently Purchased groceries with Apriori algorithm.
8.	Program to implement Finding Teen Segments of Market.
9.	Program to implement Tuning stock models for better performance.
	Contact Hours : 30
	Total Contact Hours : 75

Co	urse Outcomes:
On	completion of the course, the students will be able to
•	Understand the application and uses of data science techniques.
•	Apply basic constructs of R.
•	Apply data science by various classification techniques.

٠	Apply market basket analysis and clustering techniques.
٠	Evaluate the performance of the models built and fine tune the models to improve them.

Tex	Text Books:								
1	Brett Lantz, "Machine Learning with R", ISBN 978-1-78216-214-8, 2019, Packt Publishing.								
2	Beginning R: The Statistical Programming Language , Mark Gardener, Wrox Wiley Publication, First Edition, 2012								

Ref	Reference Books:							
1	Nina Zumel, John Mount, -Practical Data Science with RI, Manning Publications, 2014							
2	W. N. Venables, D. M. Smith and the R Core Team, -An Introduction to RI, 2013							
3	Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, —Practical Data Science Cookbookl, Packt Publishing Ltd., 2014							

Web link:

1. http://www.johndcook.com/R_language_for_programmers.html

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	РО 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19542.1	2	2	2	1	1	-	-	-	-	-	1	2	2	3	2
AI19542.2	2	2	2	1	1	-	-	-	-	-	2	2	2	3	3
AI19542.3	2	2	2	2	2	-	-	-	-	-	2	3	3	3	3
AI19542.4	2	2	2	2	2	-	-	-	-	-	2	3	3	3	3
AI19542.5	2	2	2	2	2	-	-	-	-	-	2	3	3	3	3
Average	2	2	2	1.6	1.6	-	-	-	-	-	1.8	2.6	2.6	3	2.8

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
CS19541	COMPUTER NETWORKS	PC	3	0	4	5

Ob	jectives:
•	Understand the concepts of computer networks and error detection-correction of data.
•	Be exposed to various addressing schemes and routing protocols.
•	Learn the Transport Layer, flow control and congestion control algorithms.
•	Be familiar with real time applications of networking devices and tools.
	To configure different devices and trace the flow of information between nodes in the network using various
•	tools.

UNIT-I FUNDAMENTALS AND DATA LINK LAYER 9 Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Application Application Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detection and Correction - Reliable transmission. 9 UNIT-II MEDIA ACCESS AND INTERNETWORKING 9 Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels. 9 UNIT- ROUTING 9 III 9 9 Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements. 9 UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 9			0
Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Application Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detection and Correction - Reliable transmission. 9 Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Internet Work access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Internet Work access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Internet Work access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching 9 Internet Work access ARP - DHCP – ICMP- Virtual Networks and Tunnels. 9 UNIT- ROUTING 9 III Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing 9 UNIT- TRANSPORT LAYER 9 IV Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive 9 UNIT-V APPLICATION LAYER 9 <td>UNIT-I FUNDAMENTALS AND DATA LINK LAYER</td> <td></td> <td>9</td>	UNIT-I FUNDAMENTALS AND DATA LINK LAYER		9
Application Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detection and Correction - Reliable transmission. 9 UNIT-II MEDIA ACCESS AND INTERNETWORKING 9 Media Access Protocols – ALOHA - CSMA/CA/CD – Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels. 9 UNIT- III ROUTING 9 Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM. 9 UNIT- IV TRANSPORT LAYER 9 Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements. 9 UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 1	Building a network – Requirements – Layering and protocols – Internet Architecture – Network software -		
Correction - Reliable transmission. 9 UNIT-II MEDIA ACCESS AND INTERNETWORKING 9 Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels. 9 UNIT- ROUTING 9 III 9 9 IV Noting – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM. 9 UNIT- TRANSPORT LAYER 9 IV 0verview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements. 9 UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 1	Application Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detec	ion a	nd
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Media Access Protocols – ALOHA - CSMA/CA/CD –Ethernet – Wireless LANs - 802.11- Bluetooth - Switching and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels. UNIT- ROUTING 9 III 9 Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM. 9 UNIT- TRANSPORT LAYER 9 IV Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements. 9 UNIT-V APPLICATION LAYER 9 E-Mail (S/TP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 1	UNIT-II MEDIA ACCESS AND INTERNETWORKING		9
and Forwarding - Bridges and LAN Switches – Basic Internetworking- IP Service Model – IP fragmentation - Global Addresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels. UNIT- ROUTING III 9 III 9 Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM. 9 UNIT- TRANSPORT LAYER 9 IV 0 9 Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements. 9 UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 9	Media Access Protocols - ALOHA - CSMA/CA/CD - Ethernet - Wireless LANs - 802.11- Bluetooth -	Switc	hing
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III III Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BGP- IPv6 – Multicast routing - DVMRP- PIM. 9 IV IRANSPORT LAYER 9 IV Overview of Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements 9 IV IV 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 9	UNIT- ROUTING		9
Routing – Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing (CIDR) - BCP- IPv6 – Multicast routing - DVMRP- PIM. UNIT- TRANSPORT LAYER 9 IV Overview Transport layer – UDP – TCP - Segment Format – Connection Management – Adaptive Retransmission - TCP Congestion control - Congestion avoidance (DECbit, RED) – QoS – Application requirements 9 UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON.	Ш		
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UNIT-V APPLICATION LAYER 9 E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON. 9	requirements.	-	
E-Mail (SMTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON.	UNIT-V APPLICATION LAYER		9
	E-Mail (SMTP, MIME, POP3, IMAP), HTTP - DNS - FTP - Telnet - web services - SNMP - MIB - RMC	DN.	
Contact Hours : 45	Contact Hours		45

List of E	Experiments							
1.	To Configuration of Network in Linux Environment.							
2.	Learning and Assign of IP Address to computers.							
3.	Implementation of Subnet mask in IP addressing.							
4.	Write a socket PING program to testing the server connectivity.							
5.	Design, Build & Configure Networks using Cisco Packet Tracer tools.							
6.	Study & Implement the different types of Network Cables (RS 232C).							
7.	Implementation of setup a Local Area Network (using Switches) – Minimum 3 nodes and Internet.							
8	Write a socket program Remote Procedure Call using connection oriented / connectionless protocols							
0.	(programs like echo, chat, file transfer etc).							
9.	To Identify the various port & its usage using NMAP tool.							
10	To capture, save, and analyze network traffic on TCP / UDP / IP / HTTP / ARP /DHCP /ICMP /DN	S						
10.	using Wireshark Tool.							
11.	Write a code using Raw sockets to implement packet Sniffing.							
12	Perform a case study using OPNET / NS3 tools about the different routing algorithms to select the							
14.	Network path with its optimum and economical during data transfer.							
13.	Simulation of Link State routing algorithm using OPNET or NS3 tool.							
14.	Simulation of Distance Vector Routing algorithm OPNET or NS3 tool.							
15.	15. To Analyze the different types of servers using Webalizer tool.							
	Contact Hours : 60							
	Total Contact Hours :	105						

Course Outcomes:								
On completion of the course, the students will be able to								
•	Choose the required functionality at each layer for given application.							
٠	Trace the flow of information from one node to another node in the network.							
•	Apply the knowledge of addressing scheme and various routing protocols in data communication to select optimal path.							
•	Monitor the traffic within the network and analyze the transfer of packets.							
٠	Develop real time applications of networks using different tools.							

Text Books:							
1	Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.						
2	Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition, McGrawHill, 2017.						

Reference Books:						
1	William Stallings, "SNMP, SNMPv2, SNMPv3 and RMON 1 and 2", Third Edition, Pearson Edition, 2009.					
2	James F. Kurose, Keith W. Ross, Computer Networking - A Top-Down Approach Featuring the Internet,					
	Seventh Edition, Pearson Education, 2017.					
3	Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 5th Edition, Prentice Hall publisher, 2010.					
4	William Stallings, "Data and Computer Communications", Eighth Edition, Pearson Education, 2011.					

Web link:

1. https://realpython.com/python-sockets/

CO - PO – PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CS19541.1	3	2	1	0	3	1	1	1	1	0	1	1	2	1	1
CS19541.2	2	2	1	0	2	1	1	0	0	0	2	2	1	1	1
CS19541.3	3	3	1	0	3	0	1	0	0	0	2	1	2	3	2
CS19541.4	2	3	0	0	3	1	1	1	0	0	2	2	1	2	3
CS19541.5	3	2	2	2	3	0	1	1	0	0	3	3	3	3	3
Average	2. 6	2. 4	1	2	2.8	1	1	0.6	1	0	2	1.8	1.8	2	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"
Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
CB19342	COMPUTATIONAL STATISTICS	BS	3	0	2	4

Ob	jectives:
٠	To study the mean, variance, linear regression models and error term for use in Multivariate data analysis.
•	To understand the relationship of the data collected for decision making.
•	To know the concept of principal components, factor analysis and cluster analysis for profiling and interpreting the data collected.

UNIT-I 9 MULTIVARIATE NORMAL DISTRIBUTION Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters. UNIT-II **DISCRIMINANT ANALYSIS** Q Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties. PRINCIPAL COMPONENT ANALYSIS UNIT-III 9 Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot. UNIT-IV FACTOR ANALYSIS 9 Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores. UNIT-V CLUSTER ANALYSIS 9 Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters. **Contact Hours** 45

List of Experiments Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, 1. Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files – Reading and Writing Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More 2. Graph Types, Getting and setting values, Patches. Multivariate data analysis: Multiple regression, multivariate regression, cluster analysis with various algorithms, factor analysis, PCA and linear discriminant analysis. Various datasets should be used for each 3. topic. **Contact Hours** : 30 **Total Contact Hours** : 75

Co	Course Outcomes:									
On	On completion of the course, the students will be able to									
	Analyze means and variances of the individual variables in a multivariate set and also the correlations between									
•	those variables.									
•	To find discriminants, rules to optimally assign new objects to the labelled classes.									
•	Apply the principal component techniques to reduce data and to interpret.									
•	To reduce the number of variables in regression models using Factor analysis									
•	Apply the techniques of clustering methods for massive amounts of data.									

Te	xt Books:
1	T.W. Anderson."An Introduction to Multivariate Statistical Analysis". Wiley, Third edition, 2003
2	J.D. Jobson,"Applied Multivariate Data Analysis", Volume I & II, Springer texts in statistics, New York, Fourth Edition 1999.
3	Python 3 for Absolute Beginners, Tim Hall and J-P Stacey. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.
4	Mark Lutz.,"ProgrammingPython"O'Reilly Media ,Germany, Fourth edition, 2011.

Ref	ference Books / Web links:
1	D.A. Belsey, E. Kuh and R.E. Welsch,"Regression Diagnostics, Identifying Influential Data and Sources of
-	Collinearety"
r	Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, "Introduction to Linear Regression Analysis",
2	Fifth Edition, Wiley, 2012.
3	Johnson R.A. &Wichern, D.W, "Applied Multivariate Statistical Analysis", Sixth Edition, Pearson, 2018.
4	Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Third Edition, Apress, 2005.
5	M.R. Anderberg, "Cluster Analysis for Applications", Academic Press.
-	

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CB19342.1	3	2	3	3	2	1	-	-	-	2	2	-	2	2	2
CB19342.2	3	3	2	3	2	1	-	-	-	1	2	I	2	2	2
CB19342.3	3	3	2	3	3	1	-	-	-	1	2	I	2	3	2
CB19342.4	3	3	2	3	3	2	-	-	-	2	2	I	2	3	3
CB19342.5	3	3	2	3	3	2	-	-	-	2	2	-	2	3	3
Average	3.0	2.8	2.2	3.0	2.6	1.4	-	-	-	1.6	2.0	-	2.0	2.6	2.4

Subject Code	Subject Name (Laboratory Course)	Category	L	Т	Р	С
AI19511	MOBILE APPLICATION DEVELOPMENT LABORATORY	РС	0	0	2	1
	FOR ML AND DL APPLICATIONS					

0	bjectives: Broad objective of this course is
	To know the components and structure of mobile application development frameworks for android and windows OS-
	based mobiles.
●	To understand how to work with various mobile application development frameworks.
•	To learn the basic and important design concepts and issues of development of mobile applications.
•	To be familiar with text and speech processing applications.
•	To be familiar with image processing applications.

 Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & apk file extension Android API levels (versions & version names). Android Java Basics: Getting started with Android developme project folder structure, simple programming, running project, generating build/APK of the app from Andro Studio. Develop an application to change the font and color of the text and display toast message when the user press the button. Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [Ye scientific calculator should contain +, *, /, =, cos, sin, tan, pow, sqrt, log, Natural Log and mod]. Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop android application to perform the following operation using SQLite developer classes. a. Insert student Details b. Update the student Record c. Delete a specified record. View the details. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 	List o	f Experiments							
 Develop an application to change the font and color of the text and display toast message when the user press the button. Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [Ye scientific calculator should contain +, *, /, =, cos, sin, tan, pow, sqrt, log, Natural Log and mod]. Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop android application to perform the following operation using SQLite developer classes. a. Insert student Details b. Update the student Record c. Delete a specified record. View the details. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an android application to capture image using camera and displaying the image using image view (DecLearning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (DecLearning based application). 9. Develop an android application). 	1.	Introduction: About Android, Pre-requisites to learn Android, Dalvik Virtual Machine & .apk file extension, Android API levels (versions & version names). Android Java Basics: Getting started with Android development, project folder structure, simple programming, running project, generating build/APK of the app from Android Studio.							
 3. Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [Yet scientific calculator should contain +, *, /, =, cos, sin, tan, pow, sqrt, log, Natural Log and mod]. 4. Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop android application to perform the following operation using SQLite developer classes. a. Insert student Details b. Update the student Record c. Delete a specified record. View the details. 5. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 	2.	Develop an application to change the font and color of the text and display toast message when the user presses the button.							
 4. Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop android application to perform the following operation using SQLite developer classes. a. Insert student Details b. Update the student Record c. Delete a specified record. View the details. 5. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an android application to capture image using camera and displaying the image using image view (DecLearning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (DecLearning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 	3.	Develop a scientific calculator to perform arithmetic and mathematical functions using Math class. [Your scientific calculator should contain $+$, $*$, $/$, $=$, cos, sin, tan, pow, sqrt, log, Natural Log and mod].							
 a. Insert student Details b. Update the student Record c. Delete a specified record. View the details. 5. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 	4.	Create a Database table with the following structure using SQLite: Student (Name, roll no, Marks) Develop an android application to perform the following operation using SQLite developer classes.							
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 c. Delete a specified record. View the details. 5. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 		b. Update the student Record							
 5. Design an android activity with two text boxes where the user can enter (username and ID) and a butt (validate). Validate the entered username and ID field for the following using android code. a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 1. Total Contact Hours: 2. 30 		c. Delete a specified record. View the details.							
 a. Both the fields should not be empty, b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 	5.	Design an android activity with two text boxes where the user can enter (username and ID) and a button (validate). Validate the entered username and ID field for the following using android code.							
 b. Name field should have alphabets, c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deelearning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 		a. Both the fields should not be empty.							
 c. ID field should have numeric values (only 4-digit). 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 		b. Name field should have alphabets,							
 6. Develop an android application to perform the following: (Machine Learning based application) a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). 1. Total Contact Hours : 30 		c. ID field should have numeric values (only 4-digit).							
 a. Text to Speech b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deer Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30 	6.	Develop an android application to perform the following: (Machine Learning based application)							
b. Speech to Text 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30		a. Text to Speech							
 7. Develop an application to read OCR on road signs (Deep Learning based application). 8. Develop an android application to capture image using camera and displaying the image using image view (Deet Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30 		b. Speech to Text							
 8. Develop an android application to capture image using camera and displaying the image using image view (Dee Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30 	7.	Develop an application to read OCR on road signs (Deep Learning based application).							
Learning based application). 9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30	8.	Develop an android application to capture image using camera and displaying the image using image view (Deep							
9. Develop an android app for barcode scanning (Deep Learning based application). Total Contact Hours : 30		Learning based application).							
Total Contact Hours : 30	9.	Develop an android app for barcode scanning (Deep Learning based application).							
		Total Contact Hours : 30							

Course Outcomes: On completion of the course, the students will be able to	
• Learn the components of mobile application development.	
• Gain the knowledge of how to work with various mobile application development frameworks.	
Acquire the basic and important design concepts and issues of development of mobile applications.	
Deploy simple text and speech processing.	
• Develop simple image processing mobile applications.	

CO/PO	PO 1	PO 2	PO 2	PO 4	PO 5	PO	PO 7	PO	PO	PO1	PO1	PO1	PSO 1	PSO	PSO	PSO
	1	4	3	4	5	0	1	0	9	U	L	4	I	4	3	4
AI19511.1	3	3	3	3	3	3	2	2	-	-	1	3	3	3	2	3
AI19511.2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2	3
AI19511.3	3	3	3	3	3	-	-	2	2	-	2	2	3	2	3	3
AI19511.4	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3	3
AI19511.5	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3	3
Average	3	3	3	3	3	2	1.1	0.8	0.4	-	1.6	2	3	2.8	2.6	3

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial(High)

No correlation : "-"

Subject Code	Subject Name (Employability Enhancement Courses)	Category	L	Т	Р	С
GE19521	SOFT SKILLS II	EEC	0	0	2	1

Ob	Objectives:						
•	To help students break out of shyness.						
•	To build confidence.						
•	To enhance English communication skills.						
•	To encourage students' creative thinking to help them frame their own opinions.						

Learning and Teaching Strategy:

Week	Activity Name	Description	Objective
1	The News hour	Students are made to read news articles from the English newspapers. The students also have to find words and their meaning from the article they have not come across before and share it with the group. They then use these words in sentences of their own.	The aim of this activity is not only to get the students to read the newspaper but also aims at enhancing the students' vocabulary.
2	Court Case	The facilitator provides the participants the premise of a story and proceeds to convert the story into a court case. The students are required, department wise to debate and provide their points to win the case for their clients.	The aim of the lesson is to encourage creative and out-of-the-box thinking to ensure a good debate and defense skills.
3	The ultimate weekend	The students design activities they are going to do over the weekend and they have to invite their classmates to join in the activity. The students move around the class and talk to other students and invite them.	The aim of this activity is to develop the art of conversation among students. It also aims at practicing the grammatical structures of "going to" "have to" and asking questions.
4	The Four Corners	This is a debate game that uses four corners of the classroom to get students moving. The following is written on the 4 corners of the room "Strongly Agree, Somewhat Agree, Somewhat Disagree and Strongly Disagree". The topics are then given to the class and students move to the corner that they feel best explains their opinions.	This activity aims at getting students to come up with their own opinions and stand by it instead of being overshadowed by others and forcing themselves to change based on others opinions.
5	Debate	Boarding school or day school? Which is more beneficial for a student?	The aim of this activity is to encourage students to draw up feasible points on the advantages and benefits of both. And enhance their debating ability
6	Grand Master	The facilitator starts the session by keeping an individual in mind, upon which the students guess it only through "Yes or No" questions. Post few trials the students are given same opportunity to do the same with the crowd.	The aim of the lesson is designed to teach the art of questioning. It also helps to enhance the students' speaking and listening skills.
7	Debate	Does violence on the TV and Video games influence children negatively?	This activity aims at encouraging the students to debate on real life scenarios that most students spend a lot of time on.

8	Turn Tables	This is a speaking activity where the students need to speak for and against the given topics when the facilitator shouts out 'Turn Table'.	The aim of this activity is to make the participants become spontaneous and have good presence of mind.
9	Debate	Do marks define the capabilities of a student?	This debate activity aims at allowing the students to argue on this worrisome adage of marks.
10	FictionAD	The Participants are asked to create an Ad for a challenging topic only using fictional characters.	The activity aims at developing their creativity and presentation skills.
11	Debate	Are social networking sites effective, or are they just a sophisticated means for stalking people?	This activity aims at refining the students debating skills on a very real life situation.
12	Talent Hunt	Talent Hunt is a fun activity where the students are selected at random and supported to present any of their own skills.	The aim of this activity is designed to evoke their inner talents and break the shyness and the fear of participating in front of a crowd.
13	Feedback	At the end of the session in the final week (12) the trainer would provide feedback to the students on best practices for future benefits.	The aim is to do both give feedback to students as well as obtain feedback on the course from them.

Cou	Course Outcomes:							
•	Be more confident							
•	Speak in front of a large audience without hesitation							
•	Think creatively							
•	Speak impromptu							
•	Communicate in English							

RO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
GE19521.1	-	-	-	-	-	-	-	-	2	3	1	1	2	3	3
GE19521.2	-	-	-	-	-	-	-	-	2	3	2	-	-	1	2
GE19521.3	-	1	-	-	-	-	-	-	2	3	1	1	-	2	3
GE19521.4	-	-	-	-	-	-	-	-	2	3	-	-	1	1	1
GE19521.5	-	1	-	-	-	-	-	-	2	3	1	1	3	3	3
Average	0	1	0	0	0	0	0	0	2	3	1.25	1	2	2	2.4

SEMESTER VI

Subject Code	Subject Name (Theory Courses)	Category	L	Т	Р	С
BA19602	FUNDAMENTALS OF ACCOUNTING	HS	3	0	0	3

Ob	jectives:
	To create an awareness about the importance and usefulness of the accounting concepts and their managerial
•	implications.
	To develop an understanding of the financial statements and the underlying principles and learn to interpret
•	financial statements.
٠	To create awareness about cost accounting, different types of costing and cost management.
	Understand how financial statement information can help solve business problems and increase the ability to
•	read and understand financial statements and related information

Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls. UNIT-II FINANCIAL ACCOUNTING 9 Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
Statements. Company Accounts and Annual Reports- Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls. UNIT-II FINANCIAL ACCOUNTING 9 Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
Report, Notes to Accounts, Pitfalls. 9 UNIT-II FINANCIAL ACCOUNTING 9 Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
UNIT-II FINANCIAL ACCOUNTING 9 Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
Book Keeping and Record Maintenance, Fundamental Principles and Double Entry, Journal format - Ledger format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
format-Trial Balance format - balance sheets, Final accounts-cash books and subsidiary books - Introduction to Capital Expenditure and Capital Revenue							
to Capital Expenditure and Capital Revenue							
UNIT-III ANALYSIS OF FINANCIAL STATEMENTS 9							
Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting							
Standards. Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam							
UNIT-IV MANAGEMENT ACCOUNTING 9							
Introduction, How to prepare – Cash flow and Fund flow, Difference between them.							
UNIT-V COST ACCOUNTING 9							
Elements of Cost, Cost Behavior, Cost Allocation, Overhead Allocation, Unit Costing, Process Costing, Job							
Costing Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis, Class							
Discussion: Application of costing concepts in the Service Sector.							
Contact Hours : 45							

Co	Course Outcomes:									
On	On completion of the course, the students will be able to									
•	Understand the theories, concept, and evolution of management.									
•	Demonstrate the ability to employ the management way of thinking.									
	Understand how organizations work and find it easier to grasp the intricacies of other management areas such									
•	as finance, marketing, strategy etc.									
•	Understand the qualities of a leader in the managerial aspect in future terms.									
•	Understand the managerial ethics and CSR and its importance.									

Tey	xt Books:
1	Robert N Anthony, David Hawkins, Kenneth Marchant, "Accounting: Texts and Cases", Thirteenth Edition,
1	McGraw-Hill, 2017.
2	M.Y.Khan&P.K.Jain, "Management Accounting", Tata McGraw Hill, 2011.
3	R.Narayanaswamy, Financial Accounting – A managerial perspective, Fifth Edition, PHI Learning, New Delhi,
0	2011.

Re	ference Books:
1	Jan Williams, "Financial and Managerial Accounting – The basis for business Decisions", Fifteenth Edition,
1	Tata McGraw Hill Publishers, 2010.
2	Horngren, Surdem, Stratton, Burgstahler, Schatzberg, "Introduction to Management Accounting", Sixteenth
2	Edition, PHI Learning, 2014.
3	Stice&Stice," Financial Accounting Reporting and Analysis", Eight Edition, Cengage Learning, 2010.
4	SinghviBodhanwala, "Management Accounting -Text and cases", Third Edition, PHI Learning, 2018.
5	Ashish K. Battacharya, Introduction to Financial Statement Analysis, Elsevier, 2009.

CO - PO - PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	DSO2
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	P305
BA19602.1	2	1	2	1	2	3	2	2	-	-	2	2	-	-	-
BA19602.2	2	1	2	2	2	3	3	3	-	-	2	2	-	-	-
BA19602.3	2	1	2	3	2	3	2	2	-	-	2	2	-	-	-
BA19602.4	2	1	2	3	2	3	1	1	-	-	2	2	-	-	-
BA19602.5	2	1	2	3	2	3	2	2	-	-	2	2	-	-	-
Average	2	1	2	2.4	2	3	2.2	2	-	-	2	2	-	-	-

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
AI19641	COMPUTER VISION AND ITS APPLICATIONS	PC	3	0	2	4

Ob	Objectives:				
•	Learn the basic concepts of image processing and computer vision.				
•	Understand the ideas about image segmentation and feature based alignment.				
•	Explore the ideas of Image Recognition and restoration.				
٠	Interpret various CNN model for object detection in Computer Vision.				
•	Identify possible solutions to Train common problems with GAN model.				

INTRODUCTION UNIT-I

Introduction : Image formation -Geometric primitives and transformations - Photometric image formation - The digital camera- Image processing - Point operators - Linear filtering -More neighborhood operators -Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization - Feature detection and matching Points and patches - Edges – Lines (Chapter 1,2,3,4 of T1) 8

UNIT-II IMAGE SEGMENTATION

Segmentation : Active contours - Split and merge - Mean shift and mode finding - Normalized cuts -Graph cuts and energy-based methods - Feature-based alignment - 2D and 3D feature-based alignment - Pose estimation -Geometric intrinsic calibration. (chapter 5,6 of T1) 10

UNIT-III IMAGE RECOGNITION AND RESTORATION

Object detection -Face recognition -Instance recognition - Category recognition -Context and scene understanding -Recognition databases and test set, **3D reconstruction** : Shape from X - Active range finding - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction -Recovering texture maps and albedos (chapter 12 and 14 of T1)

OBJECT DETECTION IN COMPUTER VISION UNIT-IV

CNN architectures-components of a CNN- Image classification using CNNs- Object detection with R-CNN, Object detection with Single-shot detector (SSD)- High-level SSD architecture- Base network- Multi-scale feature layer-Architecture of the multi-scale layers. case study: Train an SSD network in a self-driving car application(Link 5 Chapter 3,6, and 7)

UNIT-V	GENERATIVE ADVERSARIAL NETWORKS			8
Overview of	GAN Structure-Discriminator-Discriminator Training Data-Generator-GA	N Training-Converge	nce	-Loss
Functions-M	inimax Loss-Modified Minimax Loss-Wasserstein Loss. Case study:			
Build and tra	in a GAN for generating hand-written digits in the TF-GAN (Link 5 chapter	r 8,Link 6)		
		Contact Hours	:	45

	List of Experiments					
1.	Write a program to demonstrate the working of CNN architecture to	classify images				
2.	Build a simple CNN model for image segmentation					
3.	Build and train a CNN model for Face recognition(L3)					
4.	Design and train a model for objects detection with real time example	le				
5.	Design and implement Multiple Object Tracking using OpenCV(L9)					
6.	Load and implement the Face Detection method in OpenCV using p	ython (L9)				
7.	Train an SSD network in a self-driving car application(L5)					
8.	A PyTorch implementation of Object Detection with Single Shot Det	tector (L8)				
9.	Building a simple Generative Adversarial Network (GAN) using Ten	sorFlow				
10.	Build and train a GAN for generating hand-written digits(L5)					
		Contact Hours	:	30		
		Total Contact Hours	:	75		

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING R2019

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Co	Course Outcomes:				
On	On completion of the course, the students will be able to				
٠	Design the computer vision application.				
٠	Explain the issue of segmentation in computer vision algorithms and implement in open CV.				
٠	Design and Build a CNN model for image recognition and object detection.				
٠	Train the CNN model with different real time application.				
•	Build and train a GAN for generating hand written digits and other applications.				

Tey	Text Books:				
1	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.				
2	D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2 nd edition, 2012 Pearson Education.				

Reference Books:

1	Richard Hartley and Andrew Zisser man, Multiple view geometry in computer vision 2nd edition, Cambridge University press, 2015 (printing).
2	Anil Jain K, "Fundamentals of Digital Image Processing", Prentice-Hall of India, 2001.

Web link:

- 1. http://vision.deis.unibo.it/fede/dida/computer_vision/
- 2. https://www.datacamp.com/community/tutorials/face-detection-python-opencv
- 3. https://vinsol.com/blog/2016/06/28/computer-vision-face-detection/
- 4. <u>https://github.com/microsoft/computervision-recipes</u>
- 5. https://livebook.manning.com/book/grokking-deep-learning-for-computer-vision/chapter-7/286
- 6. <u>https://developers.google.com/machine-learning/gan/applications</u>
- 7. https://www.pyimagesearch.com/2016/07/25/convolutions-with-opencv-and-python/
- 8. https://github.com/enginBozkurt/Object Detection With SSD
- 9. https://opencv.org

CO - PO - PSO matrices of course

PO/PSO	PO 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
0															
AI19641.1	-	2	-	3	3	-	-	-	-	-	-	-	2	3	2
AI19641.2	-	2	2	3	2	-	-	1	-	-	-	-	2	3	2
AI19641.3	2	3	-	3	2	-	-	1	-	-	-	-	2	3	2
AI19641.4	-	2		3	3	3	1	-	2	-	-	-	2	3	2
AI19641.5	-	2	-	3	2	-	-	2	2	-	-	-	2	3	2
Average	2	2.2	2	3	2.4	3	1	1.3	2	-	-	-	2	3	2

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С	
AI19642	TIME SERIES ANALYSIS AND FORECASTING	PC	3	0	2	4	

Ob	Objectives:				
٠	To understand the basic concepts of time series analysis.				
٠	To familiarize the basic statistical methods to modeling, analyzing, and forecasting time series data.				
٠	To learn the application of regression models for forecasting.				
٠	To explore Autoregressive Integrated Moving Average (ARIMA) Models.				
٠	To introduce multivariate time series and forecasting models.				

UNIT-I INTRODUCTION OF TIMESERIES ANALYSIS

Time Series and Forecasting -Different types of data-Internal structures of time series-Models for time series analysis-Autocorrelation and Partial Autocorrelation-Examples of Time series- Nature and uses of forecasting-Forecasting Process-Data for forecasting –Resources for forecasting.(T2-CHAPTER NO:1, T1-CHAPTER NO 1)

STATISTICS BACKGROUND FOR FORECASTING UNIT-II

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Graphical Displays-Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modelling and Forecasting- Evaluating and Monitoring Forecasting Model Performance. (T1- CHAPTER NO:2) 0

UNIT-III REGRESSION ANALYSIS AND FORECASTING Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression-Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression -Generalized and Weighted Least Squares- Regression Models for General Time Series Data. (T1- CHAPTER NO:2)

UNIT-IV AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS 9 Linear models for stationary time series - Finite order moving average processes - Finite order autoregressive processes -Mixed autoregressive-moving average Processes - Non stationary processes - Time series model building forecasting ARIMA processes - Seasonal processes. (T1- CHAPTER NO:5)

MULTIVARIATE TIME SERIES MODELS AND FORECASTING METHODS UNIT-V

Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting. (T1-CHAPTER NO:7) 45 :

Contact Hours

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List of Experiments Implement programs for time series data cleaning, loading and handling times series data and pre-processing techniques. Implement programs for visualizing time series data. Implement programs to check stationary of a time series data. Implement programs for estimating & eliminating trend in time series data- aggregation, smoothing. Develop a linear regression model for forecasting time series data.

Implement program to apply moving average smoothing for data preparation and time series forecasting. 6. Implement program for decomposing time series data into trend and seasonality. 7. 8. Create an ARIMA model for time series forecasting. Develop neural network-based time series forecasting model. 9. 10. Develop vector auto regression model for multivariate time series data forecasting. **Contact Hours** 30 : **Total Contact Hours** 75 :

Course Outcomes:

On completion of the course, the students will be able to

- Explain the basic concepts in time series analysis and forecasting.
- Apply various time series models for forecasting.
- Analyze various time series regression models.
- Distinguish the ARIMA modelling of stationary and non stationary time series.

• Compare with multivariate times series and other methods of applications.

Tex	xt Books:
1	Introduction To Time Series Analysis and Forecasting, 2nd Edition, Wiley Series in Probability and Statistics, By
I	Douglas C. Montgomery, Cheryl L. Jen (2015).
2	Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek PalDr. Pks Prakash
2	(2017).

Re	ference Books:
1	Time Series Analysis and Forecasting by Example Soren Bisgaard Murat Kulahci Technical University of
1	Denmark Copyright c2011 By John Wiley & Sons, Inc.
2	Peter J. Brockwell Richard A. Davis Introduction to Time Series and Forecasting Third Edition. (2016).
2	Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical Science Temple
3	University, Philadelphia, PA, SA 2019 John Wiley & Sons Ltd 2019.
4	Time Series Analysis and Forecasting by Example Soren Bisgaard Murat Kulahci Technical
	University Of Denmark Copyright c 2011 By John Wiley & Sons, Inc.

Web link:

1. https://b-ok.cc/book/3413340/2eb247

2.https://b-ok.cc/book/2542456/2fa941

3.https://b-ok.cc/book/1183901/9be7ed

4. https://www.coursera.org/learn/practical-time-series-analysis

CO - PO - PSO matrices of course

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19642.1	2	1	1	1	2	-	-	-	-	-	-	2	3	3	2
AI19642.2	2	2	1	1	2	-	-	-	-	-	-	2	3	3	2
AI19642.3	2	2	3	1	3	-	-	-	1	-	1	2	3	3	2
AI19642.4	2	2	3	1	3	-	-	-	1	-	1	2	3	3	2
AI19642.5	2	2	3	1	3	-	-	-	1	-	1	2	3	3	2
Average	2	1.8	2.2	1	2.6	-	-	-	1	-	1	2	3	3	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С	
AI19643	FOUNDATIONS OF NATURAL LANGUAGE PROCESSING	PC	3	0	2	4	

Ob	Objectives:							
•	To understand the concepts and techniques of Natural language Processing for analyzing words based on							
	Morphology and CORPUS.							
•	To learn mathematical foundations, Probability theory with Linguistic essentials such as syntactic analysis of text.							
	To learn mathematical foundations, Probability theory with Linguistic essentials such as and semantic analysis of							
•	text.							
•	To familiarize the Statistical learning methods from deep learning.							
•	To interpret cutting-edge research models from deep learning.							

INTRODUCTION TO NLP UNIT-I Introduction to NLP - Various stages of NLP - The Ambiguity of Language: Why NLP Is Difficult Parts of Speech: Nouns and Pronouns, Words: Determiners and adjectives, verbs, Phrase Structure. Statistics Essential Information Theory : Entropy, perplexity, The relation to language, Cross entropy(T1:Chapters 1,2,3) TEXT PREPROCESSING AND MORPHOLOGY UNIT-II Character Encoding, Word Segmentation, Sentence Segmentation, Introduction to Corpora, Corpora Analysis. Inflectional and Derivation Morphology, Morphological analysis and generation using Finite State Automata and Finite State transducer (T1:Chapters 4) UNIT-III LANGUAGE MODELLING Q Words: Collocations- Frequency-Mean and Variance – Hypothesis testing: The t test, Hypothesis testing of differences, Pearson's chi-square test, Likelihood ratios. Statistical Inference: n -gram Models over Sparse Data: Bins: Forming Equivalence Classes- N gram model - Statistical Estimators- Combining Estimators(T1:Chapters 5, 6)) UNIT-IV WORD SENSE DISAMBIGUATION 9 Methodological Preliminaries, Supervised Disambiguation: Bayesian classification, An information theoretic approach, Dictionary-Based Disambiguation: Disambiguation based on sense, Thesaurus based disambiguation, Disambiguation based on translations in a second-language corpus.(T1:Chapters 7) UNIT-V MARKOV MODEL AND POS TAGGING 9 Markov Model: Hidden Markov model, Fundamentals, Probability of properties, Parameter estimation, Variants, Multiple input observation. The Information Sources in Tagging: Markov model taggers, Viterbi algorithm, Applying HMMs to POS tagging, Applications of Tagging. (T1:Chapters 9,10)

Contact Hours : 9

45

	List of Experiments								
1.	Perform Morphological Analysis for an interrogative sentence, declarative sentence and complex sentences with more two sentences connected using conjunctions.								
2.	Perform Coarse-grained POS Tagging and Fine-grained POS Tagging.								
3.	Named Entity Recognition with Python.								
4.	Sentiment Analysis with Python.								
5.	Keyword Extraction with Python.								
6.	Spelling Correction Model with Python.								
7.	Resume Screening with Python.								
8.	Twitter Sentiment Analysis.								
9.	NLP For WhatsApp Chats.								
10.	NLP for Other languages.								
	Contact Hours : 30								
	Total Contact Hours:75								

Co	Course Outcomes:							
On	On completion of the course, the students will be able to							
•	Realize semantics and pragmatics of English language for text processing							
•	Create CORPUS linguistics based on digestive approach (Text Corpus method)							
•	Check a current methods for statistical approaches to machine translation.							
	Demonstrate the state-of-the-art algorithms and techniques for text-based processing of natural language with							
	respect to morphology.							
•	Develop a Statistical Methods for Real World Applications and explore deep learning based NLP.							

Te	Text Books:							
1	Christopher D. Manning and HinrichSchutze, "Foundations of Natural Language Processing", 6th Edition, The							
	MIT Press Cambridge, Massachusetts London, England, 2003 2009.							
2	Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd edition, Prentice Hall, 2009.							

Ref	ference Books:
1	NitinIndurkhya, Fred J. Damerau "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010.
2	James Allen "Natural Language Understanding", Pearson Publication 8th Edition. 2012
3	Chris Manning and HinrichSchütze, "Foundations of Statistical Natural Language Processing", 2nd edition, MITPress Cambridge, MA, 2003.
4	Hobson lane, Cole Howard, Hannes Hapke, "Natural language processing in action" MANNING Publications, 2019.
5	Alexander Clark, Chris Fox, Shalom Lappin, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell, 2012
6	Rajesh Arumugam, RajalingappaShanmugamani "Hands-on natural language processing with python: A practical guide to applying deep learning architectures to your NLP application". PACKT publisher, 2018.

Web link:

1. https://blog.algorithmia.com/introduction-natural-language-processingnlp

2. https://www.udacity.com/course/natural-language-processingnanodegree--nd892

3. https://www.coursera.org/learn/language-processing

4. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part- processing-understanding-text-

<u>9f4abfd13e72</u>

5. https://www.edx.org/course/natural-language-processing

CO - PO – PSO matrices of course

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19643.1	2	1	3	3	3	3	-	-	2	2	2	2	3	3	3
AI19643.2	2	1	3	3	3	3	-	-	2	2	2	2	3	3	3
AI19643.3	2	1	3	3	3	3	-	-	2	2	2	2	3	3	3
AI19643.4	2	3	3	3	3	3	-	-	2	2	2	2	3	3	3
AI19643.5	2	3	3	3	3	3	-	-	2	2	2	2	3	3	3
Average	2	1.8	3	3	3	3	-	-	2	2	2	2	3	3	3

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
AI19644	IOT ARCHITECTURE AND ITS PROTOCOLS	PC	3	0	2	4

Ob	Objectives:						
•	To learn basics of Embedded Systems Architecture.						
•	To understand ISA Architecture Models and memory interfaces.						
•	To interpret Smart Objects and IoT Architectures.						
•	To familiarize about various IOT-related protocols.						
	To build simple IoT Systems using Arduino and Raspherry Pi						

UNIT-I IOT FUNDAMENTALS

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs. (Chapter 1 of T1)

UNIT-II IOT REFERENCE ARCHITECTURE, SOFTWARE DESIGN

Control Units – Communication modules – Bluetooth – Zigbee – Wifi – GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..), MQTT, Wired Communication, Power Sources. (Chapter 7 of R1)

UNIT-III RESOURCE MANAGEMENT IN IOT

Clustering - Clustering for Scalability - Clustering for routing - Clustering Protocols for IOT - The Future Web of Things – Set up cloud environment – Cloud access from sensors– Data Analytics for IOT. (Chapter 3 of R2)

UNIT-IV IOT ACCESS TECHNOLOGIES

IoT Access Technologies: Physical and MAC layers - topology and Security of IEEE 802.15.4 - 802.15.4g - 802.15.4e, Network Layer: Need for Optimization - Constrained Nodes - Constrained Networks – IP versions Optimizing IP for IoT: From 6LoWPAN to 6Lo - Routing over Low Power and Lossy Networks. **Case studies**: An IoT Blueprint for Public Safety. (Chapter 1, 12 of T2 and Chapter 4, 5 and 15 of R3)

UNIT-V DESIGN AND DEVELOPMENT OF IOT APPLICATION

Design Methodology - Embedded computing logic - Microcontroller - System on Chips – Basic building blocks of IoT - Arduino Board details - IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming case studies :illustrating to design home automation. (Chapter 7and 9 of T2)

L			Contact Hours	:	45
	List of E	xperiments			
	1.	Familiarization with Arduino/Raspberry Pi and perform necessary sof	tware installation.		
	2.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a pro- every 2 seconds. To interface Push button/Digital sensor (IR/LDR) w program to turn ON LED when push button is pressed or at sensor det	ogram to turn ON LED for a with Arduino/Raspberry Pi a tection.	l sec nd w	after rite a
	3.	To interface DHT11 sensor with Arduino/Raspberry Pi and write humidity readings. To interface motor using relay with Arduino/Ras ON motor when push button is pressed.	a program to print temper pberry Pi and write a progra	atur am to	e and o turn
	4.	To interface Bluetooth/Wifi with Arduino/Raspberry Pi and write smartphone using Bluetooth/Wifi.	e a program to send sense	or da	ata to
	5.	 Mini Projects(any one for each group) i. Home Automation system with mobile Integration. ii. Weather Monitoring system using Raspberry Pi/Arduino iii. Automatic plant watering/irrigation system using Raspberry Pi/Arduino. v. Vehicle Tracking System using Raspberry Pi/Arduino. v. Intrusion detection System using Raspberry Pi/Arduino. vi. Smart Parking System using Raspberry Pi/Arduino 	duino.		
			Contact Hours	:	30
ſ			Total Contact Hours	:	60

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Course Outcomes:

On completion of the course, the students will be able to

• Comprehend the architecture of Embedded systems.

- Design and develop programs for specific embedded applications.
- Apply the basic concepts of IoT.
- Integrate various IoT Access Technologies.
- Design and develop an IOT based real time application.

Text Books:							
1	ArshdeepBahga, Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, India PVT						
I	Limited 2014.						
	David Hanes, Gonzalo Salgueiro, Rob Barton "IoT Fundamentals: Networking Technologies, Protocols, and Use						
2	Cases for the Internet of Things", Cisco Press June 2017.						

Ref	erence Books:
1	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key Applications and Protocols", Wiley, 2012 .(CH-4)
2	Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.
3	David Hanes, Gonzalo Salgueiro, Rob Barton "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press June 2017.

Web link:

1.https://www.arduino.cc/

2.https://www.educba.com/applications-of-iot

3.https://www.edureka.co/blog/iot-applications

CO - PO - PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19644.1	1	2	3	3	1	-	2	1	-	-	2	-	1	2	2
AI19644.2	1	1	3	3	3	2	-		2	1	2	2	2	2	1
AI19644.3	2	2	2	-	1		2					3	2	2	2
AI19644.4	2	1	1	2	3	2		1	2	1	2	2	2	2	3
AI19644.5	2	3	2	2	3	2	1		2	1	2	3	2	2	1
Average	1.8	1.8	2	2.3	2.5	2	1.5	1	2	1	2	2.5	2	2	1.8

Subject Code	Subject Name (Lab Courses)	Category	L	Т	Р	С
AI19611	MINI PROJECT	EEC	0	0	2	1

Objectives:

• To improve the design and development skills.

	List of Domain Buckets (not limited)											
1.	Smart Automation											
2.	Smart Vehicles											
3.	Transportation & Logistics											
4.	Robotics and Drones											
5.	Clean & Green Technology											
6.	Travel & Tourism											
7.	Agriculture, Food Technology & Rural Development											
	Contact Hours : 30											

Co	urse Outcomes:							
On	completion of the course, the students will be able to							
٠	Formulate the problem.							
٠	Design the architecture.							
٠	Develop solutions for real world problem.							
•	Explain multi disciplinary ideas.							
•	Prepare the report.							

CO - PO – PSO matrices of course

PO/PSO	PO 1	РО 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
00															
AI19611.1	3	3	3	3	3	1	2	1	3	3	3	3	3	3	3
AI19611.2	3	3	3	3	3	1	1	1	3	3	3	3	3	3	3
AI19611.3	3	3	3	3	3	1	1	2	3	3	3	3	3	3	3
AI19611.4	3	3	3	3	3	1	2	1	3	3	3	3	3	3	3
AI19611.5	3	3	3	3	3	2	1	1	3	3	3	3	3	3	3
Average	3	3	3	3	3	1.2	1.4	1.2	3	3	3	3	3	3	3

Subject Code	Subject Name (Lab Courses)	Category	L	Т	Р	С
GE19621	PROBLEM SOLVING TECHNIQUES	EEC	0	0	2	1

Ob	Dbjectives: Broad objective of this course is						
•	To improve the numerical ability and problem-solving skills.						

	List of Experiments											
1.	Numbers system											
2.	Reading comprehension											
3.	Data arrangements and Blood relations											
4.	Time and Work											
5.	Sentence correction											
6.	Coding & Decoding, Series, Analogy, Odd man out and Visual reasoning											
7.	Percentages, Simple interest and Compound interest											
8.	Sentence completion and Para-jumbles											
9.	Profit and Loss, Partnerships and Averages											
10.	Permutation, Combination and Probability											
11.	Data interpretation and Data sufficiency											
12.	Logarithms, Progressions, Geometry and Quadratic equations.											
13.	Time, Speed and Distance											
	Contact Hours : 30											

Course Outcomes:

CUL	in se Outcomes.								
On	On completion of the course, the students will be able to								
•	Have mental alertness								
•	Have numerical ability								
•	Solve quantitative aptitude problems with more confidence.								

<u>CO - PO – PSO matrices of course</u>

PO/PSO	РО	PSO	PSO	PSO											
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
GE19621.1	2	2	2	2	1	1	-	-	-	-	1	1	2	2	2
GE19621.2	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
GE19621.3	3	3	2	3	1	1	-	-	-	-	1	1	2	2	2
Average	2.7	2.7	2.0	2.7	1.0	1.0	0.0	0.0	0.0	0.0	1.0	1.0	2.0	2.0	2.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

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SEMESTER – VII

Subject Code	Subject Name (Theory Course)	Category	L	Т	Р	С
AI19701	SECURE SYSTEMS ENGINEERING	PC	3	0	0	3

Ob	jectives:
•	Able to know the fundamentals of secure systems.
•	Understand the basic cryptography and key management techniques.
•	Able to build and evaluate trusted system.
•	Explore different auditing mechanisms and Network security.
	Learn the various security systems

UNIT-I INTRODUCTION TO SECURE SYSTEMS

An overview of Computer Security – Access Control matrix – Foundational results – Security Policies – Confidentiality policies – Hybrid policies.

UNIT-II BASIC CRYPTOGRAPHY AND KEY MANAGEMENT

Classical Crypto systems: Transposition ciphers, Substitution ciphers, Data Encryption Standard – Public Key cryptography: RSA – Cryptographic checksums: HMAC – Key Management: Key Exchange, Cryptographic key infrastructure – Digital Signature.

UNIT-III INTRODUCTION TO ASSURANCE AND EVALUATING SYSTEMS

Assurance and Trust – Building secure and trusted systems: Life cycle, Waterfall life cycle model, Prototyping – Evaluating Systems: Role of formal evaluation, TCSEC requirements, classes, processes, impact. FIPS requirements, Security levels, impact.

UNIT-IV AUDITING AND NETWORK SECURITY

Auditing: Anatomy of an auditing system, Designing an auditing system, auditing mechanisms. Network Security: Introduction, Policy Development, Network Organization anticipating attacks.

UNIT-V SYSTEM SECURITY, USER SECURITY AND PROGRAM SECURITY

System Security: Introduction, Policy, Networks. User Security: Policy, Access, Processes. Program Security: Introduction, Requirements and policy, Design, Refinement and Implementation.

Contact Hours :

9

9

9

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9

45

Co	Course Outcomes:						
On	completion of the course, the students will be able to						
•	Identify the different secure systems and policies.						
•	Apply cryptography and key management techniques to design a secure systems.						
•	Design and evaluate secure trusted system.						
•	Apply different auditing mechanisms and ensure network security						

• Apply various security systems for real time problem.

Т	xt Books:
1	Matt Bishop, Introduction to Computer Security, Pearson Publications, 2006
2	Ross J. Anderson: Security Engineering: A Guide to Building Dependable Distributed System. Wiley.
3	Introduction to Computer Security: Pearson New International Edition Michael Goodrich, Roberto Tamassia Pearson Education, 29-Aug-2013 -

Re	ference Books:
1	John Musa D, Software Reliability Engineering, 2nd Edition, Tata McGraw-Hill, 2005.
2	Julia H Allen, Sean J Barnum, Robert J Ellison, Gary McGraw, Nancy R Mead, Software Security Engineering:
	A Guide for Project Managers, Addison Wesley, 2008
3	Howard, M. and LeBlanc, D., Writing Secure Code, 2nd Edition, Microsoft Press, 2003

Web link:

- 1. http://www.cse.iitm.ac.in/~chester/courses/18o_sse/index.html
- 2. https://www.niti.gov.in/sites/default/files/2019-07/CyberSecurityConclaveAtVigyanBhavanDelhi_1.pdf

CO - PO - PSO matrices of course

PO/PSO	РО	РО	РО	PO	РО	PO	РО	PO	PO	PO	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19701.1	2	2	2	2	2	-	-	-	-	-	1	2	2	2	2
AI19701.2	2	2	2	2	2	-	-	-	-	-	1	2	2	3	3
AI19701.3	2	2	2	2	2	-	-	-	-	-	1	2	3	3	3
AI19701.4	2	2	2	2	2	-	-	-	-	-	2	2	3	3	3
AI19701.5	2	2	2	2	2	-	-	-	-	-	2	2	3	3	3
Average	2	2	2	2	2	-	-	-	-	-	1.4	2	2.6	2.8	2.8

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory Course)	Category	L	Т	Р	С
AI19702	SOCIAL AND ETHICAL ISSUES IN AI	PC	1	0	0	1

Ob	jectives:
•	Study the morality and ethics in AI
•	Learn about the Ethical initiatives in the field of artificial intelligence
•	Study about AI standards and Regulations
٠	Study about social and ethical issues of Robot Ethics
٠	Study about AI and Ethics- challenges and opportunities

UNIT-I INTRODUCTION

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.(Text Book1 :Chapter 1 & 2)

ETHICAL INITIATIVES IN AI UNIT-II

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles, Warfare and weaponisation.((Text Book1 :Chapter 3)

UNIT-III AI STANDARDS AND REGULATION 3 Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations -Standard for Child and Student Data Governance - Standard for Transparent Employer Data Governance - Standard for Personal Data Artificial Intelligence (AI) Agent -Ontological Standard for Ethically Driven Robotics and Automation Systems- Standard for Ethically Driven Nudging for Robotic, Intelligent and Autonomous Systems - Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems -Standard for the Process of Identifying and Rating the Trustworthiness of News Sources - Standard for Machine Readable Personal Privacy Terms. (Text Book1 :Chapter 4) UNIT-IV **ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS:** 3

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy. (Link 1) **UNIT-V** 3

AI AND ETHICS- CHALLENGES AND OPPORTUNITIES

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.(Link 2,3,4,5 & Text Book1 :Chapter 5)

> **Contact Hours** 15 :

3

Co	urse Outcomes:
On	completion of the course, the students will be able to
٠	Learn about morality and ethics in AI
٠	Acquire the knowledge of real time application ethics, issues and its challenges.
•	Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous
•	Systems
٠	Understand the concepts of Robotics and Morality
٠	Learn about the National and International Strategies on AI

Te	xt 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- December 2011.

Ref	ference Books:
1	Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and
T	Algorithms) by Paula Boddington
2	Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series
2	John Havens, " Heartificial Intelligence: Embracing Our Humanity to Maximize Machines", Jeremy
3	Tarcher/Penguin, Am imprint of Penguin Random House, New York, 2016
4	Bernd Carsten Stahl, "Artificial Intelligence for a Better Future An Ecosystem Perspective on the Ethics of AI
4	and Emerging Digital Technologies", Springer, 2021.

We<u>b link:</u>

- 1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
- 2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/
- 3. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/

4. https://sci-hub.mksa.top/10.1159/000492428

CO - PO - PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19702.1	2	1	1	1	-	1	1	2	-	-	1	1	2	1	1
AI19702.2	1	1	1	1	-	1	1	1	-	-	1	1	2	1	1
AI19702.3	1	1	1	1	-	1	1	1	-	-	1	1	2	1	1
AI19702.4	2	1	1	1	-	1	1	1	-	-	1	1	1	1	1
AI19702.5	1	1	1	1	-	1	1	1	-	-	1	1	2	1	1
Average	1.4	1	1	1	-	1	1	1	-	-	1	1	1.8	1	1

SEMESTER – VIII

Subject C	ode	Subject Name (Lab oriented Theory Courses)	Category	L T	P	С
AI1974	1	BIG DATA TECHNOLOGY	PC	3 0	2	4
Objectives	3:					
• To un	dersta	nd the basic concepts of big data and Hadoop				
• To ha	ve kno	owledge on accessing, storing and manipulating the huge data from differen	t resources.			
• To be	famili	ar with working principles of big data management using NoSQL				
• To un	dersta	nd the working environment of Pig, Hive and HBase.				
• To im	pleme	nt queries to process the data using Sqoop and to be familiar on searching r	nechanism usin	ıg Solr		
UNIT-I	Int	roduction To Big Data And Hadoop				9
Analyzing Data with Strategy, In	conce Unix t ntrodu	pts, needs and challenges, types and sources of big data, History of ools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo Syste ction to Infosphere Big Insights and Big Sheets.	Hadoop, Apac em, IBM Big D	he Ha Pata	doo	ур,
UNIT-II	HI	DFS (Hadoop Distributed File System)				9
The Design Ingest with Data struct Reduce Ty	n of H Flum ures. A pes an	DFS, HDFS Concepts, Command Line Interface, Hadoop file system interf ie and Scoop and Hadoop archives, Hadoop I/O: Compression, Serializatior Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and id Formats, Map Reduce Features.	aces, Data flow n, Avro and File Sort, Task Exe	7, Data e-Base cution	d , M	ap
UNIT-III	No	SOL				9
Introductio	n to N	VoSOL, aggregate data models, aggregates, key-value and document data n	nodels, relation	ships.	gra	ph
databases,	schen	na less databases, materialized views, distribution models, sharding, mas	ster-slave replic	cation,	pe	er-
peer replic and combin	ation, ning, c	sharding and replication, consistency, relaxing consistency, version stamp composing MapReduce calculations.	s, map-reduce,	partiti	oni	ng
UNIT-IV	Fu	ndamentals of Apache Pig, Hive ,and HBase				9
Pig: Introd	uction	to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grun	t, Pig Latin, Us	er Def	ine	d
Functions,	Data 1	Processing operators. Hive: Hive Shell, Hive Services, Hive Meta store, Co	mparison with	Tradit	ion	al
Databases, HBase Ver	Hive(sus R	QL, Tables, Querying Data and User Defined Functions. HBase: HBase Co DBMS.	oncepts, Clients	, Exan	nple	>,
UNIT-V	Fu	ndamentals of Apache Sqoop, and Solr				9
Sqoop- Ex data to Hiv Apache So attributes a default que	port tr e, Imp olr- Ir and ty ery.	ansfer data from Hadoop, update the data, update at the same time, export port data to HBase, htroduction, Information retrieval search engine, categories of data, in pes. Indexing -indexing tool. Indexing operations using csv documents.	subset of colu- verted index. Searching data	mns. I Desigr -paran	mp n-fie nete	ort eld rs,
			ontact Hours	•	Δ	5
			situer Hours	•		-
		List of Experiments				
1. Instal	lation	of Hadoop. (3)				
File N	/Ianag	ement tasks in Hadoop. (3)				
•	o Up	load and download a file in HDFS				

- Copy a file from source to destination
- Copy to file from /to local file system to HDFS
- Move file from source to destination
- Remove a file/directory in HDFS

2.

3.

Implement word count program using Map Reduce.(3)

4. Weather Report POC-Map Reduce Program to analyze time-temperature statistics and generate report with

	max/min temperature.(3)							
5.	5. Pig Latin scripts to sort, group, join, project, and filter your data.(6)							
6.	Hive Databases, Tables, Views, Functions and Indexes .(6)							
7.	Programs in Sqoop: Export data from Hadoop using Sqoop to import data to Hive.(6)							
	Contact Hours	:	30					
	Total Contact Hours	:	75					
Co	urse Outcomes:							
On	completion of the course, the students will be able to							
٠	Get familiar with the concepts of big data and Hadoop							
٠	Understand the process of accessing, storing and manipulating the huge data from different resources	•						
٠	Learn the working principles of big data management using NoSQL							
•	• Learn and implement small programs in Pig, Hive and HBase.							

• Get the concepts of Sqoop and Solr.

Tex	xt Books:
1	Big Data Analytics, Introduction to Hadoop, Spark, and Machine-Learning, Raj kamal, Preeti Saxena, McGraw Hill, 2019.
2	Hadoop: The Definitive Guide, Tom White ,Third Edition, O'Reilley, 2012.
3.	Programming Pig, Alan Gates, O'Reilley, 2011.

Ref	Reference Books:						
1	Hadoop Practice Guide: SQOOP, PIG, HIVE, HBASE for Beginners by Jisha Mariam Jose.						
2	Introduction to Big Data And Analytics Black And White Edition by Amandeep Kaur, Harish Madaan						
3	Programming Hive, E. Capriolo, D. Wampler, and J. Rutherglen, O'Reilley, 2012.						
4	HBase: The Definitive Guide, Lars George, O'Reilley, 2011.						
5	Andrea Gazzarini, Apache Solr Essentials, PACKT Publications, 2015.						

<u>CO - PO – PSO matrices of course</u>

PO/PSO- CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO 3
AI19741.1	-	1	-	2	2	-	-	-	-	-	-	1	3	3	3
AI19741.2	-	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI19741.3	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI19741.4	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
AI19741.5	1	2	1	2	2	-	-	-	1	2	-	1	3	3	3
Average	1	1.8	1	2	2	-	-	-	1	2	-	1	3	3	3

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER – V

PROFESSIONAL ELECTIVE – I

Subject Code	Subject Name	Category	L	Т	P	С
AI19P51	KNOWLEDGE REPRESENTATION AND REASONING	PE	2	0	2	3

Ob	Objectives:						
•	To learn the concepts of First Order Logics.						
•	To understand the concepts of Knowledge Engineering and Resolution.						
•	To acquire the knowledge of Rules, Fames and Structured Description.						
•	To familiarize the fundamentals of uncertainty and degrees of belief.						
•	To understand the fundamental concepts of Planning.						

UNIT-I INTRODUCTION

Introduction: The Key Concepts, Need for Knowledge Representation and Reasoning - The Role of Logic. The Language of First-Order Logic: Introduction-The Syntax- The Semantics-The Semantics-Explicit and Implicit Belief.(Text Book 1: Chapter 1 & 2)

EXPRESSING KNOWLEDGE AND RESOLUTION UNIT-II 6 Expressing Knowledge: Knowledge Engineering – Vocabulary - Basic Facts - Complex Facts - Terminological Facts Entailments- Other Sorts of Facts. Resolution : The Propositional Case- Handling Variables and Quantifiers - Dealing with Computational Intractability - Backward Chaining - Forward Chaining.(Text Book 1: Chapter 3, 4 & 5)

UNIT-III RULES, FRAMES AND STRUCTURED DESCRIPTION

Rules in Production System: Basic Operation, Working Memory, Production Rules and examples- Conflict Resolution- Applications and Advantages. Frames: objects and frames - Basic frame formalism- Frame examples. Structured Description: Descriptions- A Description Language- Meaning and Entailment- Computing Entailments-Taxonomies and Classification. (Text Book 1: Chapter 7,8 & 9)

UNIT-IV UNCERTAINTY AND DEGREES OF BELIEF

Non-categorical Reasoning- Objective Probability- Subjective Probability- Vagueness. Explanation and Diagnosis: Diagnosis- Explanation- A Circuit Example.(Text Book 1: Chapter 12 & 13) 6

UNIT-V PLANNING

Planning in the Situation Calculus - The STRIPS Representation- Planning as a Reasoning Task- Hierarchical Planning - Conditional Planning. (Text Book 1: Chapter 15)

> **Contact Hours** 30

6

6

6

List of Experiments (can be implemented using Python)							
1.	Data preprocessing and annotation and creation of datasets.						
2.	2. Learn existing datasets and Treebanks.						
3.	3. Implementation of searching techniques in AI.						
4.	Implementation of Knowledge representation schemes.						
5.	Scientific distributions used in python for Data Science - Numpy, scify,	pandas.					
6.	Scientific distributions used in python for Data Science- scikitlearn, stat	tmodels, nltk.					
		Contact Hours	:	30			
		Total Contact Hours	:	60			

Course Outcomes

On	completion of the course, the students will be able to
٠	Apply the concept of First Order Logic for knowledge representation.
٠	Apply the concepts of unification and resolution to solve real time facts.
٠	Integrate the concepts of rules and frames for real world phenomena.
	Analyze the concept of uncertainty and degrees of belief to find the varying levels of knowledge and confidence
•	level of real time facts.
	Explain the concepts of planning to find the difference between plan space and state space

• Explain the concepts of planning to find the difference between plan space and state space

Text Books:

- Ronald J. Brachman Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
 Descale Khemeni A First Course in Artificial Intelligence McCrew Hill Education (India), 2012.
- 2 Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.

Ref	Reference Books:					
1	Schank Roger C., Robert P. Abelson: Scripts, Plans, Goals, and Understanding: An Inquiry into Human					
1	Knowledge Structures. Hillsdale, NJ: Lawrence Erlbaum, 1977.					
2	R. C. Schank and C. K. Riesbeck: Inside Computer Understanding: Five Programs Plus Miniatures , Lawrence					
4	Erlbaum, 1981.					
3	Murray Shanahan: A Circumscriptive Calculus of Events. Artificial Intelligence 77(2), pp. 249-284, 1995.					
4	John F. Sowa: Conceptual Structures: Information Processing in Mind and Machine Addison-Wesley Publishing					
4	Company, Reading Massachusetts, 1984.					
5	John F. Sowa: Knowledge Representation: Logical Philosophical, and Computational Foundations, Brooks/Cole,					
	Thomson Learning, 2000.					

Web link:

1. https://www.cs.ox.ac.uk/people/james.worrell/lecture9-2015.pdf

2. https://www.section.io/engineering-education/forward-and-backward-chaining-in-ai/

3. https://www.cpp.edu/~ftang/courses/CS420/notes/planning.pdf

<u>CO - PO – PSO matrices of course</u>

PO/PSO	PO 1	PO 2	РО 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
СО															
AI19P51.1	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AI19P51.2	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
AI19P51.3	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AI19P51.4	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
AI19P51.5	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
Average	2.6	1.6	1	1	1	-	-	-	-	-	1	1	2	1	1

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: "-"

Subject Code	Subject Name	Category	L T P C	7

AI FOR GAME PROGRAMMING

2 0 2 3 PE

6

6

6

Objectives:

- To learn the fundamentals of Game programming.
- To understand the 3D Graphics, vertex and pixel shader.scenes.
- To learn the various PyGame Development process and its design attributes. •
- To interpret working knowledge in various game platforms. •
- To familiarize various games using reinforcement learning.

UNIT-I **INTRODUCTION**

Elements of Game-Game Architecture-Application Layer-Game Logic-Game View for the Human Player-Game View for AI agents-Networked Game Architecture-Remote Game View-Remote Game Logic.(Text Book 1: Chapter 2) **3D GRAPHICS** UNIT-II 6

3D Graphics Basics- Pipeline-3D MATH 101-Vector Classes-Matrix Mathematics-Quaternion Mathematics. 3D Vertex and Pixel Shader : Vertex Shader Syntax-Compiling the vertex shader-The pixel shader-Rendering the shader Helper Classes. 3D Scenes: Graph Basics-Special Scene Graph Nodes. (Text Book 1: Chapter 14,15,16)

UNIT-III PYGAME AND 3D AND PYPLATFORMERS

Installing Packages-Getting started with OpenGL-Adding the Pygame Library-Drawing the openGL-Basic Collision Detection Game-An introduction to Game Design-Introducing Pymunk-Building a Game Framework-Developing Pyplatformers.(Text Book 2 : Chapter 5 & 6)

UNIT-IV AUGMENTING A BOARD GAME WITH COMPUTER VISION

Planning the checker application-setting up OpenCV and Other dependencies-Supporting multiple version of Open CV-Configuring Cameras-Working With Colors-Building the analyser-Converting OpenCV images for wxPython-Building the GUI Application-Troubleshooting the projects.(Text Book 2 : Chapter 7) 6

UNIT-V **REINFORCEMENT LEARNING AND GAMES**

Intelligence and Games- Reinforcement Learning - Heuristic Planning - Adaptive Sampling-Deep Supervised Learning-Deep Reinforcement Learning.(Text Book 3:Chapter 2, 3,4, 5 and 6)

Contact Hours 30

List of Experiments (can be implemented using any tools: Play Canvas, jMonkey Engine, Direct 3D 11, Scratch, Python or Unity.)

1.	Texture the Triangle using Direct 3D 11.
2.	Programmable Diffuse Lightning using Direct3D 11.
3.	To Implement Make Bouncing Ball Game.
4.	To Implement " virtual pet" game.
5.	To Implement " treasure hunt " game.
6.	To Implement Shooting games.
7.	To Implement <u>Tynker</u> games.
8.	Introduction about PyGame, Unity software.
9.	Learning 2D Game Development with Unity.
	Contact Hours : 30
	Total Contact Hours : 60

-							
Co	Course Outcomes:						
On	On completion of the course, the students will be able to						
•	Explain the need for Game programming.						
•	Integrate various concepts and techniques of 3D Game design.						
•	Design and model interactive game.						
•	Explain the need for advanced game development platforms.						
•	Design and develop games using reinforcement learning.						

Te	Text Books:							
1	Mike "MrMike" McShaffry and David "Rez" Graham, "Game Coding Complete, Fourth Edition", Course							
1	Technology PTR, A part of Cengage Learning.							
2	Alejandro Rodas de Paz, Joseph Howse, "Python Game Programming By Example", Packt Publishing, 2015.							
3	Learning to Play (Springer), Reinforcement Learning and Games by Aske Plaat, 2020.							

Re	Reference Books:						
1	Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 2 nd edition, 2016.						
2	John Horton, "Learning Java by Building Android Games", Packt Publishing Limited, 1st edition, 2015.						
3	Jorge Palacios, "Unity 5.x Game AI Programming Cookbook", Packt Publishing Limited, 1st edition, 2016.						

Web link:

- 1. https://docplayer.net/62131747-Python-game-programming-by-example.html
- 2. https://www.3dgep.com/introduction-opengl/
- 3. https://link.springer.com/chapter/10.1007/978-3-642-27645-3_17

CO - PO – PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P52 .1	1	2	2	2	2	-	-	-	-	-	-	-	1	1	-
AI19P52 .2	2	2	3	2	2	-	-	-	-	-	-	-	2	2	-
AI19P52.3	2	2	3	3	3	-	-	-	-	-	2	-	3	3	-
AI19P52.4	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
AI19P52.5	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
Average	1.8	2	2.8	2.6	2.6	-	-	-	-	-	1.2	-	2.4	2.4	0.8

Subject Code	Subject Name	Category	L	Т	Р	С
AI19P53	MOBILE TECHNOLOGY	PE	3	0	0	3

Ob	Objectives:						
•	To understand the basic concepts of mobile computing.						
•	To learn the basics of mobile telecommunication system.						
•	To study the basic evolution of Modern Mobile Wireless Communication Systems.						
•	To be familiar with the network layer protocols and Ad-Hoc networks.						
-							

• To gain knowledge about different mobile platforms and application development.

UNIT-I INTRODUCTION

Introduction to Mobile Computing - Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing - Spread spectrum -MAC Protocols - SDMA- TDMA- FDMA- CDMA (Chapter 1,2 and 3 of T1)

UNIT-II MOBILE COMMUNICATION SYSTEMS

GSM-System architecture-DECT - System architecture-TETRA-UMTS and IMT-2000-Broadcast systems-Digital audio broadcasting -Digital video broadcasting-Convergence of broadcasting and mobile communications (Chapter 4 and 6 of T1)

UNIT-III 4G NETWORKS

Personal Area Networks: PAN - Public wide-area Wireless Networks -First Generation (1G) Wireless Networks -Second Generation-GSM architecture and protocol(2G) Wireless Cellular Networks - Third Generation (3G) Wireless Networks - Vision for 4G- Cellular Mobile Wireless Network- Description of cellular system- Channel Assignment Schemes in cellular networks- Cellular Communication Principle-Radio Resource Management (Chapter 2,3,6,8,and 11 of R2) 9

UNIT-IV WIRELESS NETWORKS

Mobile IP – DHCP – AdHoc– Proactive protocol-DSDV, Reactive Routing Protocols – DSR, AODV, Hybrid routing -ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET) -MANET Vs VANET - Security. (Chapter 8 of T1) 9

UNIT-V MOBILE PLATFORMS AND APPLICATIONS

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(Chapter 9,10 and 11 of T2) and (Link 1,2,3 and 4) 45

Contact Hours : 9

9

Co On	urse Outcomes: completion of the course, the students will be able to
•	Explain the basic concepts of mobile communication.
•	Apply the concepts of mobile telecommunication systems.
•	Apply different generation of mobile technology.
•	Determine the functionality of MAC, network layer and Identify a routing protocol for a given Ad hoc network.
•	Develop a mobile application using android/blackberry/ios/Windows SDK.

Te	Text Books:						
1	Jochen Schiller,Mobile Communications, PHI, Second Edition, 2003						
2	Prasant Kumar Pattnaik, Rajib Mall, —Fundamentals of Mobile Computing, PHI Learning Pvt.Ltd, New Delhi – 2012.						

Re	Reference Books:					
1	Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt					
I	Ltd, 2005					
ſ	Wireless Communications and Networks, 3G and beyond, ITI Saha Misra, TMH, 2009, 2013 by the McGraw Hill					
2	Education (India) Private Limited					
2	William.C.Y.Lee,—Mobile Cellular Telecommunications-Analog and Digital Systems, Second					
3	Edition, TataMcGraw Hill Edition ,2006.					
4	Principle of wireless Networks by Kaveh Pahlavan and Prashant Krishnamurthy, Pearson 2002.					

Web link:

- 1. Android Developers : <u>http://developer.android.com/index.html</u>
- 2. Apple Developer : <u>https://developer.apple.com/</u>
- 3. Windows Phone DevCenter : <u>http://developer.windowsphone.com</u>
- 4. BlackBerry Developer : <u>http://developer.blackberry.com</u>

CO - PO - PSO matrices of course

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	РО 9	РО 10	РО 11	PO 12	PSO 1	PSO 2	PSO 3
AI19P53.1	-	2	-	2	-	-	-	-	-	-	-	2	2	1	1
AI19P53.2	2	2	3	2	2	1	-	-	2	1	-	2	1	2	1
AI19P53.3	1	2	2	3	2	2	1	1	-	-	-	3	2	3	2
AI19P53.4	1	2	3	2	3	1	-	2	1	-	-	1	-	-	-
AI19P53.5	1	2	3	2	3	1	-	2	1	-	2	2	-	-	-
Average	1.2	2	2.8	2.2	2.5	1.2	1	1.8	1.3	1	2	2	1.5	2.5	1.5

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	Р	С
CS19P12	DISTRIBUTED SYSTEMS	PE	2	0	2	3

Ob	Objectives:				
প্ল	To explain the goals and types of Distributed Systems.				
8	To describe Communications and distributed web based system.				
8	To learn about Distributed objects and File System.				
8	To emphasize the benefits of using Distributed Transactions and Concurrency.				
٠	To learn issues related to process and Security.				

UNIT-I	INTRODUCTION TO DISTRIBUT	ED SYSTEMS		6	
Introduction to Dist	ributed systems - Design Goals-Challer	nges - Types of Distributed Syste	ems - Architect	ural Styles –	
Middleware - Syste	m Architecture - Centralized and Dec	centralized organizations - Peer	-to-Peer System	1 –Focus on	
resource sharing -Ca	se Study: Skype, Bittorrent.				
UNIT-II COMMUNICATIONS AND DISTRIBUTED WEB BASED SYSTEM 6					
Fundamentals - Rem	ote Procedure Call - Stream oriented co	ommunication – Message oriented	l communication	1 – Multicast	
communication -We	b based system architecture-Web service	es-Case Study: Apache Web serve	er, HTTP, SOAF)	
UNIT-III	DISTRIBUTED OBJECTS AND FI	LE SYSTEM		6	
Remote Invocation	- Request Reply Protocol - Java RM	I - Distributed Objects - CORI	BA -Object to	component -	
Enterprise java Bear	n- Introduction to Distributed File Syst	tem - File Service architecture -	- Andrew File	System, Sun	
Network File System	n - Case Study: Google File System				
UNIT-IV SYNCHRONIZATION AND DISTRIBUTED TRANSACTIONS 6					
Clock Synchronizati	on – Physical Clocks– Clock Synchroniz	ation Algorithms- Logical Clock	s-Lamport's Log	gical Clocks-	
Vector Clocks-Elect	ion Algorithms-Ring based Algorithm	-Bully Algorithm- Distributed	Transactions-	Nested	
Transaction-Locks-	Concurrency Control- Timestamp Order	ring - Atomic Commit-Distributed	d Deadlock.		
UNIT-V SEC	UNIT-V SECURITY AND PROCESS 6				
Introduction to Security – Security Threats, Policies, and Mechanisms-Design Issues-Cryptography-Secure Channels –					
Authentication-Message Integrity and Confidentiality-Secure Group Communication-Example: Kerberos- Process-					
Threads-Virtualizati	on.				
		Contact Hours	:	30	

List	of Experiments						
1	Install Skype and initiate a chat between users.						
2	Write a program to add two numbers in Java RMI.						
3	3 Write a program in java for creating a simple chat application with TCP.						
4	Write a program to illustrate UDP sockets.						
5	Write a program to Distributed Deadlock Detection using Chandy Haas Miss	a.					
6	Create a SOAP based web service for a simple Java calculator class with op web service client which consumes web service and displays the result of inv	erations add and subtract. A voked web service.	lso cr	eate			
7	7 Write a java program to illustrate multithreaded server where the client send a number to the server and in response to each client, the server should send back the square of the received number.						
		Contact Hours	:	30			
		Total Contact Hours	:	60			
Cou	rse Outcomes:						
On o	completion of the course, the students will be able to						
8	Gain knowledge about goals and types of Distributed Systems.						
8	Ability to describe Communications and distributed web based system.						
8	Clear knowledge about Distributed objects and File System.						
8	Emphasize the benefits of using Distributed Transactions and Concurrency.						

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING R2019

ß	Gain knowledge about process	and Security.
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Tey	xt Books(s):
1	Tanenbaum, A. and van Steen, M., "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2007.
2	Coulouris, G, Dollimore, J., and Kindberg, "Distributed Systems: Concepts and Design", Fourth Edition, Addison-Wesley, 2006.

Re	ference Books:
1	Pradeep K Sinha, "Distributed Operating Systems", Prentice-Hall of India, First Edition, New Delhi, 2001.
2	Jean Dollimore, Tim Kindberg, George Coulouris, "Distributed Systems -Concepts and Design", Pearson Education, Fourth edition, 2005.
3	M.L. Liu," Distributed Computing Principles and Applications", Pearson Education, First edition, 2004.
4	HagitAttiya and Jennifer Welch,"Distributed Computing: Fundamentals, Simulations and Advanced Topics", Wiley, First edition, 2004.

CO - PO - PSO matrices of course

PO/PSO CO	PO 1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	P O 10	P O 11	P O 12	PS O 1	PS O 2	PS O3
CS19P12.1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS19P12.2	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CS19P12.3	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CS19P12.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS19P12.5	3	3	3	2	2	2	2	2	2	2	3	2	3	2	3
Average	3	2.8	2.8	2.6	2.6	2	2	1.8	2.4	1. 8	3	2	2.8	2.4	2.8

Note: Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-"

SEMESTER – VI

PROFESSIONAL ELECTIVE – II

Subject Code	Subject Name	Category	L	Т	Р	С
AI19P61	GPU PROGRAMMING	PE	2	0	2	3

Ob	jectives:
•	To learn the basics of GPU architectures.
•	To write programs for massively parallel processors.
•	To understand the issues in mapping algorithms.
•	To interpret different GPU programming models.
٠	To familiarize various algorithms for GPU programming.

UNIT-I	GPU ARCHITECTURE		6
Evolution of	f GPU architectures – Understanding Parallelism with GPU – Typical GPU Architectur	e – CUDA	
Hardware O	verview – Threads, Blocks, Grids, Warps, Scheduling – Memory Handling with CUD.	A: Shared Me	mory,
Global Mem	nory, Constant Memory and Texture Memory.		
UNIT-II	PROGRAMMING ISSUES		6
Common Pr	oblems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithms	ithmic Issues,	
Finding and	Avoiding Errors.		
UNIT-III	OPENCL BASICS		6
OpenCL Sta	andard – Kernels – Host Device Interaction – Execution Environment – Memory Mode	l – Basic Ope	nCL
Examples.			
UNIT-IV	ALGORITTHMS ON GPU		6
Parallel Patt	erns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming	Heterogeneo	us
Cluster.		-	
UNIT-V	CUDA PROGRAMMING		6
Using CUD	A – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem D	ecomposition	
Memory Co	nsiderations, Transfers, Thread Usage, Resource Contentions.		
	Contact	Hours :	30

List of	Experiments			
1.	To write a c/c++ CUDA program to get introduced to heterogeneous co	mputing.		
2.	To write a c/c++ CUDAprogram to do parallel computing using blocks			
3.	To write a c/c++ CUDA program to get introduced to threads.			
4.	To write a c/c++ CUDA program to combine threads and blocks.			
5.	To write a c/c++ CUDA program to work on cooperating threads.			
6.	To write a c/c++ CUDA program to work on Asynchronous operation a	and Handling errors.		
7.	To write a c/c++ CUDA program to work on managing devices			
		Contact Hours	:	30
		Total Contact Hours	••	60

Co	urse Outcomes:
On	completion of the course, the students will be able to
•	Explain the GPU architecture.
•	Implement programs using CUDA, identify issues and debug them.
٠	Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication.
٠	Develop simple programs using OpenCL.
•	Identify efficient parallel programming patterns to solve problems.

Tex	xt Books:
1	Shane Cook, CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing), First Edition, Morgan Kaufmann, 2012.
2	David R. Kaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, —Heterogeneous computing with OpenCL, 3rd Edition, Morgan Kauffman, 2015.

Reference Books:							
1	Nicholas Wilt, —CUDA Handbook: A Comprehensive Guide to GPU Programming, Addison – Wesley, 2013.						
2	Jason Sanders, Edward Kandrot, —CUDA by Example: An Introduction to General Purpose GPU Programming, Addison – Wesley, 2010.						
3	David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors – A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.						
4	http://www.nvidia.com/object/cuda home new.html						

Web link:

1. https://nptel.ac.in/courses/106/105/106105220/

2. https://www.udemy.com/course/cuda-gpu-programming-beginner-to-advanced/

3. https://www.coursera.org/courses?query=gpu

CO - PO – PSO matrices of course

PO/PSO CO	РО 1	РО 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	РО 9	РО 10	РО 11	PO 12	PSO 1	PSO 2	PSO 3
AI19P61.1	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19P61.2	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19P61.3	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19P61.4	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19P61.5	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	-	2.0	1.8	2.0	2.0	2.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"
Subject Code	Subject Name	Category	L	Т	P	С
AI19P62	DATA ANALYSIS AND DATA MINING	PE	2	0	2	3

Ob	Objectives:							
٠	To learn the introduction of Data Warehouse and Data Mining.							
٠	To understand the concepts of clustering analysis.							
٠	To learn the basics of mining text data.							
٠	To acquire the basics of mining spatial data.							

• To study the basic concepts of mining web data.

INTRODUCTION TO DATA WAREHOUSE AND DATA MINING UNIT-I 6 Data Warehouse: Characteristics of Data Warehouse - Data Warehouse Components - Designing the Data Warehouse - Data Warehouse Architecture - Getting Heterogeneous Data into the Warehouse - Getting Multidimensional Data out of the Warehouse. Data Mining: Definition - Architecture - data mining: on what kind of data? - Data mining functionalities. (T2: Chapter -1 and 2) CLUSTERING ANALYSIS UNIT-II 6 Introduction – Feature selection for clustering – Representative based algorithms – Hierarchical clustering algorithms - probabilistic model based algorithms - Grid based and density based algorithms - Graph based algorithms - non negative matrix factorization – clustering validation. (T1: Chapter – 6) UNIT-III MINING TEXT DATA 6 Document Preparation and Similarity computation - Specialized clustering methods for text - topic modeling -Specialized Classification Methods for Text – Novelty and First Story Detection. (T1: Chapter –13) UNIT-IV | MINING SPATIAL DATA 6 Mining with Contextual Spatial Attributes - Trajectory mining - Equivalence of Trajectories and Multivariate Time Series - Converting Trajectories to Multi dimensional Data - Trajectory Pattern Mining - Trajectory Clustering -Trajectory Outlier Detection – Trajectory Classification. (T1: Chapter –16) UNIT-V MINING WEB DATA 6 Web crawling and Resource Discovery - Search Engine Indexing and Query Processing - Ranking Algorithm Recommender Systems – Web Usage Mining. (T1: Chapter –18) **Contact Hours** : 30

Lis	t of Experiments							
	In H ₂ O implement the following							
1	Perform the basic pre-processing operations on data relation such as removing an attribute and filter attribute							
1	bank data							
2	2 To predict the Numerical Values in the given Data Set is using Regression Methods.							
3	To predict with the smallest total error using rules based on One attribute							
4	To understand the theoretical aspects and build a hierarchy of clusters using hierarchical clustering techniques							
5	To Demonstrate Clustering features in Large Databases with noise							
6	Generate association rule for the credit card promotion dataset using a priory algorithm with the support range							
0	40% to 100% confidence as 10% incremental decrease as 5% and generate 6 rules							
	Contact Hours : 30							
	Total Contact Hours : 60							

Cou	Course Outcomes:								
On	On completion of the course, the students will be able to								
•	Explain the introduction of Data Warehouse and Data Mining.								
•	Apply the concepts of clustering analysis.								
•	Analyze the basics of mining text data.								
•	Integrate the concepts of mining spatial data.								
•	Demonstrate the basic concepts of mining web data.								

Edition.						
sity, Phagwara.						
Reference Books:						

- Knowledge Discovery And Data Mining", The M.I.T Press, 1996. N. J. Nilsson, "Principles of Artificial Intelligence", Narosa Publishing House, 1980. 2

CO - PO – PSO matrices of course

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P62.1	3	3	-	-	-	-	-	-	-	-	-	-	3	-	1
AI19P62.2	3	3	2	-	-	-	-	-	-	-	-	-	3	-	1
AI19P62.3	-	2	3	3	2	-	3	2	3	-	3	3	-	3	3
AI19P62.4	-	3	3	3	2	-	3	3	3	-	3	3	-	3	3
AI19P62.5	-	3	3	3	3	-	3	3	3	-	3	3	-	3	3
Average	1.2	2.8	2.2	1.8	1.4	-	1.8	1.6	1.8	-	1.8	1.8	1.2	1.8	2.2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	Р	С
CS19P06	HUMAN COMPUTER INTERACTION	PE	2	0	2	3

Ob	Objectives:							
প্ল	Learn the foundations of Human Computer Interaction.							
8	Be familiar with the design technologies and software process.							
8	Learn human interaction models and theories							
8	Be aware of Design thinking concepts.							
•	Learn the guidelines of design thinking and apply it.							

UNIT-I	FOUNDATIONS OF HCI								
The Human: I/O channels - Memory - Reasoning and problem solving; The computer: Devices - Memory -									
and networks; Interaction: Models - Frameworks - Ergonomics - Styles - Elements - Interactivity - Paradigms.									
UNIT-II DESIGN & SOFTWARE PROCESS									
Interactive Desig	gn basics – Process – Scenarios – Navigation – Scr	een design - Iteration and prototy	ping. HCl	in software					
process - Softw	vare life cycle - Usability engineering - Prototy	ping in practice - Design ratior	nale - De	sign rules –					
Principles, Stand	lards, Guidelines, Rules – Universal Design.								
UNIT-III MODELS AND THEORIES									
Cognitive model	s –Socio-Organizational issues and stake holder re	equirements -Communication and	l collabora	ation models					
- Task Analysis.									
UNIT-IV	MOBILE HCI			6					
Mobile Ecosyste	em: Platforms-Application frameworks- Types of	Mobile Applications: Widgets- A	Applicatio	ns– Games–					
Mobile Informat	ion Architecture–Mobile 2.0.								
UNIT-V WEB INTERFACE DESIGN									
Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages.									
Contact Hours :									

List of	List of Experiments									
1	Design a user interface for Welcome screen.									
2	2 Design a user interface by applying design rules for assigning a grade to students based on the subject marks.									
3	Design a user interface with Layouts for printing the numbers in ascending order and descending order.									
4	4 Design a user interface by using task analysis for calculator.									
5	Design a user interface with direct selection for registration of a student for admissions.									
6	Design a user interface by using colours for displaying and changing of picture on the form.									
7	Design a user interface with widgets for end semester exam registrations.									
8	Design a user interface by using drag and drop for creating forms.									
9	Design a user interface with Overlays and Inlays for menu-based program.									
10	Mini Project.									
		Contact Hours	:	30						
		Total Contact Hours	:	60						

Co	urse Outcomes:							
On	On completion of the course, the students will be able to							
8	Describe the foundations of Human Computer Interaction.							
8	Demonstrate with the design technologies and software process.							
8	Apply the concepts of human interaction models and theories .							
8	Design effective HCI for individuals and persons with disabilities.							
8	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.							
Te	xt Book(s):							
1	Jeff Johnson, "Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines",							
1	Morgan Kaufmann, 2014.							
2	Brian Fling, "Mobile Design and Development", First Edition, O,,Reilly Media Inc., 2009.							
3	Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O,,Reilly, 2009.							
Re	ference Book(s)/Web link(s)							
1	Jeff Johnson, "Designing with the Mind in Mind. Simple Guide to Understanding User Interface Design Guidelines",							
1	Morgan Kaufmann, 2014.							

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O 1	PS O 2	PS O3
CS19P06.01	2	3	-	-	2	2	3	-	-	3	-	-	-	3	-
CS19P06.02	3	3	3	3	2	-	3	2	3	3	2	3	-	3	3
CS19P06.03	2	3	3	2	3	1	2	3	3	3	-	3	2	3	3
CS19P06.04	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CS19P06.05	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Average	2.4	3.0	3.0	2.7 5	2.6	2.25	2.8	2.75	3.0	3.0	2.6 7	3.0	2.6 7	3.0	3.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	Р	С
CS19P09	C# AND .NET PROGRAMMING	PE	2	0	2	3

Ob	Objectives:					
প্ল	To learn basic programming in C# and the object oriented programming concepts.					
ଷ୍ଟ	To study the advance programming concepts in C#.					
8	To understand the working of base class libraries, their operations and manipulation of data using XML.					
8	To update and enhance skills in writing Windows application, WPF, WCF and WWF with C# and .NET.					
•	To implement mobile applications using .Net compact framework.					

UNIT-I	UNIT-I C# LANGUAGE BASICS 6						
.Net Architectu	.Net Architecture – Core C#– Objects and Types- – Inheritance- Generics – Arrays and Tuples – Operators and Casts.						
UNIT-II	UNIT-II C# ADVANCED FEATURES 6						
Delegates – La	mbdas - Events- Strings and Regular Expressions - Collections - Asynchronous Programming	ng- Memory					
Management an	nd Pointers – Errors and Exceptions – Reflection.						
UNIT-III	BASE CLASS LIBRARIES AND DATA MANIPULATION	6					
Diagnostics -Tasks, Threads and Synchronization – Manipulating XML-ADO.NET- Peer-to-Peer Networking –Core							
Windows Presentation Foundation (WPF).							
UNIT-IV	WINDOW BASED APPLICATIONS, WCF AND WWF	6					
Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services -							
.Net Remoting -Windows Service – Windows Workflow Foundation (WWF)							
UNIT-V	UNIT-V .NET FRAMEWORK AND COMPACT FRAMEWORK 6						
Assemblies - Custom Hosting with CLR Objects - Core XAMLNet Compact Framework - Compact Edition Data							
Stores – Errors	Stores – Errors, Testing and Debugging – Optimizing performance.						
	Contact Hours :	30					

List of	f Experiments
	Write a console application that obtains four int values from the user and displays the product.
1	Hint: you may recall that the Convert.ToDouble() command was used to convert the input from the console to a
	double; the equivalent command to convert from a string to an int is Convert.ToInt32().
	Write an application that receives the following information from a set of students:
	Student Id:
	Student Name:
2	Course Name:
	Date of Birth:
	The application should also display the information of all the students once the data is
	Entered. Implement this using an Array of Structures.
3	Write a program to declare a class "staff" having data members as name and post. Accept this data 5 for 5 staffs
5	and display names of staff who are HOD.
4	Write a program to implement multilevel inheritance from following figure. Accept and display data for one
4	student.

	Class student Data Members : Roll no , name			
	Class Test Data Members : marks1 , marks2			
	• •			
	Class Result Data Members : total			
5	Write a program to create a delegate called TrafficDel and a class called Tra- with the following delegate methods. Public static void Yellow(){ Console.WriteLine("Yellow Light Signal To Get Ready"); } Public static void Green(){ Console.WriteLine("Green Light Signal To Go"); } Public static void Red(){ Console.WriteLine("Red Light Signal To Stop"); } Also include a method IdentifySignal() to initialize an array of delegate with methods and a method show() to invoke members of the above array.	fficSignal		
6	Write a program to accept a number from the user and throw an exception if	the number is not an even no	umber	r .
7	Create an application that allows the user to enter a number in the textbox number in the textbox "getnum" is palindrome or not. Print the message as Ibldisplay when the user clicks on the button "check".	named "getnum". Check wh coordingly in the label contr	nether ol na	the med
8	Create a project that calculates the total of fat, carbohydrate and protein. A The grams of fat, grams of carbohydrate and grams of protein. Each gra carbohydrate is 4 calories. Display the total calories of the current food it display and accumulated some of calories and the count of items entered. The user to enter the grams for each category include label next to each text box	llow the user to enter into te m of fat is 9 calories and p tem in a label. Use to other ne form food have 3 text box indicating what the user is en	ext bo protei labe tes for nter.	xes. n or ls to r the
9	Database programs with ASP.NET and ADO.NET. Create a Web App to display all the Empname and Deptid of the employee control and bind it to GridView. Database fields are(DeptId, DeptName, En	from the database using SQ npName, Salary).)L soi	urce
10	Programs using ASP.NET Server controls. Create the application that accepts name, password, age, email id, and compulsory. Password should be reconfirmed. Age should be within 21 to should have at least a capital letter and digit as well as length should be betw	user id. All the information 30. Email id should be vali- veen 7 and 20 characters.	n entr d. Use	y is er id
11	For the web page created for the display OF Employee data change the author	entication mode to Windows		<u> </u>
		Contact Hours	:	30
		Total Contact Hours	:	60

Co	Course Outcomes:								
On	On completion of the course, the students will be able to								
8	& Write various applications using C# Language.								
8	 Write various applications using advanced C# concepts. 								
8	& Create window services, libraries and manipulating data using XML.								
8	Develop distributed applications using .NET Framework.								
8	& Create mobile applications using .NET compact Framework.								

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING | R2019

Tex	Text Books(s):						
1	Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, "Professional C# 2012 and .NET 4", Wiley, 2012.						
2	Andy Wigley, Daniel Moth, Peter Foot, "Mobile Development Handbook", Microsoft Press, 2007.						

Reference Books:

|--|

2 D Andrew Troelsen, "Pro C# 5.0 and the .NET 4.5 Framework", Apress publication, 2012.

CO - PO - PSO matrices of course

PO/PS O CO	PO 1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CS19P09.1	2	2	1	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.2	2	2	1	2	1	-	-	-	1	-	2	2	2	2	-
CS19P09.3	2	2	2	1	1	-	-	-	1	-	-	1	2	1	-
CS19P09.4	2	2	2	2	2	-	-	-	2	-	2	2	2	2	2
CS19P09.5	3	2	2	2	3	-	-	-	3	-	2	2	2	2	2
Average	2.2	2.0	1.6	1.6	1.6	-	-	-	1.6	-	2.0	1.6	2.0	1.6	2.0

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER – VII

PROFESSIONAL ELECTIVE – III

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	Р	С
RO19P19	INTRODUCTION TO AI ROBOTICS	PE	2	0	2	3

Ob	Objectives:				
•	To study the basics of robotic system.				
•	To introduce the concepts of Expert Systems and GA in robotic assembly.				
•	To learn about mobile robots.				
•	To learn the methods of solving motion planning problems.				
•	To understand the role of ANN, FL and DL in Robotics.				

UNIT-I INTRODUCTION 6					
Introduction to robotics- History, growth; Robot applications- Manufacturing industry, defense, rehabilitation					
medical etc., Laws of Robotics, Robot kinematics.					
UNIT-II ASSEMBLY MODELING 6					
Artificial Intelligence, Robot application in assembly. Assembly Sequence Planning, Modeling and representation of					
assembly Sequences-Non-Sequential assembly plans, Non-Linear assembly sequences, Non-Monotone assembly					
sequences, Pseudo-Non-Coherent assembly plans. Application of rule based, graph based techniques and Genetic					
Algorithm (GA) in Assembly Sequence Planning.					
UNIT-III MOBILE ROBOT 6					
Introduction to mobile robots and mobile manipulators. Principle of locomotion and types of locomotion. Types of					
mobile robots: ground robots (wheeled and legged robots), aerial robots, underwater robots and water surface robots.					
UNIT-IVMOTION PLANNING ALGORITHMS6					
Gross and fine motion planning, motion planning schemes-visibility graph, voronoi diagram, tangent graph					
accessibility graph, path velocity decomposition, incremental planning, relative velocity approach, reactive control					
strategy and potential field approach.					
UNIT-VANN,FL AND DL APPLICATION IN ROBOTS6					
Introduction to Soft computing techniques. Neural networks- inverse kinematic motion calculation- obstacle					
avoidance system. Fuzzy logic usage in mobile robot navigation and obstacle avoidance. Deep learning techniques to					
train biped robot to walk.					
Total Contact Hours : 30					

	List of Experiments			
1.	Create, modify and execute a teach pendant program in 6-axis Industria	al Robot.		
2.	Execute a material handling program in 6-axis Industrial Robot.			
3.	Performing blocks world problem using Dobot Robot arm.			
4.	Line follower mobile robot control using vision sensor.			
5.	Implementing SLAM in Raspberry Pi mobile robot.			
6.	Navigation control of mobile robot using Neural Network algorithm.			
		Contact Hours	:	30
		Total Contact Hours	:	60

Co Or	Course Outcomes: On completion of course students will be able to			
٠	Identify and classify the robots for different applications.			
٠	Apply appropriate AI methods to solve assembly problem.			
٠	Classify mobile and legged robots based on their structure.			
٠	Implement different motion planning schemes.			
•	Apply ANN, FL and DL based techniques in robotic systems.			

Tex	Text Books:				
1	Pratihar.D.K, "Fundamentals of Robotics", Narosa Publishing House, India, 2019.				
2	Robin R. Murphy, "Introduction to AI Robotics", A Bradford Book The MIT Press Cambridge, Massachusetts, 2004.				

Ref	Reference Books :			
1	Ian GoodFellow, Yoshua Bengio & Aaron Courville, Deep Learning, MIT Press, USA, 2016.			
2	John Craig J. "Introduction to Robotics: Mechanics and Control", Pearson; 4th edition, 2017.			
3	Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.			
4	Raju Bahubalendruni and Bibhuthi Bhushan Biswal, Computer aided Optimal Robotic Assembly Sequence Generation, Lap Lambert Academic Publishing; 1st edition, 2017.			
5	Saeed B. Niku, "Introduction to Robotics Analysis, Control, Applications", John Wiley & Sons Ltd, 2020.			

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	РО 11	PO 12	PSO 1	PSO 2	PSO 3
RO19P19.1	1	2	2	2	2	-	-	-	-	-	-	-	1	1	-
RO19P19.2	2	2	3	2	2	-	-	-	-	-	-	-	2	2	-
RO19P19.3	2	2	3	3	3	-	-	-	-	-	2	-	3	3	-
RO19P19.4	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
RO19P19.5	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
Average	1.8	2	2.8	2.6	2.6	-	-	-	-	-	1.2	-	2.4	2.4	0.8

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	С
AI19P71	DATA VISUALIZATION USING PYTHON	PE	2	0	2	3

Ob	Objectives:		
•	To understand the various visualization techniques		
•	To explore the basics of numpy arrays		
٠	To perform Data manipulation with pandas		
٠	To visualize the data with Matplotlib		
•	To explore the Machine learning techniques		

UNIT-I VISUALIZATION

Introduction-Classification of Visual Data Analysis Techniques-Data Type to be Visualized-Visualization Techniques-Interaction Techniques-Specific Visual Data Analysis Techniques (CHAPTER NO: 11 from T1)

UNIT-II NUMPY

Understanding Data Types in Python-The Basics of NumPy Arrays-Computation on NumPy Arrays: Universal Functions-Aggregations: Min, Max, and Everything In Between-Computation on Arrays: Broadcasting-Comparisons, Masks, and Boolean Logic-Fancy Indexing-Sorting Arrays-Structured Data: NumPy's Structured Arrays (CHAPTER NO: 2 from T2)

UNIT-III DATA MANIPULATION WITH PANDAS

Introducing Pandas Objects-Data Indexing and Selection-Operating on Data in Pandas-Handling Missing Data-Hierarchical Indexing-Combining Datasets: Concat and Append-Combining Datasets: Merge and Join-Aggregation and Grouping-Pivot Tables-Vectorized String Operations-Working with Time Series-High-Performance Pandas: eval() and query() (CHAPTER NO: 3 from T2)

UNIT-IV VISUALIZATION WITH MATPLOTLIB

Simple Line Plots-Simple Scatter Plots-Visualizing Errors-Density and Contour Plots-Histograms, Binnings, and Density-Customizing Plot Legends-Customizing Color bars-Multiple Subplots-Text and Annotation Customizing Ticks-Customizing Matplotlib: Configurations and Stylesheets-Three-Dimensional Plotting in

Matplotlib-Geographic Data with Base map-Visualization with Seaborn (CHAPTER NO: 4 from T2)

UNIT-V MACHINE LEARNING

Machine Learning-Introducing Scikit-Learn-Hyperparameters and Model Validation-Feature Engineering-Naive Bayes Classification-Linear Regression-Support Vector Machines-Decision Trees and Random Forests-Principal Component Analysis-Manifold Learning-k-Means Clustering-Gaussian Mixture Models-Kernel Density Estimation (CHAPTER NO: 5 from T2)

Contact Hours :

5

6

6

8

30

	List of Experiments
1	Implement Data visualization techniques and visualize data using any plotting framework
1	1. Line chart 2.Bar chart
2	Implement Data visualization techniques and visualize data using any plotting framework
2	1.Box plot 2. Scatter plot
3	Implement Data visualization techniques and visualize data using any plotting framework.
5	1.Area Chart 2. Heat Map 3. Correlogram
4	Visualize the text data using word cloud
5	Implementation of Linear Regression
6	Implementation of Logistic Regression
7	Implementation of SVM classification techniques
8	Implementation of Decision tree classification techniques
9	Implementation of clustering techniques –Hierarchical

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10	Implementation of clustering techniques- K Means		
	Contact Hours	:	30
	Total Contact Hours	:	60

Co	Course Outcomes:				
On	On completion of the course, the students will be able to				
•	Understand the Visualization techniques				
•	Appreciate the computation on numpy arrays				
•	Operates on data in pandas				
•	Appreciate the visualization with Matplotlib				
٠	Explore the Machine learning techniques				

Text Books:

1	Michael Berthold, David J. Hand (Eds.),"Intelligent Data Analysis An Introduction", 2nd revised and extended Edition.
2	Jake VanderPlas, "Python Data Science Handbook", Released November 2016, Publisher(s): O'Reilly Media, Inc., ISBN: 9781491912058

Re	ference Books:
1	Charles D. Hansen and Chris R. Johnson, Visualization Handbook, Academic Press, 2004.
2	Will Schroeder, Ken Martin, and Bill Lorensen, The Visualization Toolkit: An Object-Oriented Approach to 3D Graphics, Kitware Inc. Publishers, 2004.
3	Data visualization with Python for beginners, AI Publishing, 2020.

CO - PO – PSO matrices of course

PO/PSO CO	РО 1	РО 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
00															
AI19P71.1	2	2	3	3	3	3	3	2	1	-	3	1	3	3	1
AI19P71.2	3	2	3	3	3	3	3	2	1	-	3	1	3	3	1
AI19P71.3	3	2	3	3	3	3	3	2	1	-	3	1	3	3	1
AI19P71.4	3	2	3	3	3	3	3	2	1	-	3	1	3	3	1
AI19P71.5	3	2	3	3	3	3	3	2	1	-	3	1	3	3	1
Average	2.8	2	3	3	3	3	3	2	1	-	3	1	3	3	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	С
AI19P72	INNOVATION IN DESIGN THINKING FOR AI	PE	2	0	2	3

Ob	jectives:
•	To understand the process of Design Thinking
٠	To explore the analysis and experiment various methods and tools
٠	To understand the concept synthesis and strategic requirements
٠	To visualize the process of Journey mapping
	To adopt Artificial Intelligences in the process of Design Thinking

• To adopt Artificial Intelligence in the process of Design Thinking

UNIT-I PRINCIPLES OF DESIGN THINKING

Principles of Design Thinking- Process of Design Thinking – Planning a Design Thinking project- Understanding of the problem - Observation Phase - Point-of-View Phase - Ideate Phase - Prototype Phase - Test Phase - Implementation

(CHAPTER NO: 1 to 8 from T1)

UNIT-II EXPLORE, EMPATHIZE AND EXPERIMENT PHASES

Explore phase-STEEP Analysis, Strategic priorities, Activity System, Stakeholder Mapping, Opportunity Framing-Empathize - Methods & Tools, Field observation, Deep user interview, Needs Finding, Persona Development Experiment-Methods & Tools, Ideation using Scamper, Analogous Inspiration, Deconstruct & Reconstruct, User Experience Design, Prototyping (PAGE NO: 3 to 47 from T2)

UNIT-III ENGAGE AND EVOLVE PHASE

Engage-Methods & Tools, Storytelling, Storyboarding, co-creation -Evolve- Methods & Tools, Concept Synthesis, Strategic requirements, Activity system integration, viability analysis, Innovation Tool (Using User needs, CAP,4S), Change management tool using review, Quick wins, Art of Story telling (PAGE NO: 51 to 77 from T2)

UNIT-IV VISUALIZATION

Visualization-Journey Mapping-Value chain analysis-Mind Mapping-Brainstorming-Concept Development-Assumption Testing-Rapid prototyping-customer co-creation-Learning Launch-Leading growth and innovation in an organization

UNIT-V ADOPTION OF ARTIFICIAL INTELLIGENCE

Introduction to the adoption of Artificial Intelligence-Design and its operating context-AI empowered design in practice-Design for Artificial Intelligence-Implications for Innovation and Design Theories

Contact Hours : 30

6

6

6

6

6

	List of Experiments
1	Design a mind map of design thinking
2	Thirty circle Exerciseideation
3	Prepare a toothpick bridge (mock-up model)
4	Prepare a marble maze (mock up model)
5	Build a wind power car (mock up model)
6	Make a hydraulic elevator (mock up models)
7	Construct empathy maps for a given case study
8	Develop customer journey map for a given case
9	Make a paper prototype for user testing (mock-up model)
10	Design and development of cell phone wallet (mock-up model)
11	Design thinking using sprint base software
	Contact Hours : 30
	Total Contact Hours:60
Cou	irse Outcomes:
On	completion of the course, the students will be able to

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•	Plan a Design Thinking project
•	Empathize and experiment the methods and tools
•	Understand the strategic requirements
•	Appreciate the concept development
•	Appreciate the adoption of Artificial Intelligence
Te	xt Books:
1	Müller-Roterberg, Christian. (2018). Handbook of Design Thinking.
2	Design Thinking The Guide Book
3	Jeanne Liedtka and Tim Ogilvie.(2011). Designing for Growth: a design thinking tool kit for managers.
4	Roberto Verganti,Luca Vendraminelli,Marco Iansiti.(2020). Innovation and Design in the Age of Artificial Intelligence.Volume 37,Issue 3.

 Reference Books:

 1
 Tim Brown, Barry Katz — Change by Design - How Design Thinking Transforms Organizations and Inspires Innovation, First Edition, HapperCollins,2009

 2
 Thomas Lockwood, — Design Thinking – Integrating, Innovation, Customer experience and Brand value, First Edition, Allworth Press, 2009

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19P72.1	1	2	2	2	2	2	2	1	2	1	2	2	3	3	2
AI19P72.2	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AI19P72.3	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AI19P72.4	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AI19P72.5	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
Average	1	2.8	2.8	2.8	2.8	2.8	2.8	2.6	2.8	1	2.8	2.8	3	3	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory Course)	Category	L	Т	P	1	С
IT19P77	COMPUTATIONAL LINGUISTICS	PE	3	0	0		3

Objecti	Objectives: Broad objective of this course is								
•	To learn the fundamentals required for Computational Linguistics.								
•	To understand the concept of Phonology and Morphology.								
•	To deal with Statistical and Rule based Models.								
•	To understand the concepts of Language Structure, Analysis and their Applications.								
•	To study various Linguistic Models.								

UNIT-I INTRODUCTION

Introduction about Computational Linguistics - Linguistics and its structures - The role of Natural LanguageProcessing-Issues - Motivation - Theory Of Language - Words- Features of Indian Languages.

MORPHOLOGY AND PARTS-OF-SPEECH UNIT-II

Phonology - Computational Phonology- Words and Morphemes - Categorization and Lemmatizations - Word Form Recognition Valency - Agreement - Regular Expressions and Automata- Morphological issues of Indian Languages - Transliteration.

UNIT-III PROBABILISTIC MODELS

Probabilistic Models of Pronunciation and Spelling - Weighted Automata - N- Grams - Corpus Analysis - Smoothing - Entropy -Parts-of-Speech - Taggers - Rule based - Hidden Markov Models - Speech Recognition.

UNIT-IV SYNTAX & CONTEXT FREE PARSING

Basic Concepts of Syntax- Parsing Techniques - General Grammar rules for Indian Languages - Context Free Grammar - Parsing with Context Free Grammars - Top Down Parser - Earley Algorithm - Features and Unification -Lexicalized and Probabilistic Parsing. 9

SEMANTICS AND PRAGMATICS UNIT-V

Representing Meaning - Computational Representation - Meaning Structure of Language - Semantic Analysis - LexicalSemantics -WordNet - Pragmatics - Discourse - Reference Resolution - Text Coherence - Dialogue Conversational Agents.

Contact Hours 45 Periods :

9

9

9

9

Course Outcomes:

On com	apletion of the course, the students will be able to
•	Comprehend the basic requirement of Computational Linguistics.
•	Understand the design of Phonological structures, generalization and Morphological Analyzers.
•	Evaluate the performance of different Probabilistic Models.
•	Use Context free languages to describe the syntactic structure of a language and parsing methods.
•	Understand the concept of Semantics , Pragmatics and Language Modelling.

Text Bo	oks:
1	Daniel Jurafskey and James H. Martin "Speech and Language Processing", Prentice Hall, 2000.
2	Ronald Hausser "Foundations of Computational Linguistics", Springer-Verleg, 1999.

Refer	rence Books:
1	James Allen "Natural Language Understanding", Benjamin/Cummings Publishing Co. 1995.
2	Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3	Steve Young and Gerrit Bloothooft "Corpus – Based Methods in Language and Speech Processing", Kluwer Academic Publishers, 1997.

CO - PO - PSO matrices of course

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO 3
СО	1	2	3	4	5	6	/	8	9	10	11	12	1	2	-
IT19P77.1	1	2	2	2	2	2	-	-	-	-	2	2	3	3	2
IT19P77.2	1	3	3	3	3	3	-	-	-	-	3	3	3	3	2
IT19P77.3	1	3	3	3	3	3	-	-	-	-	3	3	3	3	2
IT19P77.4	1	3	3	3	3	3	-	-	-	-	3	3	3	3	2
IT19P77.5	1	3	3	3	3	3	-	-	-	-	3	3	3	3	2
Average	1	2.8	2.8	2.8	2.8	2.8	-	-	-	-	2.8	2.8	3	3	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER – VII

PROFESSIONAL ELECTIVE – IV

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	C
AI 19P73	FOUNDATIONS OF ROBOTIC PROCESS AUTOMATION	PE	2	0	2	3

Ob	jectives:
•	Describe RPA, where it can be applied and how it's implemented
٠	Describe the different types of variables, Control Flow and data manipulation techniques
٠	Identify and understand Image, Text and Data Tables Automation
٠	Describe how to handle the User Events and various types of Exceptions and strategies.
	Understand the Deployment of the Robot and to maintain the connection

UNIT-I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

RPA Basics :History of Automation, What is RPA, RPA vs Automation, Processes & Flowcharts, Programming Constructs in RPA, What Processes can be Automated, Types of Bots, Workloads which can be automated-Standardization of processes, RPA Development methodologies, Difference from SDLC, Robotic control flow architecture, RPA business case, RPA Team ,Process Design Document/Solution Design Document-,Risks& Challenges with RPA, RPA and emerging ecosystem (chapter 1 of T1) WORKING WITH TOOLS UNIT-II The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Managing Arguments - The Arguments Panel - Using Arguments - Importing New Namespaces- Control Flow - Control Flow Activities - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data (chapter 2 of T1) UNIT-III ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES 6 Image, Text & Advanced Citrix Automation :Introduction to Image & Text ,Automation, Image based automation, Keyboard based automation, Information Retrieval, Advanced Citrix Automation challenges, Best Practices, Using tab for Images, Starting Apps- Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Using anchors in PDF (chapter 5 of T1) UNIT-IV HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING 6 What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger -Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. (chapter 7 of T1) **EMERGING AND FUTURE TRENDS** UNIT-V 6 Hardware Robot locomotion, Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, controllability, Robot kinematics and dynamics Forward and inverse kinematics, holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots; AI based techniques for navigation, Bio Inspired Algorithm, Multiple robot coordination. Design of intelligent robots (Chapter 2,3 of T2) **Contact Hours** 30 :

	List of Experiments					
1	Build a workflow that fills the form on RPAChallenge.com website with organized data from an excel file.					
n	Build a workflow that replaces double spaces with single spaces from a text stored in multiple Notepad files with					
2	different names.					
3	Build a workflow using To String method that converts an integer to string.					
4	Build a workflow using Format, Join, Index Of, Split, and Substring methods that extract key information from a					
4	text and prints in a different format.					
5	Build a workflow using Split and Contains methods that extract sentences containing "RPA" from a paragraph.					

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6

6	Build a workflow using data table activities to join two library databases using matching student ID and	l di	splay		
0	the output in a message box.				
7	Build a workflow using Concat and Join method that merges two lists containing the UK and Spain city	y na	ames,		
	sorts it, capitalizes the first letter of each item, and displays it in a message box.				
0	Build a workflow using a Screen Scraper Wizard that scrapes text using the Tesseract OCR scraping	me	ethod		
0	from an image and stores it in a Notepad.				
0	Build a workflow using the Screen Scraper Wizard that scrapes text using the Full-Text scraping met	thoo	l and		
9	stores it in a Notepad file.				
10	Build a workflow using the Data Scraping wizard that scrapes blog post titles from the UiPath Blog	og	from		
10	multiple pages.				
11	Build a workflow using a Read PDF Text activity and extract only Email IDs and Phone Numbers from	n a	PDF		
11	¹¹ file and store it in an MS Word file.				
	Contact Hours	:	30		
	Total Contact Hours	:	60		

Course Outcomes:

On completion of the course, the students will be able to

•	Understand the RPA and the ability to differentiate it from other types of automation and Summarize the Risks and Challenges towards the implementation of RPA
٠	Understand to store and manipulate data in a more persistent way using such files as CSV and Excel
•	Understand Image, Text and Data Tables Automation.

• Make use of exception handling techniques to handle the log errors

• Know about the current topics in the focus area

Te	xt Books:
	UiPath Associate Certification Guide: The go-to guide to acing your Associate certification exam with
1	the help of mock tests and quizzes, Niyaz Ahmed, Lahiru Fernando, Rajaneesh Balakrishnan, Packt
	Publishing Limited, 2022.
2	Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with
2	the Leading RPA Tool – UiPath, Alok Mani Tripathi, Packt Publishing Limited, 2018.

Re	ference Books:
1	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation
I	Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.
2	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems, Tom Taulli,
2	Apress, 2020.
	Democratizing Artificial Intelligence with UiPath: Expand automation in your organization to
3	achieve operational efficiency and high performance, Fanny IP, Jeremiah Crowley, Packt
	Publishing Limited, 2022.
4	UiPath Administration and Support Guide: Learn industry-standard practices for UiPath
4	program support and administration activities, Arun Kumar Asokan, Packt Publishing, 2022.

Web link:

1. <u>https://www.uipath.com/rpa/robotic-process-automation</u>

2. http://www.academy.uipath.com/

<u>CO</u> -	- PO -	PSO	matrices	of	course
					-

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI 19P73.1	2	2	1	-	1	-	-	-	-	-	1	2	2	2	2
AI 19P73.2	2	2	1	-	2	-	-	2	-	-	2	3	3	3	3
AI 19P73.3	2	2	2	-	3	1	2	2	-	-	2	3	3	3	3
AI 19P73.4	2	2	2	-	2	-	-	-	-	-	2	3	3	3	3
AI 19P73.5	3	2	3	1	3	1	2	2	-	-	2	3	3	3	3
Average	2.2	2	1.8	1	2.2	1	2	2	-	-	1.8	2.8	2.8	2.8	2.8

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

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Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	C
AI19P74	FUZZY LOGIC	PE	2	0	2	3

Ob	jectives:					
•	To introduce the basic concepts of modelling in systems using fuzzy sets					
•	To understand their role in applications of semantic interpreters					
•	To learn their role in applications of control systems					
•	To understand the applications of reasoning systems					
•	To explore the applications of Pattern reorganization					

UNIT-I	FUZZY SETS	6		
Basic concepts of fuzzy set, t-norm, t-conorms, membership function, α-cut, Algebra of fuzzynsets , distance between				
fuzzy sets, fuzzy relation. (T1-Chapters 1,2,				
UNIT-II	FUZZY ARITHMETIC	6		
Fuzzy numbers,	Arithmetic operations of fuzzy numbers, Extension principle, Interval arithmetic, Defuzzification.			
(T1-Chapter 4)				
UNIT-III	FUZZY FUNCTION	6		
Fuzzy valued fur	nctions, fuzzy equations, fuzzy inequalities, system of fuzzy. Linear equations, maximum and minim	um of		
fuzzy functions.	(T2-Chapter	s 5,6)		
UNIT-IV	FUZZY LOGIC	6		
Classical Logic	- Multi-valued Logics - Fuzzy Propositions - Fuzzy Quantifiers - Linguistic hedges - Inference fror	n		
conditional Fuzz	zy proposition. (T2-Chap	ter 8)		
UNIT-V	APPLICATIONS OF FUZZY SET THEORY	6		
Fuzzy sets in Decision making, Optimization in Fuzzy environment, Fuzzy set application in image processing, Fuzzy set				
application in Pattern reorganization. (T1-Chapter 13,14,				

Contact Hours : 30

List of Experiments									
1	Implementation of Fuzzy Operations (Union, Intersection, Complement).								
2	Implementation of Fuzzy Relations (Max-min Composition)								
3	Implementation of Fuzzy Controller (Washing Machine)								
4	Implementation of Simple Neural Network (McCulloh-Pitts model)								
5	Implementation of Perceptron Learning Algorithm								
6	Implementation of Unsupervised Learning Algorithm (Clustering and Association)								
7	Implementation of Simple Genetic Application								
8	Study of ANFIS Architecture								
9	Study of Derivative-free Optimization								
		Contact Hours: 30							
		Contact Hours: 30 Total Contact Hours: 60							
Course	Outcomes:	Contact Hours: 30 Total Contact Hours: 60							
Course On com	Outcomes: Deletion of the course, the students will be able to	Contact Hours: 30 Total Contact Hours: 60							
Course On comj	Outcomes: oletion of the course, the students will be able to Understand basic knowledge of the fuzzy sets, operations and their properties.	Contact Hours: 30 Total Contact Hours: 60							
Course On comp •	Outcomes: bletion of the course, the students will be able to Understand basic knowledge of the fuzzy sets, operations and their properties. Understand the fundamental concepts of Fuzzy functions and Fuzzy logic.	Contact Hours: 30 Total Contact Hours: 60							
Course On comj •	Outcomes: Deletion of the course, the students will be able to Understand basic knowledge of the fuzzy sets, operations and their properties. Understand the fundamental concepts of Fuzzy functions and Fuzzy logic. Apply the concepts of Fuzzy sets in image processing.	Contact Hours: 30 Total Contact Hours: 60							
Course On comp • •	Outcomes: Deletion of the course, the students will be able to Understand basic knowledge of the fuzzy sets, operations and their properties. Understand the fundamental concepts of Fuzzy functions and Fuzzy logic. Apply the concepts of Fuzzy sets in image processing. Apply the concepts of Fuzzy sets in Pattern reorganization	Contact Hours: 30 Total Contact Hours: 60							
Course On comp • • •	Outcomes: bletion of the course, the students will be able to Understand basic knowledge of the fuzzy sets, operations and their properties. Understand the fundamental concepts of Fuzzy functions and Fuzzy logic. Apply the concepts of Fuzzy sets in image processing. Apply the concepts of Fuzzy sets in Pattern reorganization Apply the concepts of Fuzzy sets in Decision making.	Contact Hours: 30 Total Contact Hours: 60							

Text B	Text Books:											
1	George J.Klir and Bu Yuan, Fuzzy sets and Fuzzy logic Theory and applications, Prentice Hall of India, New Delhi.											
2	Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 2016											

Refere	nce Books:
1	Didier Bubois and Henri Prade, Fuzzy sets and systems, Academic Press
2	James J Buckley, Esfandiar Eslami, An Introduction to Fuzzy logic and Fuzzy sets (Springer).
3	H.J.Zimmernman, Fuzzy set theory and application (Allied Publication in Association with KLUWER)

Web Links
1 https://fuzzylogic.me
2. https://www.udemy.com/topic/fuzzy-logic/
3. https://www.routledge.com/A-First-Course-in-Fuzzy-Logic

CO - PO - PSO matrices of course

PO/PSO	РО	РО	PO	РО	PO	РО	PO	PO	РО	PO	PO	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P74.1	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2
AI19P74.2	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2
AI19P74.3	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2
AI19P74.4	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2
AI19P74.5	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2
Average	2	3	3	3	2	2	2	2	1	1	2	1	2	2	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	Р	С
IT19P76	IMAGE PROCESSING AND VISION TECHNIQUES	PE	3	0	0	3

Obj	jectives: Broad objective of this course is
•	To review image processing techniques for computer vision.
•	To outline the image enhancement in the Spatial and Frequency Domain.
•	To understand Image Restoration and Image Compression.
•	To understand three-dimensional image analysis.
•	To study some applications of computer vision algorithms.

UNIT-I	IMAGE PROCESSING FOUNDATION	9						
Introduction-	Image Processing Operations– Basic Image filtering operations: Noise Suppression by Gaussian							
Smoothing- N	Median Filters- Mode Filters- Rank Order Filters- The Role of Filters in Industrial Applications of Vision	n-						
Thresholding	g- Adaptive Thresholding-Edge detection techniques - corner and interest point detection - mathematica	ıl						
morphology -	- Some Basic Approaches to Texture Analysis.							
UNIT-II	IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN	9						
Image enhancement by point Processing-Image enhancement by neighbourhood processing- Basic Gray Level 20%								
Transformations-Histogram Processing-Enhancement Using Arithmetic and Logic Operations-Zooming- Basics of								
Spatial Filter	s- Smoothening and Sharpening Spatial Filters-Combining Spatial Enhancement Methods. Introduction	to						
Fourier Trans	sform and the frequency Domain-Smoothing and Sharpening Frequency Domain Filters- Homomorphic							
Filtering.								
UNIT-III	IMAGE RESTORATION AND IMAGE COMPRESSION	9						
Model of Th	ne Image Degradation / Restoration Process-Noise Models- Restoration in the presence of Noise O	nly						
Spatial Filter	ring- Periodic Noise Reduction by Frequency Domain Filtering-Linear Position-Invariant Degradatio	ons-						
Estimation of	f Degradation Function- Inverse Filtering-Wiener filtering- Constrained Least Square Filtering-Geome	tric						
Mean Filter-	Geometric Transformations. Data Redundancies-Image Compression Models-Elements of Information							
Theory- Loss	sless and Lossy compression-Huffman Coding-Shanon-Fano Coding- Arithmetic Coding-Golomb Codin	ıg-						
LZW Coding	g-Run Length Coding-Loss less predictive Coding- Bit Plane Coding- Image compression standards.							
UNIT-IV	3D VISION	9						
3-D Vision -	Methods for 3D vision – projection schemes – shape from shading – photometric stereo – Surface							
Smoothness-	- shape from texture – use of structured lighting- three-dimensional object recognition schemes- Image							
Transformations and Camera Calibration.								
UNIT-V APPLICATION 9								
Automated Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – Eigen								
faces - Active appearance and 3D shape models of faces Application- Surveillance-foreground-background separation -								
particle filter	s - Chamfer matching- tracking- and occlusion - combining views from multiple cameras - human gait							
analysis App	lication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrians.	•						
	Contact Hours : 45 Per	riods						

Course Outcomes:										
On completion of the course, the students will be able to										
 Implement fundamental image processing techniques required for computer vision. 										
 Understand the image enhancement in the Spatial and Frequency Domain. 										
Apply Image Restoration and Image Compression.										
• Apply 3D vision techniques.										
Develop applications using computer vision techniques.										

Text Books:									
1	E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.								
2	Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 2nd edition, Pearson Education.								

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Refe	rence Books:
1	R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.
2	Simon J. D. Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012
3	Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition,
	Academic Press, 2012.
4	D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
5	Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly
	Media, 2012.
6	A.K. Jain, "Fundamental of Digital Image Processing", PHI.

CO - PO – PSO matrices of course

CO/PO	PO1	PO2	PO	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO11	PO1 2	PSO1	PSO2	PSO3	PSO4
			3													
IT19P76.1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
IT19P76.2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
IT19P76.3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
IT19P76.4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
IT19P76.5	-	2	3	3	-	-	-	-	-	-	3	-	-	3	-	-
СО					-	-	-	-	_	_						
(Avg)	3.0	2.6	2.7 5	2.8							3.0	-	3.0	3.0	3.0	-

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory course)	Category	L	Т	P	(;
IT19P85	SOCIAL NETWORKS	PE	3	0	0	3	

Obje	Objectives:								
•	To study the basics of Social Networks								
•	To understand the ties and homophily								
•	To learn the market and Strategic Interaction in Networks								
•	To understand link analysis and searching								
•	To understand the concepts of modeling networks								

UNIT-I INTRODUCTION

Aspects of Networks; Representing and Measuring Networks-Representing Networks-Statistics and Characteristics of Network; Graphs-Paths and Connectivity-Distance and Breadth First Search-Basic Graph Theory; Network Datasets An Overview

UNIT-II EMPIRICAL BACKGROUND ON SOCIAL

Observations about the Structure of Networks; Strong and Weak Ties; Networks in Their Surrounding Contexts Homophily-Mechanisms Underlying Homophily: Selection and Social Influence-Affiliation-Tracking Link Formation in On-Line Data-A Spatial Model of Segregation; Positive and Negative Relationships

UNIT-III MARKETS AND STRATEGIC INTERACTION IN NETWORKS

Matching Markets-Bipartite Graphs and Perfect Matchings-Valuations and Optimal Assignments-Prices and the Market-Clearing Property-Constructing a Set of Market-Clearing Prices; Network Models of Markets with Intermediaries Bargaining and Power in Networks

UNIT-IV INFORMATION NETWORKS AND THE WORLD WIDE WEB

The Structure of the Web; 4 Link Analysis and Web Search; Growing Random Networks- Uniform Randomness: an Exponential Degree Distribution- Hybrid Models- Small Worlds, Clustering, and Assortativity; Cascading Behavior in Networks; Institutions and Aggregate Behavior- Voting

UNIT-V LEANRING AND GAME THEORETICAL MODELLING

Learning and Networks; Decisions, Behavior, and Games on Networks; Game-Theoretic Modeling of Network Formation; Allocation Rules, Networks, and Cooperative Games; Observing and Measuring Social Interaction Specification and Identification- Community Structures, Block Models, and Latent Spaces

Contact Hours : 45 Periods

9

9

9

9

Course Outcomes:

On completion of the course, the students will be able to

- Remember the basics of Social Networks
- Create the ties and homophily
- Apply the market and Strategic Interaction in Networks
- Perform link analysis and searching
- Develop the model for social networks

Text Book(s):

1 Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010.

2 Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

Re	Reference Books(s):									
1	Peter Mika, "Social Networks and the Semantic Web", , First Edition, Springer 2007.									
2	BorkoFurht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010									
3	GuandongXu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking –									
	Techniques and applications", First Edition Springer, 2011.									

CO - PO – PSO matrices of course

CO/PO	PO1	PO2	P	PO 4	PO	PO6	PO7	PO	PO9	PO1	PO1 1	PO1 2	PSO1	PSO2	PSO3	PSO4
			03		5			8		0						
IT19P85.1	3	2	-	2	-	2	1	-	-	-	2	2	-	-	1	2
IT19P85.2	3	2	-	2	-	2	1	-	-	-	2	1	-	-	1	2
IT19P85.3	2	2	-	2	-	2	2	-	-	-	3	2	-	2	2	2
IT19P85.4	1	1	-	2	2	2	1	-	-	-	2	2	-	2	2	2
IT19P85.5	-	-	-	2	2	2	-	-	1	-	2	2	-	-	2	2
CO (Avg)	2.2 5	1.75	-	2.00	2. 0	2.00	1.25	-	-	-	2.20	1.80	-	2.00	1.6	2.00

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

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SEMESTER – VII

PROFESSIONAL ELECTIVE – V

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Τ	Р	С
CS19642	CRYPTOGRAPHY AND NETWORK SECURITY	PE	2	0	2	3

Ob	jectives:
•	Learn basics of encryption and Number Theory.
•	Understand the methods of public key encryption.
•	Acquire knowledge of hash functions and digital signatures.
•	Apply techniques of system level securities.
•	Know the current trends in e-mail, IP and web security

UNIT-I INTRODUCTION & NUMBER THEORY OSL accurate and the security model Classical Encrumtion techniques (Symmetric sinker model or									
OSI security techniques, and Euler's	v architecture-Network security model-Classical Encryption techniqu transposition techniques, steganography)-Number Theory: Modular theorem -The Chinese Remainder theorem	es (Symmetric cipher model, su arithmetic- Euclid's algorithm	ubstitution n-Fermat's						
UNIT-II BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY									
Data Encryp of public ke Elliptic cur	Data Encryption Standard (DES)-Advanced Encryption Standard (AES)-Triple DES. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management-Attacks on RSA - Diffie-Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography								
UNIT-III HASH FUNCTIONS AND DIGITAL SIGNATURES									
Authenticat and authenti	ion requirement – MAC – Hash function – MD5 - SHA - HMA cation protocols – DSS	C - Merkle Hash TreeDigital	signature						
UNIT-IV	SECURITY PRACTICE & SYSTEM SECURITY		6						
Kerberos – signatures C	Kerberos – Firewall types and design - Intrusion detection system – Malicious software - Antivirus: introduction - signatures Case Study:- 3D-Secure								
UNIT-V	E-MAIL, IP & WEB SECURITY		6						
E-mail Sec Encapsulatio Case Study	urity: Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSe on Security Payload (ESP) Web Security: SSL/TLS Basic Protocol- e Privacy and Security of Aadhar	ec - IP and IPv6-Authenticatio computing the keys- client auth	n Header- entication.						
		Contact Hours :	30						

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LIST O	FEXPERIMENTS									
1.	Implement the following substitution and transposition techni	iques:								
	a) Caesar Cipher									
	b) Playfair Cipher									
	c) Rail Fence – Row & Column Transformation									
2.	Implement the following algorithms:									
	a) RSA Algorithm									
	b) Diffie-Hellman Key Exchange									
3.	Implement the Digital Signature Algorithm (DSA).									
4.	Implement a Keylogger to record the keystrokes.									
5.	Perform Code injection in running processes using ptrace.									
6.	Perform wireless audit on an access point or a router and decr	rypt WPA keys (aircrack-ng)								
7.	Demonstrate Intrusion Detection System using any tool (snor	t or any other equivalent s/w)								
8.	Demonstrate various exploits of Windows OS using Metasplo	oit framework.								
9.	Install and Configure Firewalls for a variety of options (iptable	les or pfsense)								
10.	Demonstrate a simple MITM attack (ettercap)									
		Contact Hours	:	30						
				(0)						
		1 otal Contact Hours	:	60						
				1						

Cour On co	Course Outcomes: On completion of the course, the students will be able to								
•	Grasp concepts in classical encryption techniques and number theory								
•	Thoroughly understand Public Key Encryption and apply to real-world applications								
•	Apply hashing algorithms and digital signatures.								
•	Comprehend system level securities.								
•	Perceiving the best in email, IP and Web Security.								

Tex	xt Books(s):
1	William Stallings, "Cryptography and Network Security-Principles and Practices", Seventh Edition, Pearson Education, 2017
2	Christo Paar and Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", First Edition, Springer, 2010

Re	ference Books(s) / Web links:
1	JoxeanKoret and Elias Bachaalany," The Antivirus Hackers Handbook", First Edition, Wiley, 2015
2	Douglas R. Stinson," Cryptography: Theory and Practice", Third Edition, by, CRC Press, Taylor and Francis Group (Indian Edition),2006
3	https://blockonomi.com/merkle-tree/
4	https://www.educba.com/md5-alogrithm/
5	https://www.iusmentis.com/technology/hashfunctions/md5/

PO/PSO CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	РО 11	PO 12	PSO 1	PSO 2	PSO 3
CS19642.1	3	3	1	2	0	2	0	0	1	0	0	3	2	2	2
CS19642.2	3	3	2	1	0	0	0	0	1	0	0	3	2	2	2
CS19642.3	3	3	2	2	2	0	0	2	0	0	0	3	1	1	2
CS19642.4	0	1	2	2	2	0	0	0	2	0	0	3	1	1	2
CS19642.5	0	2	2	2	2	0	0	0	2	1	0	3	1	1	2
CO (Avg)	3.0	2.4	1.8	1.8	2.0	2.0	-	2.0	1.5	1.0	-	3.0	1.4	1.4	2.0

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	С
AI19P75	INFORMATION RETRIEVAL	PE	2	0	2	3

Obje	ctives:
٠	Learn the information retrieval models.
٠	Learn the process of retrieval
٠	Learn the mathematics behind the ranking of the resultant pages
٠	Understand the application probability in retrieval
٠	Be familiar with Web Search Engine.

UNIT-I Introduction to Information retrieval	6				
Information retrieval process- Indexing- Information retrieval model- Boolean retrieval model Tokenization-					
words- Stemming- Inverted index- Skip pointers- Phrase queries(Chapter 1,2)					
UNIT-II Tolerant Retrieval and Term Weighting and Vector Space Model	6				
Dictionaries and tolerant retrieval - Wild card queries- Permuterm index- Bigram index- Spelling correct	ion- Edit				
distance- Jaccard coefficient- Soundex Parametric and zone indexes Term frequency and weighting The vec	tor space				
model for scoring Variant tf-idf functions(chapter 3,4,6)					
UNIT-III Efficient scoring and ranking	6				
Information retrieval system evaluation - Standard test collections - Evaluation of unranked retrieval sets - E	valuation				
of ranked retrieval results - Assessing relevance -A broader perspective: System quality and user utility- R	elevance				
feedback and pseudo relevance feedback -Query reformulation(Chapter 8,9)					
UNIT-IV XML retrieval using Probability Ranking Principle	6				
XML retrieval - Challenges in XML retrieval - A vector space model for XML retrieval - Evaluation of XML	retrieval				
- Text-centric vs. data-centric XML retrieval - The 1/0 loss case - The PRP with retrieval costs- Th	e Binary				
Independence Model - Deriving a ranking function for query terms - Probabilistic approaches to relevance fe	edback -				
An appraisal of probabilistic models - Tree-structured dependencies between terms - Okapi BM25: a no	on-binary				
model - Bayesian network approaches to IR(chapter 10,11)					
UNIT-V Web Search and web crawling	6				
Overview - Features a crawler must provide- Features a crawler should provide - Crawling - Crawler architectures	itecture -				
DNS resolution - The URL frontier- Distributing indexes - Connectivity servers- Link analysis - web as	a graph-				
Anchor text and the web graph -PageRank - Markov chains - The PageRank computation -Hubs and Authorities-					
Choosing the subset of the Web(chapter 19,20,21)					
Contact Hours	: 30				

List of	f Experiments	
1	Develop a system to do Document summarization	
2	Develop a movie Title recommendation system	
3	Develop a program for Spam mail detection	
4	Develop a small search engine for wiki	
5	Develop a classifier system for tweets classification	
		Contact Hours: 30
		Total Contact Hours: 60

Course Outcomes:On completion of the course, the students will be able to&Understand the fundamental of the Information Retrieval

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Ś	Get the understanding different Information retrieval model.
8	Evaluate methods of the information retrieval model.
8	Acquire knowledge of retrieval from XML
10	Envilling of the design of the second second second

 Log
 Familiarize with the working of search engines

Te	xt Books:
1	1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2	2. Ricardo Baeza -Yates and Berthier Ribeiro - Neto, Modern Information Retrieval: The Concepts and Technology behind Search 2nd Edition, ACM Press Books 2011.

Reference Books:

IU	ci c
1	Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in Practice, 1 st Edition Addison Wesley, 2009.
2	Mark Levene, An Introduction to Search Engines and Web Navigation, 2 nd Edition Wiley, 2010.
3	Stefan Buettcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.
4	Ophir Frieder "Information Retrieval: Algorithms and Heuristics: The Information Retrieval Series ", 2 nd Edition, Springer, 2004.

Web link:

- 1. http://www.tartarus.org/martin/PorterStemmer/
- 2. http://www.searchenginewatch.com
- 3. http://www.google.ca/intl/en/corporate/tech.html

<u>CO - PO – PSO matrices of course</u>

PO/PSO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PSO	PSO	PSO 3
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
AI19P75.1				1			1					1			1
AI19P75.2		1		2		1	1		2		1	2			1
AI19P75.3	3	3		3		2	1	2	2		3	3	3	3	3
AI19P75.4	3	3		3		3	3	3	3		3	3	3	3	3
AI19P75.5	2	3		3		3	3	3	3		3	3	3	3	3
CO (Avg)	2.7	2.5		2.4		2.3	1.8	2.7	2.5		2.5	2.4	3	3	2.2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), No correlation: "-"

Subject Code	Subject Name (Theory Course)	Category	L	Т	P	С
AI19P76	SUPPLY CHAIN ANALYTICS	PE	3	0	0	3

Ob	jectives:
	To understand the basics of supply chain analytics and its processes.
	To know the role of modelling in the supply chain.
	To learn the visualization techniques and performance measurement systems in the supply chain.
	To explore supply chain analytics for supply chain strategy processes.
	To understand prescriptive models and optimization models in supply chain analytics.

UNIT-I Introduction to Supply Chain Analytics	9				
Data Science-Data Analytics-Supply Chain Analytics Components-Supply Chain Partners and Analytics-Probler					
solving, decision making and analytics-Supply chain analytics relevance to service and manufacturing-Supply	oly chain				
analytics lifecycle-Overview of four process SCM framework- Overview of the three SC analytics categories.					
(T1-CHAPTER 1,2)					
UNIT-II Role of Modelling in the Supply Chain	9				
Defining the supply chain-The supply chain as a complex system-Supply chain models and modelling-Th	ie use of				
computer modeling in the supply chain. Data in supply chain-data analytics methodology-Data type-small and	l big data				
in supply chain-Challenges in working with data. (T2-CHAPTER 2, 3)					
UNIT-III Visualization Techniques and Performance Measurement Systems in Supply Chain	9				
Data visualization-process, information and network visualization-The development of supply chain per	ormance				
measurement systems: Current applications- Analytical tools used in connection with performance measurement	res -The				
future of performance measurement systems. (T2-CHAPTER 4, 5)					
UNIT-IV Supply Chain Analytics for Supply Chain Strategy Processes	9				
Supply chain strategy processes-PESTLE analysis- Strength, weakness, opportunities and threats (SWOT)	analysis-				
supply chain strategy alignment- supply chain strategy implementation planning - supply chain strategy risk	analysis-				
Financial analysis of projects- Case study: using analytics to improve operation performance.(T1-CHAPTER	4)				
UNIT-V Supply Chain Analytics: Prescriptive models	9				
Optimization models using linear programming-Facility location problem-Vehicle routing problem	n-Future				
opportunities in supply chain analytics and modelling. (T2-CHAPTER 7, 8)					
Contact Hours	: 45				

Course Outcomes:	
On completion of the course, the students will be able to	
Explain the impact of supply chain decisions on the success of a company and identify key decision areas.	
Make data-driven decisions in choosing the right supply chain model.	
Apply visualization tools for supply chain data and define key metrics that track the performance of the suppl	ly
chain.	
List the supply chain analytics techniques to enhance the supply chain strategy processes.	
Use optimization methods for facility location and vehicle routing decisions using decision analysis.	

Te	Text Books:									
1	Peter W. Robertson (2021), Supply Chain Analytics Using Data to Optimise Supply Chain Processes, Routledge, Taylor & Francis, New York, 1st Edition,. ISBN 9780367540067									
2	Tipi, Nicoleta. (2021). Supply Chain Analytics and Modelling: Quantitative Tools and Applications. United Kingdom: Kogan Page.									

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Ref	ference Books:
1	Chopra S. and Meindl P. (2012), Supply Chain Management: Strategy, Planning and Operation, 5th Edition,
	Pearson Education, USA.
2	Fisher M. and Raman A. (2008). The new Science of Retailing: How analytics are transforming the supply chain
	and improving performance, Harvard Business Press, Boston, Massachusetts, USA.
2	Feigin G. (2011). Supply Chain Planning and Analytics: The right product to the right place at the right time,
3	Business Expert Press, New York, USA.
4	Handfield R. (2006). Supply Market Intelligence: A managerial handbook for building sourcing strategies, Taylor
4	and Francis Group, Auerbach Publications, New York, USA.

Web link:

1. <u>https://alison.com/courses/an-introduction-to-modelling-and-analytics-in-supply-networks/content</u>

2. https://www.coursera.org/learn/supply-chain-analytics

3. <u>https://onlinecourses.nptel.ac.in/noc20_mg27/preview</u>

CO - PO – PSO matrices of course

PO/PSO	РО	РО	РО	PO	РО	PO	PO	РО	PO	РО	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P76.1	2	1	1	1	2	-	-	-	-	-	-	2	1	3	2
AI19P76.2	2	2	1	1	2	-	-	-	1	-	1	2	1	3	2
AI19P76.3	2	2	3	1	3	-	-	-	1	-	1	2	2	3	2
AI19P76.4	2	2	2	1	3	-	-	-	1	-	1	2	1	3	2
AI19P76.5	2	2	3	1	3	-	-	-	1	-	1	2	2	3	2
CO (Avg)	2	1.8	2	1	2.6	-	-	-	0.8	-	0.8	2	1.4	3	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High), No correlation: "-"

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	C
AI19P77	HYPOTHESIS TESTING	PE	2	0	2	3

Obj	Objectives:							
8	To get knowledge of the sampling techniques							
8	To get introduced with Estimation							
8	To Understand how to develop Null and Alternative Hypotheses along with errors							
ß	Acquaint knowledge with the standard tool on Hypothesis Testing							
8	To use the acquired knowledge in the real world applications							

UNIT-I Sampling

Basic concepts of sampling - Population - Parameter - Statistic - Unbiasedness - Mean square error - simple problems. Simple random sampling with and without replacement - Estimation of population mean - Variance of estimators -Stratified Sampling: Estimation of total, mean - Its variance - Allocation problems.(T1,Chapter 12)

UNIT-II Theory of Estimation

Unbiasedness, Consistency - Efficiency - Cramer - Rao inequality - Chapman - Robbin's inequality Method of moments - Method of maximum likelihood - Method of minimum chi-square, Method of modified minimum chi-square - Method of least squares Confidence intervals for mean when S.D is known and when the sample is drawn from Normal Population, Confidence interval for Proportion, Confidence interval of variance and ratio of variances. (T1.Chapter 15)

UNIT-III Testing of Hypothesis, Non-parametric Methods and Sequential Analysis	8							
Statistical hypotheses- simple null hypothesis against simple alternative - Best Critical Region. Neyman -Pearson								
Lemma - One parameter exponential family - Families with monotone likelihood ratio property - UMP tests for one								
sided hypotheses-Tests of significance - tests based on normal, t, chi - square and F distributions - Non-parameter	etric							
methods - Run test for randomness - sign test for location - Median test - Mann Whitney - Wilcoxon te	est -							
Kolmogorov-Smirnov test (T1,Chapter 16)								
UNIT-IV Introduction to SPSS	4							
Data handling Diagrammetic representation Descriptive statistics Testing of Hypothesis (T2 Chapter 0, 11)								

Data handling-Diagrammatic representation-Descriptive statistics-Testing of Hypothesis (T2,Chapter 9-11)UNIT-VApplications

UNIT-V A	pplications		6					
Applications of Descriptive Analytics in Health Care, Retailing, Quality Control, Financial (Web References)								
	Contact Hours :	:	30					

List of	f Experiments										
1	Understand the levels of Measurement like Central Tendency, Dispersion, Skewness and Kurtosis										
2	Explore Hypothesis Testing										
	a. One-Sample t Test										
	b. Independent-Samples t Test										
	c. Paired-Samples t Test										
	d. One-Way Analysis of Variance										
	e. ANCOVA										
	f. MANOVA										
	g. MANCOVA										
3	Examine Cross tabulation										
4	Estimate the relation using Chi Square										

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5	Illustrate the Measures of Association	
	a. Spuriousness	
	b. Correlation	
	c. Bivariate Linear Regression	
	d. Multiple Linear Regression	
	e. Dummy Variable Regression	
		Contact Hours: 30
		Total Contact Hours: 60

Course Outcomes:

On	On completion of the course, the students will be able to								
8	Understand Sampling								
8	Calculate the problems related to point estimation and interval estimation								
8	Evaluate the hypothesis								
8	Familiarize the tool used in Industry								
8	Apply the acquired knowledge in the real time scenario								

Tex	xt Books:
1	V.K.Kapoor and S.C.Gupta(2010): Fundamentals of Mathematical Statistics, Sultan
T	Chand & Sons, New Delhi(Note only problems to be discussed proof not needed)
2	Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications.
4	London.(Unit 5)
Ref	ference Books:
1	Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World
T	Press, Kolkata
2	Mukhopadhya Parimal (2006) : Applied Statistics, New Central Book Agency, Pvt. Ltd.
2	Calcutta.
3	Scott Hartshorn, Hypothesis Testing: A Visual Introduction To Statistical Significance, Kindle Edition
4	Keith McCormick(2015):SPSS Statistics for Dummies, 3rd Edition, Wiley
20	

CO - PO – PSO matrices of course

PO/PSO	PO 1	РО 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO															
AI19P77.1	3	3	3	3	-	-	-	3	-	-	-	-	3	3	1
AI19P77.2	3	3	3	3	I	I	I	3	I	-	I	I	3	3	2
AI19P77.3	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3
AI19P77.4	-	-	-	-	3	-	-	3	2	-	-	3	3	3	1
AI19P77.5	-	-	-	-	3	-	-	3	3	3	-	3	-	-	3
CO (Avg)	1.8	1.8	1.6	1.8	1.2	-	-	3	1	0.6	-	1.2	2.4	2.4	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

SEMESTER – VIII

PROFESSIONAL ELECTIVE – VI

Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	P	С
AI19P81	NETWORK ANALYSIS	PE	2	0	2	3

Ob	Objectives:						
•	To get introduced to the basic concepts of Social Network Analytics						
•	To understand the concept of semantic web and related applications.						
•	To learn knowledge representation using ontology.						
•	To understand human behaviour in social web and related communities.						
٠	To learn visualization of social networks.						

UNIT-I INTRODUCTION	6						
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 - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities -							
Web-based networks - Applications of Social Network Analysis. [TB1: CHAPTER 1]							
UNIT-II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION							
Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for	or the						
Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating s	social						
network data: State-of-the-art in network data representation - Ontological representation of social individu	uals -						
Ontological representation of social relationships - Aggregating and reasoning with social network data - Adva	anced						
representations. [TB1: CHAPTER 3]	-						
UNIT-III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS	6						
Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social netwo	orks -						
Definition of community - Evaluating communities - Methods for community detection and mining - Application	ons of						
community mining algorithms - Tools for detecting communities social network infrastructures and community	ities -						
Decentralized online social networks - Multi-Relational characterization of dynamic social network commun	nities.						
[TB: CHAPTER 17]	-						
UNIT-IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES							
Understanding and predicting human behaviour for social communities - User data management - Inference and							
Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online s	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 spec	ctrum						
and countermeasures. [TB2: CHAPTER 20]							
UNIT-V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS	6						
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social							
networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid							
representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation							
networks. [TB2: CHAPTER 27]							
Contact Hours	30						

S.No	List of Experiments
1.	Learn to install and load the necessary packages for performing network analysis.
2.	An experiment to perform analysis on census tract data
3.	An experiment to perform analysis on network data
4.	Perform an experiment to create the network object.
5.	Perform an experiment to visualize your network.
6.	Performing an experiment to monitor the node and network characteristics.
7.	Performing an experiment to build social and spatial network models.
	Contact Hours: 30
	Total Contact Hours: 60

Co	Course Outcomes:					
On	On completion of the course, the students will be able to:					
•	Exhibit basic understanding of networks analytics.					
•	Develop semantic web related applications.					
•	Represent knowledge using ontology.					
•	Predict human behaviour in social web and related communities.					
•	Visualize social networks.					

Text Books:						
1	Peter Mika, -Social Networks and the Semantic Webl, First Edition, Springer 2007.					
2	Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.					

Ref	Reference Books:							
1	Guandong Xu, Yanchun Zhang and Lin Li, —Web Mining and Social Networking – Techniques and							
1	applications , First Edition, Springer, 2011.							
2	Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications							
2	for Searching the Web Effectively, IGI Global Snippet, 2008.							
2	Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, —Collaborative and Social Information Retrieval and							
3	Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.							
4	John G. Breslin, Alexander Passant and Stefan Decker, —The Social Semantic Webl, Springer, 2009.							

Web link:

- 1. https://crd230.github.io/lab10.html#sfnetworks
- 2. https://www.coursera.org/learn/social-network-analysis
- 3. https://www.coursera.org/learn/python-social-network-analysis

PO/PSO	РО	PO	РО	РО	РО	PSO	PSO	PSO							
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P81.1	3	3	1	0	2	1	1	1	1	0	2.2	1	2	1	1
AI19P81.2	2	2	1	0	2	1	2	0	0	0	2	2	1	1	1
AI19P81.3	3	3	1	0	3	0	1	0	0	0	3	1	2	3	2
AI19P81.4	2	3	0	0	2	1	1	1	0	0	2	2	2	2	3
AI19P81.5	2	2	2	2	3	0	1	2	0	0	3	3	3	3	3
CO (Avg)	2.4	2.4	1.0	2.0	2.4	0.6	1.2	0.8	0.2	0.0	2.0	1.8	2.0	2.0	2.0

CO - PO – PSO matrices of course

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"
Subject Code	Subject Name (Lab Oriented Theory Course)	Category	L	Т	Р	С
AI19P82	BUSINESS INTELLIGENCE AND ANALYTICS	PE	2	0	2	3

Ob	Dbjectives:				
٠	To understand the framework for Business Intelligence				
٠	To explore the phases of the Decision-making process				
٠	To adopt the Data warehouse technology platform				
•	To understand the best practices for successful Business Intelligence				
•	To visualize the future of Business Intelligence				

UNIT-I Business Analytics

Terminology-Business Analytics Process-Relationship of Business Analytics process and Organization Decisionmaking process-A framework for Business Intelligence-Brief history of Business Intelligence-Architecture of Business Intelligence (CHAPTER 1 from T1 and CHAPTER 2 from T2)

UNIT-II Decision Making

Characteristics of Decision Making-Decision style and Decision Makers-Models-Benefits of Models-Phases of the Decision-Making Process-Decision Making: The Intelligence phase, Design phase, Choice phase, Implementation phase (CHAPTER 2 from T2)

UNIT-III Components of a Business Intelligence Architecture

Operational and Source Systems-Data Transfer: From Operational to Data Warehouse-The Data Warehouse -Data Warehouse Tables-The Data Warehouse Technology Platform -The Business Intelligence Front-End: Business Query and Reporting -Production Reporting-Online Analytical Processing (OLAP) -Microsoft Office -Dashboards - Scorecards -Performance Management -Analytic Applications-Emerging BI Modules -Best Practices for Successful Business Intelligence (CHAPTER 2 and 3 from T3)

UNIT-IV Data Quality

Data Quality-Successful Data Architectures-Master Data Management (MDM)-Right-Time Data-Data Quality's Chicken and Egg-Best Practices for Successful Business Intelligence-Agile Development: Waterfall Development process, Agile Development techniques, Sharper BI at 1-800 contacts (CHAPTER 7 and 10 from T3)

UNIT-V Future of Business Intelligence

The importance of BI tools-The role of BI standardization-The right tool for the right user-The most successful BI Module-Emerging Technologies-Predicting the future-BI search & Text Analytics-Advanced Visualization-Rich report lets-The future beyond technology. (CHAPTER 12 and 14 from T3)

Contact Hours : 30

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	List of Experiments
1	Import the legacy data from different sources such as (Excel, Sql Server, Oracle etc.) and load in the target
1	system.
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server /
2	Power BI.
3	Data Visualization from ETL Process
4	Creating a Cube in SQL server 2012
5	Apply the what - if Analysis for data visualization. Design and generate necessary reports based on the data
5	warehouse data.
6	Implementation of Classification algorithm in R Programming.
7	Practical Implementation of Decision Tree using R Tool
8	k-means clustering using R
9	Prediction Using Linear Regression
10	Data Analysis using Time Series Analysis

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11	Data Modelling and Analytics with Pivot Table in Excel		
12	Data Analysis and Visualization using Advanced Excel		
	Contact Hours	:	30
	Total Contact Hours	:	60

Co	Course Outcomes:						
On	On completion of the course, the students will be able to						
•	Understand the framework for Business Intelligence						
•	Plan the phases of Decision-making phases						
•	Appreciate the Data warehouse technology platform						
•	Appreciate the Agile Development techniques						
•	Understand the future beyond technology						

Tex	xt Books:
1	Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey," Business Analytics Principles, Concepts,
	and Applications with SAS What, Why, and How", Pearson Education, 2015.
2	Efraim Turban, Ramcsh Sharda, Dursun Delen,"Decision Support and Business Intelligence Systems",9th
2	edition.
3	Cindi Howson,"Successful Business Intelligence-Secrets to making BI a killer App",McGraw Hill,2008.
Ref	ference Books:
1	Rick Sherman,"Business Intelligence Guidebook: From Data Integration to Analytics", 1st Edition, Kindle
I	Edition.
2	Ahmed Sherif, "Practical Business Intelligence Kindle Edition".
2	Cindi Howson,"Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data", 2nd
3	Edition Kindle Edition

PO/PSO CO	PO 1	PO 2	PO 3	РО 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
AI19P82.1	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.2	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.3	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.4	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
AI19P82.5	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3
CO (Avg)	1	2	3	3	3	3	3	3	3	2	3	3	3	3	3

<u>CO - PO – PSO matrices of course</u>

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

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Subject Code	Subject Name (Theory Course)	Category	L	Т	P	С
AI19P83	QUANTUM CRYPTOGRAPHY AND CODING	PE	3	0	0	3

Ob	Objectives:					
٠	To get introduced to the basic concepts Quantum cryptography.					
•	To understand the concept of information theory and quantum information theory.					
•	To learn quantum key distribution and secret key distillation.					
•	To understand reconciliation and non-binary reconciliation					
•	To learn security analysis of quantum key distribution					

UNIT-I INTRODUCTION

A first tour of quantum key distribution – Notations and conventions – Classical cryptography: Confidentiality and secret key ciphers, secret key authentication, Public key Cryptography.

UNIT-II INFORMATION THEORY AND QUANTUM INFORMATION THEORY

Information Theory: Source- Coding- Joint and conditional entropies- channel coding- Renyi Entropies. Quantum Information Theory : Fundamental definitions- Qubits and qubit pairs – Density matrices and quantum systems – Entropies and coding – Quantum Optics.

UNIT-III QUANTUM KEY DISTRIBUTION AND SECRET KEY DISTILLATION

Cryptosystem based on quantum key distribution: A Key distribution scheme, a secret key encryption scheme, implementation of QKD based crypto system. Secret key distillation : A twostep approach, characteristics of distillation techniques, authenticated one shot and repetitive secret key distillation – Unauthenticated secret key distillation – Secret key distillation with continuous variables.

UNIT-IV RECONCILIATION AND NON BINARY RECONCILIATION

Reconciliation: Problem description – Source coding with side information – Binary interactive error correction protocols – Turbo codes – Low density parity check codes. Non binary reconciliation: Sliced error correction – Multi stage soft decoding – reconciliation of Gaussian key elements.

UNIT-V SECURITY ANALYSIS OF QUANTUM KEY DISTRIBUTION

 $Eaves dropping \ strategies \ and \ Secret \ key \ distillation - Distillation \ derived \ from \ Entanglement \ purification - A \ protocol \ with \ Coherence \ state : \ GG02 - Implementation \ GG02 - Application \ to \ the \ GG02 \ protocol.$

Contact Hours 45

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Co	Course Outcomes:						
On	On completion of the course, the students will be able to:						
•	Exhibit basic understanding of Quantum cryptography						
•	Apply quantum information theory to design secure system.						
•	Design a crypto system based on quantum key distribution and secret key distillation.						
•	Apply reconciliation and non-binary reconciliation						
•	Analyse the security strategies of quantum key distribution.						

Te	Text Books:						
1	Gilles van Assche Quantum Cryptography and Secret-Key Distillation, Cambridge University Press, 2012.						
2	Federico Grasselli, Quantum Cryptography: From Key Distribution to Conference Key Agreement, Springer, 2021						

Re	Reference Books:						
1	Neeraj Kumar, Limitations and Future Applications of Quantum Cryptography, IGI Global, 2021.						
2	Christian Kollmitzer, Mario Pivk, Applied Quantum Cryptography, Springer, 2010						

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CO - PO - PSO matrices of course

PO/PSO	РО	PO	РО	РО	РО	РО	РО	РО	PO	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AI19P83.1	3	3	3	3	3	2	-	-	-	-	2	2	3	3	1
AI19P83.2	3	3	3	3	2	1	-	-	-	-	2	2	3	3	1
AI19P83.3	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
AI19P83.4	3	3	2	3	2	1	-	-	-	-	1	1	3	3	1
AI19P83.5	3	3	2	2	2	1	-	-	-	-	1	1	3	3	1
CO (Avg)	3	3	2.4	2.6	2.2	1.2	-	-	-	-	1.4	1.4	3	3	1

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Theory Course)	Category	L	Т	P	С
IT19P84	PARALLEL COMPUTING	PE	3	0	0	3

Objec	ctives:
٠	To study the scalability and clustering issues and the technology necessary for them.
•	To understand the technologies enabling parallel computing.
•	To study the different types of interconnection networks.
•	To study the different parallel programming models.
•	To study the software support needed for shared memory programming.

UNIT-I SCALABILITY AND CLUSTERING

Evolution of Computer Architecture - Dimensions of Scalability - Parallel Computer Models - Basic Concepts of Clustering - Scalable Design Principles - Parallel Programming Overview - Processes, Tasks and Threads -Parallelism Issues -- Interaction / Communication Issues -- Semantic Issues In Parallel Programs. UNIT-II ENABLING TECHNOLOGIES 9 System Development Trends - Principles of Processor Design - Microprocessor Architecture Families - Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture - Latency Tolerance Techniques - Multithreaded Latency Hiding. UNIT-III SYSTEM INTERCONNECTS 9 Basics of Interconnection Networks - Network Topologies and Properties - Buses, Crossbar and Multistage Switches, Software Multithreading - Synchronization Mechanisms. PARALLEL PROGRAMMING **UNIT-IV** 9 Paradigms And Programmability - Parallel Programming Models - Shared Memory Programming. MESSAGE PASSING PROGRAMMING **UNIT-V** 9 Message Passing Paradigm - Message Passing Interface - Parallel Virtual Machine. Contact Hours : 45 Periods

Course Outcomes:

On completion of the course, the students will be able to

CO1 Analyze different methods used for Scalability and Clustering.

CO2 Study the Enabling Technologies of Parallel Computing.

CO3 Design various System interconnects using Network topologies.

CO4 Do the analysis and implementation procedures for Parallel programming.

CO5 Understand the concept of message passing programming.

Text Books:

1 Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw-Hill, New Delhi, 2003.

Reference Books:

1	David E. Culler & Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/Software Approach", Morgan Kaufman Publishers, 1999.
2	Michael J. Quinn, "Parallel Programming in C with MPI & OpenMP", Tata McGraw-Hill, New Delhi, 2003.
3	Kai Hwang, "Advanced Computer Architecture" Tata McGraw-Hill, New Delhi, 2003.

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CO/PO	PO1	PO2	PO3	PO 4	PO5	PO6	PO 7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO	PSO	PSO	PSO
							/						1	2	3	4
IT19P84.1	3	2	-	3			-	-		-	-	-	3	-	3	-
IT19P84.2	-	3	3	2			-	-		-	3	-	3	-	3	-
IT19P84.3	-	3	3	3			-	-		-	3	-	3	-	3	-
IT19P84.4	-	3	2	3			-	-		-	3	-	3	-	-	-
IT19P84.5	-	2	3	3			-	-		-	-	-	-	3	-	-
CO (Avg)	3	2.6	2.7	2.8			-	-		-	3		3	3	3	-

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

OPEN ELECTIVE COURSES OFFERED BY AIML

Subject Code	Subject Name (Theory Courses)	Category	L	Т	Р	С
OAI1901	ARTIFICIAL INTELLIGENCE AND NEURAL NETWORK	OE	3	0	0	3

Ob	jectives:
•	Understand the various characteristic of a problem solving agent.
•	Learn about the different strategies involved in problem solving.
•	Learn about Knowledge Representation and reasoning.
٠	To interpret the basic concepts of Neural Networks.
٠	To learn various Neural Architecture Models.

UNIT-I INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING AGENT

Introduction : AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation CHAPTER - 1, 2 & 3 (R1)

UNIT-II SEARCHING TECHNIQUES

Heuristic search techniques: Generate and test - hill climbing - Breadth first search - A^* algorithm - problem reduction - AO* algorithm - constraint satisfaction - means-ends analysis CHAPTER - 3 (T1)

UNIT-III KNOWLEDGE REPRESENTATION AND REASONING

Knowledge Representation - Using Predicate logic: representing simple facts in logic - representing instance and ISA relationships - computable functions and predicates - resolutions. Representing knowledge using rules: procedural Versus declarative knowledge - logic programming - forward versus backward reasoning. CHAPTER - 5 & 6 (T1)

 UNIT-IV
 INTRODUCTION TO NEURAL NETWORKS
 9

 Introduction
 - Basic Architecture of Neural Networks: Single Computational Layer - Multilayer Neural Network as a Computational Graph - Training a Neural Network with Backpropagation CHAPTER - 1 (T2)

 UNIT-V
 NEURAL ARCHITECTURE MODELS
 9

Common Neural Architectures - Advanced Topics: Reinforcement Learning - Separating Data Storage and Computations - Generative Adversarial Networks - Two Notable Benchmarks - The MNIST Database of Handwritten Digits - The ImageNet Database. Neural Architectures for Binary Classification Models: Revisiting the Perceptron -Least-Squares Regression - Logistic Regression - Support Vector Machines. CHAPTER – 1 & 2 (T2)

Contact Hours : 45

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С	ourse Outcomes:							
0	On completion of the course, the students will be able to							
•	Acquire the basic concepts of Artificial Intelligence and Problem solving agent.							
•	Apply various searching techniques.							
•	Understand the Knowledge Representation and Reasoning.							
•	Explain the basic concepts of Neural Networks.							
•	Apply various Neural Architecture Models.							

Te	xt Books:
1	Artificial Intelligence, 2nd Edition, E.Rich and K.Knight (TMH).
2	CharuC.Aggarwal "Neural Networks and Deep learning" Springer International Publishing, 2018.

Reference Books:

1	Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education
2	Neural networks and learning machines, simon haykin, 3rd edition, pearson, 2009.

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CO - PO - PSO matrices of course

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	РО 5	PO 6	PO 7	РО 8	PO 9	РО 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
OAI1901.1	2	1	1	1	2	-	-	-	-	-	-	-	3	2	1
OAI1901.2	2	1	1	1	2	-	-	-	-	-	-	-	3	2	1
OAI1901.3	2	2	3	1	2	-	-	-	-	1	-	-	2	2	2
OAI1901.4	2	3	3	1	2	2	-	-	2	1	2	2	1	2	3
OAI1901.5	2	3	3	1	2	2	-	-	2	1	2	2	1	2	3
Average	2	2	2.2	1	2	2	-	-	2	1	2	2	2	2	2

Correlation levels 1, 2 or 3 are as defined below:

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

No correlation: "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
OAI1902	INTRODUCTION TO MACHINE LEARNING	OE	2	0	2	3

Ob	Objectives:				
٠	To know the fundamentals of machine learning.				
٠	Be exposed to regression models.				
•	Be familiar with basic supervised learning algorithms				
٠	To understand machine learning algorithms with tree model.				
٠	To learn and apply unsupervised learning techniques.				

UNIT-I INTRODUCTION

Components of learning – learning models – geometric models – probabilistic models – logical models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation generalization trade off – bias and variance – learning curve.

UNIT-II REGRESSION MODELS

Linear classification – univariate linear regression - bivariate regression – multivariate linear regression – regularized regression – Logistic regression. Naïve Baye's – Discriminant Functions -Probabilistic Generative Models - Probabilistic Discriminative Models – Bayesian Logistic Regression.

UNIT-IIISUPERVISED LEARNING6Perceptron:- multilayer neural networks – back propagation - learning neural networks structures – support vectormachines:- soft margin SVM – going beyond linearity – generalization and over fitting – regularization – validationUNIT-IVTREE MODELSDecision tree:Training and Visualizing a Decision Tree - Making Predictions - Estimating Class Probabilities - The
CART Traing AdaBoost - Gradient Boosting – Xg boost.UNIT-IVUNSUPERVISED LEARNING06

Clustering: Nearest neighbor models – K-means – clustering around Medoids. **Dimensionality Reduction:** – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis.

Contact Hours:30

6

6

List of	List of Experiments							
1.	A python program to implement univariate regression, bivariate regression and multivariate regression.							
2.	A python program to implement logistic model.							
3.	A python program to implement single layer perceptron.							
4.	A python program to implement multi layer perceptron with back propagation.							
5.	A python program to do face recognition using SVM classifier.							
6.	A python program to implement decision tree.							
7.	A python program to implement KNN and K-means.							
	Contact Hours :	30						
	Total Contact Hours :	60						

Co	Course Outcomes:				
On	On completion of the course, the students will be able to				
•	Understand basics of machine learning.				
٠	Analyze the regression models for refining parameters.				
•	Understand and explore the supervised learning algorithms.				
•	Apply tree models for feature extraction.				
٠	Examine the supervised learning algorithms.				

Tex	Text Books:				
1	AurélienGéron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd				
	Edition. September 21019, O' Reilly Media, Inc., ISBN: 9781492032649.				
2	Stephen Marsland,Machine Learning - An Algorithmic Perspectivel, Second Edition, Chapman and Hall/CRC				
2	Machine Learning and Pattern Recognition Series, 2014.				

Ref	Reference Books:				
1	Alex Smola and S.V.N. Vishwanathan," Introduction to Machine Learning", Cambridge University Press 2008.				
2	Andreas C. Müller and Sarah Guido," Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly Media, Inc, 2016.				
3	S. Russel and P. Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Prentice Hall, 2009.				
4	C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.				

Web link:

1. https://www.coursera.org/lecture/python-machine-learning/introduction-4f2So

2. https://nptel.ac.in/courses/106/106/106106139/

CO - PO – PSO matrices of course

PO/PSO	PO	РО	РО	РО	PO	РО	PO	РО	РО	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
OAI1902.1	2	1	1	1	2	-	-	-	-	-	-	-	1	2	1
OAI1902.2	2	1	1	1	2	-	-	-	-	-	-	-	1	2	1
OAI1902.3	2	1	3	1	3	-	-	-	-	1	-	-	1	2	2
OAI1902.4	2	1	3	2	3	2	-	-	2	1	2	2	1	2	3
OAI1902.5	2	1	3	2	3	2	-	-	2	1	2	2	1	2	3
Average	2	1	2.2	1.4	2.6	2	-	-	2	1	2	2	1	2	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"

Subject Code	Subject Name (Laboratory Course)	Category	L	Т	Р	С
OAI1903	INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	OE	0	0	6	3

Ob	Objectives:				
٠	Prepare to become Junior RPA Developers.				
٠	Learn the basic concepts of Robotic Process Automation.				
٠	Develop familiarity and deep understanding of UiPath tools.				
٠	Develop the ability to design and create robots for business processes independently.				
٠	Develop skills required to pass UiPath RPA Associate v1.0 Exam.				

List of Experiments

1.	Downloading and Installing UiPath Academic Alliance.
2.	Installing UiPath Extension in Browsers.
3.	Installing Activity Packages in UiPath Studio.
4.	Version Control.
5.	Experiments based on variables and arguments.
6.	Algorithmic Approach: Selection control structures.
7.	Algorithmic Approach: Iteration control structures.
8.	Experiments based on Basic Recording.
9.	Experiments based on Desktop Recording.
10.	Experiments based on Web Recording.
11.	Experiments based on Selectors.
12.	Experiments based on Data Manipulation.
13.	Screen Scraping.
14.	Data Scrapping.
15.	PDF Extraction.
16.	Excel Automation (Read / Write)
17.	Workbook Automation.
18.	Email Automation.
19.	Orchestrator: Invoice Processing – Dispatcher.
20.	Orchestrator: Invoice Processing – Performer.
21.	Mini Projects.
	Contact Hours : 45

Co On	Course Outcomes: On completion of the course, the students will be able to		
٠	Become Junior RPA Developers.		
٠	Understand the basic concepts of Robotic Process Automation.		
٠	Understand the UiPath tools.		
•	Design and create robots for business processes independently.		
٠	Develop projects using UiPath.		

Te	Text Books:					
1	Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the					
	Leading RPA Tool – UiPath, Alok Mani Tripathi, Packt Publishing Ltd., 2018.					
2	Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An					
	RPA Consultant Paperback, 2018.					

Ref	Reference Books:				
1	Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere, Nandan Mullakara, Arun Kumar Asokan, Packt Publishing Ltd., 2020.				
2	Tom Tauli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems" 1 st Edition, Kindle Edition.				

<u>CO - PO – PSO matrices of course</u>

PO/PSO CO	РО 1	РО 2	РО 3	РО 4	PO 5	PO 6	РО 7	PO 8	PO 9	РО 10	PO 11	РО 12	PSO 1	PSO 2	PSO 3
OAI1903.1	2	1	1	1	2	-	-	-	-	-	-	-	3	2	1
OAI1903.2	2	1	1	1	2	-	-	-	-	-	-	-	3	2	1
OAI1903.3	2	2	3	1	3	-	-	-	-	1	-	-	2	2	2
OAI1903.4	2	3	3	2	3	2	-	-	2	1	2	2	1	2	3
OAI1903.5	2	3	3	2	3	2	-	-	2	1	2	2	1	2	3
Average	2	2	2.2	1.4	2.6	2	-	-	2	1	2	2	2	2	2

Correlation levels 1, 2 or 3 are as defined below: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) No correlation: "-"