# RAJALAKSHMI ENGINEERING COLLEGE (An Autonomous Institution Affiliated to Anna University, Chennai) Choice Based Credit System (CBCS) REGULATIONS – 2019 (Revised) B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE CURRICULUM

## <u>Vision</u>

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:** Graduates will demonstrate their technical skills and competency in various applications through the use of Artificial Intelligence and Data Science.

**PEO 2:** To produce motivated graduates with capability to apply acquired knowledge and skills in data analytics and visualization to develop viable systems.

**PEO 3:** Graduates will establish their knowledge by adopting Artificial Intelligence and Data Science technologies to solve the real world problems

**PEO 4:** To produce graduates with potential to participate in life-long learning through professional developments for societal needs with ethical values.

## 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 Data Science Learning Program will demonstrate

**PSO 1: Foundation Skills:** Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analysis.

**PSO 2: Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business automation.

**PSO 3: Successful Progression:** Ability to critique the role of information and analytics for an innovative career, research activities and consultancy

# CURRICULUM B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE Regulations 2019 (Revised) | Total Credits:162

	SEMESTER I										
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С			
THE	THEORY COURSES										
1.	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			
	<u> </u>										

	SEMESTER II										
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С			
THE	HEORY COURSES										
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	OURSES									
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										

	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			
LAB	LAB ORIENTED THEORY COURSES										
3.	AD19341	Fundamentals of Data Science	PC	5	3	0	2	4			
4.	CS19341	Design and Analysis of Algorithms	PC	5	3	0	2	4			
5.	AD19342	Introduction to Operating System	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	32	21	1	10	24			

		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		
2.	AD19401	Healthcare Analytics	PC	3	3	0	0	3		
LAB	LAB ORIENTED THEORY COURSES									
3.	AI19341	Principles of Artificial Intelligence	PC	5	3	0	2	4		
4.	CS19443	Database Management System	PC	7	3	0	4	5		
5.	AD19441	Introduction to Data Analytics	PC	5	3	0	2	4		
EMP	EMPLOYABILITY ENHANCEMENT COURSES									
6.	GE19421	Soft Skills I	EEC	2	0	0	2	1		
			TOTAL	26	15	1	10	21		

	SEMESTER V										
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С			
THE	'HEORY COURSES										
1.		Professional Elective I	PE	3	3	0	0	3			
2.		Open Elective – I	OE	3	3	0	0	3			
LAB	AB ORIENTED THEORY COURSES										
3.	CB19342	Computational Statistics	BS	5	3	0	2	4			
4.	CS19541	COMPUTER NETWORKS	PC	7	3	0	4	5			
5.	AD19541	Software Engineering Methodologies	PC	5	3	0	2	4			
LAB	ORATORY C	OURSES									
6.	AD19511	R Programming Laboratory	PC	4	0	0	4	2			
EMP	LOYABILIT	Y ENHANCEMENT COURSES									
7.	AD19512	Mini Project on Data Science	EEC	4	0	0	4	2			
8.	GE19521	Soft Skills II	EEC	2	0	0	2	1			
			TOTAL	33	15	0	18	24			

		SEMESTER V	Ί								
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С			
THE	THEORY COURSES										
1.	AD19651	Business Analytics	PC	3	3	0	0	3			
2.	AD19652	Data and Information Security	PC	3	3	0	0	3			
3.		Professional Elective II	PE	3	3	0	0	3			
LAB	ORIENTED	THEORY COURSES									
4.	AI19442	Fundamentals of Machine Learning	PC	5	3	0	2	4			
5.	IT19541	Web Technology	PC	5	3	0	2	4			
6.	AD19643	Innovation and Design Thinking for Artificial Intelligence and Data Science	PC	5	3	0	2	4			
EMP	EMPLOYABILITY ENHANCEMENT COURSES										
8.	GE19621	Problem Solving Techniques	EEC	2	0	0	2	1			
			TOTAL	26	18	0	8	22			

	SEMESTER VII										
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С			
THE	THEORY COURSES										
1.	1.Professional Elective IIIPE33003										
2.		Professional Elective IV	PE	3	3	0	0	3			
3.		Open Elective-II	OE	3	3	0	0	3			
4.	AD19751	Basics of Computer Vision	PC	3	3	0	0	3			
LAB	ORIENTED	THEORY COURSES									
5.	AI19741	Big Data Technology	PC	5	3	0	2	4			
LABO	LABORATORY COURSES										
6.	AD19711	Project Phase-I	EEC	6	0	0	6	3			
			TOTAL	23	15	0	8	19			

	SEMESTER VIII									
SI. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С		
THE	THEORY COURSES									
1.		Professional Elective-V	PE	3	3	0	0	3		
2.		Professional Elective-VI	PE	3	3	0	0	3		
LABO	LABORATORY COURSES									
3.	AD19811	Project Phase-II	EEC	12	0	0	12	6		
			TOTAL	18	6	0	12	12		

TOTAL NO. OF CREDITS: 162

# PROFESSIONAL ELECTIVES (PE)

		Elective – I						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AD19P51	Knowledge Representation in AI	PE	4	2	0	2	3
2.	AD19P52	Game Programming	PE	4	2	0	2	3
3.	AD19P53	Mobile Application and Development	PE	4	2	0	2	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.	AD19P61	Embedded Systems and Programming	PE	4	2	0	2	3
2.	AD19P62	Data Mining Techniques	PE	4	2	0	2	3
3.	CS19P06	Human Computer Interaction	PE	4	2	0	2	3
4.	AD19641	Advanced Artificial Intelligence	PE	4	2	0	2	3

		Elective – III						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AD19P71	Robotic Process Automation	PE	4	2	0	2	3
2.	AD19P72	Predictive Analytics	PE	4	2	0	2	3
3.	IT19P85	Social Networks	PE	3	3	0	0	3
4.	CS19741	Cloud Computing	PE	4	2	0	2	3

		Elective – IV						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AD19P74	Ethics of Artificial Intelligence	PE	3	3	0	0	3
2.	AD19P75	ENGINEERING ECONOMICS AND MANAGEMENT	PE	4	3	0	0	3
3.	IT19P76	Image processing and Vision Techniques	PE	4	3	0	0	3
4.	AD19P76	Video Processing	PE	4	2	0	2	3

		Elective – V						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AD19P77	Cyber Security Systems	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.	IT19P78	Software Testing	PE	3	3	0	0	3

		Elective – VI						
SL. NO.	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	Т	Р	С
1.	AD19P78	Speech Processing and Analytics	PE	4	2	0	2	3
2.	AI19P82	Business Intelligence and Analytics	PE	4	2	0	2	3
3.	IT19P74	Internet of Things	PE	3	3	0	0	3
4.	IT19P84	Parallel Computing	PE	3	3	0	0	3

	~	Credits per Semester										
S.NO	Course Category	1	2	3	4	5	6	7	8	Total Credits		
1	HS	3	0	0	0	0	0	0	0	3		
2	BS	8	4	7	4	4	0	0	0	27		
3	ES	5	13	0	0	0	0	0	0	18		
4	PC	0	7	17	16	11	18	7	0	76		
5	PE	0	0	0	0	3	3	6	6	18		
6	OE	0	0	0	0	3	0	3	0	6		
7	EEC	0	0	0	1	3	1	3	6	14		
8	MC	0	0	0	0	0	0	0	0	0		
	Total	16	24	24	21	22	22	19	12	162		

HS – Humanities and Science

ES – Engineering Science

PE – Professional Elective

EEC – Employability Enhancement Courses

BS – Basic Science

PC – Professional Core

OE - Open Elective

SEMESTER I	
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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.	-
UNIT-I VOCABULARY BUILDING	9
The concept of word formation – Root words from foreign languages and their use in English – Acquaintance prefixes and suffixes from foreign languages in English to form derivatives – Synonyms, antonyms, and stat abbreviations. Compound words – abbreviation – single word substitution – Listening: Listening comprehe listening to motivational speeches, podcasts and poetry. Speaking: Short talks on incidents – place of visit – adm personalities, etc.	e with andard nsion, niring
UNIT-II BASIC WRITING SKILLS	9
paragraphs in documents – Techniques for writing precisely. <b>Reading &amp; Writing</b> – Free writing – paragraphs – reading and writing criticism – change of tense forms in short text or story – inferential reading – rewrite or int text – prepare questions based on the text. <b>Speaking:</b> Everyday situations – conversations and dialogues, spea for and against.	article erpret king
UNIT-III GRAMMAR AND LANGUAGE DEVELOPMENT	9
Read from innovation and ideas that changed the world, newspaper column writing – Speaking: Demonstr speaking practice using visual aids (charts, graphs, maps, pictures, etc.)	rative
Noture and Style of consider Writing Describing Defining Classifying Providing examples or evide	9
Writing introduction and conclusion. Reading & Writing – Read from Literary pieces – identify different parts Difference between print and digital writing. Writing: Recommendations – Foreword – Review of book. Speaki Formal Presentations – Debate on social issues/taboos and solutions.	text – ng-
UNIT-V EXTENDED WRITING AND SPEAKING	9
Writing: Précis writing – Essay writing – workplace communication: Resume – Business letters and ema Proposals. Speaking: Panel discussion – reporting an event – mock interview – Master Ceremony.	ils –
Total Contact Hours :	45
Course Outcomes: On completion of the course students will be able to	
<ul> <li>Discuss and respond to the listening content.</li> </ul>	
<ul> <li>Read and comprehend different texts and appreciate them.</li> </ul>	
<ul> <li>Understand structures and techniques of precise writing.</li> </ul>	
• Analyze different genres of communication and get familiarized with new words, phrases, and sentence structures.	
• Write and speak appropriately in varied formal and informal contexts.	

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

# **Reference Books(s):**

1	Meenakshi Raman & Sangeeta Sharma, Technical Communication, Oxford University Press.
2	Bushan Kumar, Effective Communication Skills, Khanna Publishing House, Delhi.
3	Pushplata, Sanjay Kumar, Communication Skills, Oxford University Press.
4	Michael Swan, Practical English Usage, Oxford University Press, 1995.
5	F.T. Wood, Remedial English Grammar, Macmillan, 2007.
6	William Zinsser, On Writing Well, Harper Resource Book, 2001.
7	Liz Hamp-Lyons and Ben Heasly, Study Writing, Cambridge University Press, 2006.
8	Exercises in 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

Ob	jectives:
•	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.

#### UNIT-I MATRICES AND QUADRATIC FORMS

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.

#### 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	12				
Inner produ	ct and norms - Gram Schmidt orthonormalization process - Modified Gram Schmidt orthonormalization	ation				
process – Q	R Factorization-Singular value decomposition.					
UNIT-IV	DIFFERENTIAL CALCULUS-FUNCTIONS OF SEVERAL VARIABLES	12				
Partial diffe	rentiation - Homogeneous functions and Euler's theorem - Total derivative - Change of variable	es –				
Jacobians -	Partial differentiation of implicit functions - Taylor's series for functions of two variables - Maxima	and				
minima of f	unctions of two variables – Lagrange's method of undetermined multipliers.					
UNIT-V	MULTIPLE INTEGRAL	12				
Double inte	grals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by p	lane				
curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.						
	Total Contact Hours :	60				

Co	Course Outcomes:					
On	completion of the course students will be able to:					
٠	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.					
۲	Evaluate surface area and volume using multiple integrals.					

# Text Book(s):

104	cat 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				

Re	ference Books(s):
1	Friedberg, A.H., Insel, A.J. and Spence, L., Elementary Linear Algebra, a matrix approach, 2 <sup>nd</sup> 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.

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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
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

Ohi	ectives.				
•	To understand the principles of laser and fibre optics in engineering and te	chnology	V.		
•	To understand the principles of last and note optics in engineering and concept of quantum theory and applications.	cimoro <sub>5</sub> .			
•	To study the properties and applications of semiconducting, magnetic, sup-	ercondu	cting and optical mat	erials	
UN	TT-I QUANTUM PHYSICS		6 1		9
Intro	oduction- Quantum free electron theory-De Broglie's concept-Schrodinger	wave e	quation-Time indepe	ender	nt and
time	e dependent equations-Physical significance of wave function - Particle in	n a one o	dimensional box – e	lectro	ons ir
meta	als – degenerate states – Fermi – Dirac statistics – Density of energy states	s - Size	dependence of Ferm	i ene	rgy –
Qua	ntum confinement – Quantum structures – Density of states in quantum	well, qu	antum wire and qua	antun	n dot
	TIL SEMICONDUCTOR PHYSICS				0
Intri	nsic Semiconductors – Energy hand diagram – direct and indirect hand gat	n — semi	conductors – Carrier		,
cond	centration in intrinsic semiconductors – extrinsic semiconductors – Carrie	er conce	ntration in N-type a	nd P-	-type
sem	iconductors - Variation of carrier concentration with temperature - variation	on of Fer	mi level with tempe	ratur	e and
imp	urity concentration - Carrier transport in Semiconductor: random motion	n, drift,	mobility and diffusi	ion –	- Hall
effe					0
	sification of ontical materials – carrier generation and recombination t	rocesse	s = Absorption emi	esion	<b>9</b>
scat	tering of light in metals, insulators and semiconductors (concepts only) –	photo c	urrent in a P-N diod	le - l	Photo
tran	sistor-solar cell – LED – Organic LED- Optical data storage techniques-No	n Linear	Optical materials-p	roper	ties
and	applications.		1 1		
UN	T-IV LASERS AND FIBRE OPTICS				9
Lase	ers: Population of energy levels, Einstein's A and B coefficients derivation -	resonan	t cavity, optical amp	lifica	tion
(qua	litative) – Semiconductor lasers: homojunction and heterojunction- Appl	ications.	Fiber optics: princi	iple,	<b>b</b> 1
cruc	ible method-splicing technique- losses associated with optical fibers —Fiber	r optic c	ommunication system	) –Do m _ f	öuble
opti	c sensors: pressure and displacement.	i optie e	ommunication system	11 - 1	1001
UN	T-V MAGNETIC AND SUPERCONDUCTING MATERIALS				9
Mag	netic dipole moment – atomic magnetic moments- magnetic permeability	and sus	ceptibility –Magneti	ic ma	iterial
clas	sification: diamagnetism - paramagnetism - ferromagnetism - antiferrom	agnetisr	n – ferrimagnetism	– Do	main
The	ory- M versus H 14ehavior - Hard and soft magnetic materials - exam	nples an	d uses-Magnetic p	rincip	ple in
com	puter data storage – Magnetic hard disc (GMR sensor). Introduction of Sup	percondu	ictivity, Properties o	t uno	с <b>А</b>
Sup	erconductors, BCS theory (Qualitative), Type-T and Type II Superconductors	rs –Mag	inetic Levitation-SQ	UIDS	s- An
Over	view of fingh temperature superconductors.		Contact Hours	•	45
	List of Experiments (Any 10 experiment	<u>e)</u>	Contact Hours	•	
1	Determine the wavelength and angle of divergence of laser beam and num	erical an	erture using fiber cal	ole	
2	Determine the wavelength of spectrum by using spectrometer	erreur up	enture using noer eut		
2	Determine of refractive index of a given prism by using spectrometer				
3	Determine specific resistance of the material of given wires using metre br	idae			
-	Varify Ohm's law series and perallal	luge.			
5	Determine the value of Dlandk's constant using photo electric offset				
0	Determine the band can of siven comised ductor				
/	Determine the band gap of given semiconductor.				
ð	Determination of Hall coefficient of semiconducting materials.	oltz as <sup>11</sup>			
א 10	Study the magnetic field produced by current carrying colls by Using Heim	IOITZ COI	•		
10	Sundy the resonance frequency in series connected LUK circuits.	nont			
11	Determine the thickness of the given specimen by using Newton's fing Experi	nent.			
14	Determine the unckness of the given specimen by using all wedge method	Conta	et Hours	•	30
		Total (	Contact Hours	•	75
Con	rse Outcomes:	- Juli		•	
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 devices.

## Text Book(s):

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

#### **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.

# <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
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	P	С
GE19141	PROGRAMMING USING C	ES	2	0	4	4

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

#### UNIT-I GENERAL PROBLEM SOLVING CONCEPTS

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

Introduction- C Structure- syntax and constructs of ANSI C – Variable Names, Data Type and Sizes, Constants, Declarations – Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment and Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation.

#### UNIT-III I/O AND CONTROL FLOW

Standard I/O, Formatted Output – Printf, Variable-length argument lists- Formatted Input – Scanf, Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, GoTo Labels.

#### UNIT-IV FUNCTIONS AND PROGRAM STRUCTURE

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

Pointers and addresses, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional arrays, Strings, Initialisation of Pointer Arrays, Command line arguments, Pointers to functions, complicated declarations. Basic Structures, Structures and Functions, Array of structures, Pointer of Structures, Self-referential Structures, Table look up, Typedef, Unions, Bit-fields, File Access –Error Handling, Line I/O, Miscellaneous Functions.

Contact Hours : 30

6

6

6

6

6

	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

## **Course Outcomes:**

On completion of the course, the students will be able to
Formulate simple algorithms for arithmetic and logical problems.
Implement conditional branching, iteration and recursion.
Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
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 <sup>nd</sup> 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.	
•	V 1 W 1 L ULC DDD D 11' C 15th D 1C 2016	1

2 YashavantKanetkar, Let Us C, BPB Publications, 15<sup>th</sup> Edition, 2016.

### 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

### 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
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	P	С
GE19122	ENGINEERING PRACTICES – ELECTRICAL AND ELECTRONICS	ES	0	0	2	1

#### **Objectives:**

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

	List of Experiments								
A.I	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	4 Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.								
5	5 Measurement of resistance to earth of electrical equipment.								
<b>B.</b> I	ELECTRONICS ENGINEERING PRACTICE								
1	Study of Electronic components and equipment's - Resistor, colour coding, m	easurement of AC signal p	aram	eter					
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 purpos	se PCB.							
5	Measurement of ripple factor of HWR and FWR.								
		<b>Total Contact Hours</b>	:	30					

# Course 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

#### REFERENCE

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.

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

### UNIT-I INTRODUCTION

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.

UNIT-II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT	9						
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	9						
State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature –	Iudicial						
System in States - High Courts and other Subordinate Courts- Role and Importance, Municipalities: Introd	luction,						
Mayor and role of Elected Representative, CEO of Municipal Corporation, Panchayat Raj: Introduction, E	lected						
officials and their roles, ,Village level: Role of Elected and Appointed officials,							
UNIT-IV CONSTITUTIONAL FUNCTIONS AND BODIES	9						
Indian Federal System - Center - State Relations - President's Rule - Constitutional Functionaries - Assessm	ent of						
working of the Parliamentary System in India- CAG, Election Commission, UPSC, GST Council and othe	r						
Constitutional bodies NITI Aayog, Lokpal, National Development Council and other Non - Constitutional bodie	es.						
UNIT-V INDIAN FREEDOM MOVEMENT	9						
British Colonialism in India-Colonial administration till 1857- Revolt of 1857- Early Resistance to British Ru	le-Rise						
of Nationalism in India-Indian Freedom Struggle under Mahatma Gandhi-Non- Cooperation Movement-Civ	il						
Disobedience Movement- Quit India Movement-British Official response to National movement- Independent	nce of						
India Act 1947-Freedom and Partition.							
Total Contact Hours	: 45						

Course Outcomes:
On completion of the course, the students will be able to
<ul> <li>Understand the functions of the Indian government</li> </ul>
• 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
<ul> <li>Understand the sacrifices made by freedom fighters during freedom movement</li> </ul>

Text	Boo	k(s	):
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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 <sup>nd</sup> edition, 2014.
5	PK Agarwal and KN 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.
2	U.R.Gahai, Indian Political System, New Academic Publishing House, Jalandhar.

Q

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
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 knowledge of sampling techniques and use testing of hypothesis for parameter estimation.

#### **ONE – DIMENSIONAL RANDOM VARIABLE** UNIT-I

Probability- Conditional Probability- Bayes Theorem-Discrete and continuous random variables - Moments Moment generating function -Binomial, Poisson, Geometric, Uniform, Exponential, and Normal, Chi-square, t, F distributions. 12

#### TWO - DIMENSIONAL RANDOM VARIABLES UNIT-II

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and Linear regression- Multiple correlation and multiple regression-Applications of Central Limit Theorem.

### UNIT-III | SAMPLING AND ESTIMATION THEORY

Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling -Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.

#### UNIT-IV **TESTING OF HYPOTHESIS**

Statistical hypothesis - Large sample test based on Normal distribution for single mean and difference of means -Tests based on t, F and Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit.

#### UNIT-V NON PARAMETRIC TESTS

Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test.

> **Total Contact Hours** :

12

12

12

12

60

### **Course Outcomes:**

On completion of course students will be able to

•	Apply the basic concepts of probabi	vility, one dimensional	l and two dimensional	Random Variables
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- 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 McGrawHill,2018.	and	Statistics, Random	Processes	and	Queueing	Theory', First	edition,

2 I.R. Miller, J.E. Freund and R. Johnson, Probability and Statistics for Engineers, 8<sup>th</sup> Edition, 2015

#### Reference Books(s):

1	Trivedi.K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2 <sup>nd</sup> Edition, John Wiley and Sons, 2008.
2	Yates R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2 <sup>nd</sup> Edition, Wiley India Pvt. Ltd., 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. Gravbilland D.C. Boes, Introduction to the Theory of Statistics, McGraw Hill Education.

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
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	P	С
GE19101	ENGINEERING GRAPHICS	ES	2	2	0	4

Ob	Objectives:					
•	To understand the importance of the drawing in engineering applications					
•	To develop graphic skills for communication of concepts, ideas and design of engineering products					
•	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					
٠	To improve their technical communication skill in the form of communicative drawings					

CONCEPT								
CONCEPT	S AND CONVENTIONS (Not for Examination)		1					
Importance	of graphics in Engineering Applications-Use of drafting Instruments-	BIS conventions and specificati	ons-					
Size, layout	Size, layout and folding of drawing sheets– Lettering and dimensioning. Basic Geometrical constructions.							
UNIT-I	PLANECURVES AND FREE HAND SKETCH		11					
Curves used	in engineering practices: Conics–Construction of ellipse, parabola	and hyperbola by eccentricity						
method- Co	nstruction of cycloids, Construction of involutes of square and circ	le drawing of tangents and nor	mal to					
the above cu	rves. Visualization concepts and Free Hand sketching: Visualization	principles – Representation of	Three					
Dimensiona	l objects – Layout of views- Freehand sketching of multiple views fror	n pictorial views of objects						
UNIT-II	<b>PROJECTION OFPOINTS, LINESAND PLANESURFACE</b>	× v	12					
Orthographi	c projection- principles-Principal planes- projection of points. Fi	rst angle projection – Project	ion of					
straight line	s inclined to both the principal planes – Determination of true lengt	hs and t rue inclinations by						
rotating line	method- Projection of planes (polygonal and circular surfaces) incli	ned to both the principal planes	s by					
rotating obje	ect method.		2					
UNIT-III	PROJECTIONOFSOLIDS		12					
Projection of	f simple solids like prisms, pyramids, cylinder and cone when the a	xis is inclined to one of the prin	cipal					
planes by ro	tating object method.	-	-					
UNIT-IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPME	NTOF SURFACES	12					
Sectioning of	of solids in simple vertical position when the cutting plane is incline	ed to the one of the principal p	lanes					
and perpend	icular to the other – obtaining true shape of the section. Development	nt of lateral surfaces of simple a	ind					
sectioned so	lids – Prisms, pyramids, cylinders and cones.	Ĩ						
UNIT-V ISOMETRIC AND PERSPECTIVEPROJECTIONS								
Principles of	isometric projection-isometric scale-Isometric projections of simple	solids and truncated solids – P	risms.					
pyramids c	vlinders and cones. Perspective projection of simple solids-Prisms n	vramids and cylinders by visua	lrav					
method.			,					
		Total Contact Hours :	60					
L								

Course Outcomes:	
On completion of the course, th	e 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	(1) DOOK (5).
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.

Ref	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.							

# <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
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:  $1 \text{ Si}^{1} \text{ b}^{1} \text{ c}^{2} \text{ Si}^{1} \text{ b}^{1} \text{ c}^{2} \text{ c}^{2} \text{ b}^{1} \text{ b}^{1} \text{ c}^{2} \text{ c}^{2} \text{ c}^{2} \text{ b}^{1} \text{ c}^{2} \text{ c}^{2}$ 

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

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

Ob	Objectives:							
٠	To introduce electric circuits and provide knowledge on the analysis of circuits using network theorems.							
٠	To impart knowledge on the phenomenon of resonance in RC, RL and RLC series and parallel circuits.							
٠	To provide knowledge on the principles of electrical machines and electronic devices.							
•	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 DC CIRCUITS

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 AC CIRCUITS

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

### UNIT-III ELECTRICAL MACHINES

Construction, Principles of operation and characteristics of; DC machines, Transformers (single and three phase), Synchronous machines, three phase and single-phase induction motors.

### UNIT-IV ELECTRONIC DEVICES & CIRCUITS

Types of Materials – Silicon & Germanium- N type and P type materials – PN Junction –Forward and Reverse Bias – Semiconductor Diodes –Bipolar Junction Transistor – Characteristics –Field Effect Transistors – Transistor Biasing – Introduction to operational Amplifier –Inverting Amplifier –Non Inverting Amplifier.

# UNIT-V MEASUREMENTS & INSTRUMENTATION

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

0

9

9

9

List of Experiments									
1	1 Verification of Kirchhoff's Laws.								
2	2 Load test on DC Shunt Motor.								
3	3 Load test on Single phase Transformer.								
4	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							

Co	urse Outcomes:
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.
٠	Experimentally analyze the electric circuits, electrical machines, electronic devices, and transducers.
Te	xt 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

Re	Reference 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								
n	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	Objectives:								
•	To learn the basic postulates of Boolean algebra and infer the methods for simplifying Boolean expressions								
•	To understand the design of various Combinational circuits.								
•	To extrapolate the design of Synchronous Sequential circuits using Flip-Flops.								
•	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								

	0111-1	DOOLEAN ALGEBRA AND LOOIC GATES										
	Fundamentals: Boolean postulates and laws, De-Morgan's Theorem, Principle of Duality, Boolean expre											
Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS).												
	Minimizati	on Tachniques: Minimization of Poolean expressions using Poolean Laws, Kernaugh man, O	uina									

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

LINIT I ROOLFAN ALCERRA AND LOCIC CATES

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

#### ASYNCHRONOUS SEQUENTIAL CIRCUITS UNIT-IV

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

#### **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** : 0

0

9

9

0

	List of Experiments											
1	1 Implementation of Binary to Gray and Gray to Binary code converters											
2	2 Logic function implementation of Multiplexer and De-multiplexer using logic gates.											
3	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 Outcomes:**

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

- Simplify the Boolean expressions using basic postulates of Boolean algebra with suitable minimization techniques.
- Design and Implement Combinational circuits.
- Construct Synchronous Sequential circuits using Flip-Flops.
- Design Asynchronous Sequential circuits and analyse its problems.
- Implement digital circuits using Programmable Logic Devices and Familiar with Verilog HDL.

#### Text Books:

Morris Mano & Michael D Ciletti, "Digital Design: With an Introduction to Verilog HDL, 5<sup>th</sup> Edition, Pearson Education ,2013.
 Charles H.Roth. "Fundamentals of Logic Design", 7<sup>th</sup> Edition, Thomson Learning, 2014.

#### 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.							

#### Web links for virtual lab:

1 <u>http://vlabs.iitkgp.ernet.in/dec/#</u>

### 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	
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	Р	C
CS19241	DATA STRUCTURES	PC	3	0	4	5

Ob	Objectives:							
•	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 be able to incorporate various searching and sorting techniques in real time scenarios.							

#### UNIT-I LINEAR DATA STRUCTURES – LIST

Abstract Data Types (ADTs) - List ADT - array-based implementation - linked list implementation - singly linked lists- circularly linked lists- doubly-linked lists - applications of lists -Polynomial Manipulation - All operations (Insertion, Deletion, Merge, Traversal). 9

### UNIT-II LINEAR DATA STRUCTURES – STACKS, QUEUES

Stack ADT - Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression -Queue ADT - Operations - Circular Queue - DEQUE - applications of queues.

#### UNIT-III NON LINEAR DATA STRUCTURES – TREES

Tree Terminologies- Binary Tree-Representation-Tree traversals - Expression trees - Binary Search Tree-AVL Trees -Splay Trees - Binary Heap - Applications.

# UNIT-IV | NON LINEAR DATA STRUCTURES – GRAPHS

Graph Terminologies - Representation of Graph - Types of graph - Breadth-first traversal - Depth-first traversal -Topological Sort – Shortest path – Dijikstra's Algorithm – Minimum Spanning Tree- Prim's Algorithm. 0

#### SEARCHING, SORTING AND HASHING TECHNIQUES UNIT-V

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort - Quick sort - Merge Sort. Hashing- Hash Functions - Collision resolution strategies- Separate Chaining - Open Addressing -Rehashing.

**Contact Hours** : 45

0

9

0

	List of Experiments									
1	Array implementation of Stack and Queue ADTs									
2	Array implementation of List ADT									
3	Linked list implementation of List, Stack and Queue ADTs									
4	4 Applications of List, Stack and Queue ADTs									
5	Implementation of Binary Trees and operations of Binary Trees									
6	Implementation of Binary Search Trees									
7	Implementation of AVL Trees									
8	Implementation of Heaps using Priority Queues									
9	Graph representation and Traversal algorithms									
10	Applications of Graphs									
11	Implementation of searching and sorting algorithms									
12	Hashing –any two collision techniques									
	Contact Hours : 60									
	Total Contact Hours : 105									

## **Course Outcomes:**

On	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.								

Te	Text Books:								
1	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2 <sup>nd</sup> Edition, Pearson Education, 2002.								
2	ReemaThareja, Data Structures Using C, Second Edition, Oxford University Press, 2014.								
Re	ference Books:								
1	Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest and Clifford Stein, Introduction to Algorithms,								
-	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 <sup>rd</sup> edition, Pearson Education.								
4	Ellis Horowitz, SartajSahni and Susan Anderson Freed,Fundamentals of Data Structures in C, 2 <sup>nd</sup> Edition,								
-	University Press, 2008.								

# Web links for virtual lab (if any)

1 <u>http://vlabs.iitb.ac.in/vlab/labscse.html</u>

## <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						
CIVI	L ENGINEERING PRACTICE						
1.	Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in 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.						
Carpo	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						

Co	urse 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:					
٠	Learn the Python Environment using interactive and script mode					
٠	Implement Python programs with conditionals and loops.					
٠	Use functions for structuring Python programs.					
٠	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	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 On	urse Outcomes: completion of the course, the students will be able to					
٠	Run Python Programs at interactive and script mode.					
•	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	P	С
MC19101	ENVIROMENTAL SCIENCE AND ENGINEERING	MC	3	0	0	0

Ob	jectives:
•	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.

LINIT I	NATUDAL DESCUDCES		0					
	NATUKAL KESUUKUES		9					
Environmen	Environment –definition – scope and importance – forest resources –use and overexploitation –water resources –use							
and over util	and over utilization – dams – benefits and problems – water conservation –energy resources – growing energy needs –							
renewable a	nd non-renewableenergy sources – use of alternate energy sources –l	and resources –land degradatio	n –					
role of an in	dividual in conservation of natural resources							
UNIT-II	ENVIRONMENTAL POLLUTION		9					
Definition -	causes, effects and control measures of air pollution -chemical a	nd photochemical reactions in	the					
atmosphere	atmosphere – formation of smog, PAN, acid rain, and ozone depletion- noise pollution – mitigation procedures –							
control of pa	rticulate and gaseous emission (Control of SO2, NOX, CO and HC)	. Water pollution - definition-c	auses-					
effects of w	ater pollutants-marine pollution-thermal pollution-radioactive poll	ution-control of water pollution	on by					
physical, ch	emical and biological processes-waste water treatment-primary, se	econdary and tertiary treatmen	t. Soil					
pollution: de	finition-causes-effects and control of soil pollution.	5						
<b>UNIT-III</b>	SOLID WASTE MANAGEMENT		9					
Solid waste	s – sources and classification of solid wastes –solid waste man	agement options – sanitary la	ndfill,					
recycling, c	omposting, incineration, energy recovery options from wastes. Haz	ardous waste –definition –sour	ces of					
hazardous v	vaste-classification (biomedical waste, radioactive waste, chemical	waste, household hazardous w	aste)-					
characteristi	cs of hazardous waste ignitability (flammable) reactivity, corrosivity	toxicity –effects of hazardous	waste					
-case study	· Bhopal gas tragedy – disposal of hazardous waste-recycling, ne	utralization, incineration, pyro	olysis,					
secured land	fill – E-waste management –definition-sources-effects –electronic was	ste recycling technology.	5					
UNIT-IV	SOCIAL ISSUES AND THE ENVIRONMENT	, , , , , , , , , , , , , , , , , , , ,	9					
Sustainable	development –concept components and strategies – social impact	of growing human population	n and					
affluence fo	od security hunger poverty malnutrition famine – consumerism a	ad waste products – environme	nt and					
human heal	h = role of information technology in environment and human he	alth _disaster management_ fl	oods					
earthquake	cyclone and landslide	and disuster management in	00005,					
UNIT-V	TOOLS FOR ENVIRONMENTAL MANAGEMENT		0					
Environmentel impertessagement (EIA) structure, structure for righ sesseement EIS environmentel sudit ISO								
Environmental impact assessment (EIA) structure –strategies for risk assessment–EIS-environmental audit-ISO								
14000-precautionary principle and pointier pays principle- constitutional provisions pointion control boards and								
ponution co	and protocols	ment organizations- internatio	mai					
conventions	and protocols.		45					
		I otal Contact Hours :	45					

Co	Course 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							
•	Develop and improve the standard of better living.							
•	Be conversant with tools of EIA and environmental legislation.							

## Text Book(s):

102	
1	Benny Joseph, "Environmental Science and Engineering", 2 <sup>nd</sup> 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):								
1	Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt. Ltd, New Delhi, 2007.								
2	ErachBharucha, "Textbook of Environmental Studies", 3 <sup>rd</sup> 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.								

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	Objectives:			
•	To extend student's Logical and Mathematical maturity and ability to deal with abstraction.			
•	To study various enumeration methods using principle of counting.			
٠	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	12
Proposition	al calculus - propositions and connectives, syntax; Semantics - truth assignments and truth tables, v	alidity
and satisfiab	bility, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and reso	lution;
Formal redu	cibility – natural deduction system and axiom system; Soundness and completeness.	
UNIT-II	COMBINATORICS	12
Basic count	ing sum and product, balls and bins problems, generating functions, recurrence relations. Proof techni	ques,
principle of	mathematical induction, pigeonhole principle.	
UNIT-III	STRUCTURED SETS	12
Set, relation	- Algebraic System : Groups, Semi groups, monoid, homomorphism, cosets, Ring and Field (defini	tion),
Relation, Ed	uivalence relations, Poset, Lattices, Hasse diagram, Boolean algebra.	
UNIT-IV	GRAPH THEORY	12
Introduction	n – Graph Terminologies – Types of Graphs – Sub Graph- Multi Graph – Regular Graph – Isomorphis	m –
Isomorphic	Graphs – Sub-graph – Euler graph – Hamiltonian Graph – Related problems.	
UNIT-V	TREES	12
Trees – Prop	erties- Distance and Centres – Types – Rooted Tree—Tree Enumeration Labeled Tree – Unlabeled Tr	ree –
Spanning T	ree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connect	ivity-
Separability	r – Related problems.	

Co On	urse Outcomes: completion of the course, the students will be able to
٠	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.
٠	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.

**Total Contact Hours** 

: 60

Te	xt Book(s):
1	Digital Logic & Computer Design, M. Morris Mano, Pearson India Educations Services Pvt. Ltd 2016.
2	Elements of Discrete Mathematics, (Second Edition) C. L. Liu McGraw Hill, New Delhi, 2017.

Ref	ference 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 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,
5	(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).

## CO-PO-PSO matrices of course

PO/PSO															
	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO	PSO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO					-			_		-					
364 10 25 6 1	-	-	-	2								•	2	2	•
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	Р	С
GE19301	LIFE SCIENCE FOR ENGINEERS	BS	3	0	0	3

Ob	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.					

LINIT I	OVEDVIEW OF CELLS AND TISSUES		0
UNIT-I	OVERVIEW OF CELLS AND TISSUES		9
Introductio	on to Bacteria, virus, fungi and animal cells. Organisation of cells into tissues a	nd organs. Functions of	of
vital organ	S.		
UNIT-II	HEALTH AND NUTRITION		9
Balanced of	diet, Importance of RDA, BMR, and diet related diseases. Role of antioxidan	ts PUFA, DHA, Esser	ntial
amino acid	ls, Essential fatty acids in diet. Water and its significance for human health. Pl	nysical and Mental her	alth —
Significan	ce of exercise and yoga.		
UNIT-III	UNHEALTHY PRACTICES AND THEIR IMPACT ON HEALTH		9
Drug induc	ced toxicity, Unhealthy practices - Drug abuse/Narcotics/Smoking/Alcohol/Se	If-medication/Undue u	sage
of electron	ic gadgets.		
UNIT-IV	COMMON DISEASES AND LIFESTYLE DISORDERS		9
Prevention	and management of food, water and airborne illness (Common cold, dehyd	ration, food poisoning	g etc).
Lifestyle d	lisorders - obesity, diabetes, stroke, heart attack, ulcer, renal calculi, cancer, a	AIDS, hepatitis- preve	ntion
and manag	gement.		
UNIT-V	DIAGNOSTIC TESTS AND THEIR RELEVENCE		9
Normal rar	nge of biochemical parameters, significance of organ function tests, organ dona	ition.	
	Tot	al Contact Hours	: 45

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

<b>Reference Books(s):</b>	
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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.
W	eb link:
1	https://nptel.ac.in/courses/122103039/

# CO – PO – PSO matrices of course

PO/PSO	PO	РО	РО	РО	PO	Р	РО	PO	РО	РО	РО	РО	PSO	PSO	PSO3
	1	2	3	4	5	0 6	7	8	9	10	11	12	1	2	
СО						Ŭ									
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: Moderate (Medium) 3: Substantial (High) No correlation : "-"

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	С
AD19341	FUNDAMENTALS OF DATA SCIENCE	PC	3	0	2	4

Ob	Objectives:				
٠	To understand the fundamentals of Data preparation and analysis.				
•	To learn the types of data.				
•	To interpret the correlation among the data.				
•	To know the python libraries and operations on data.				
٠	To learn about data visualization.				

UNIT-I	INTRODUCTION		9			
Data Science: Benefits and uses – facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model– presenting findings and building applications – Data Mining – Data Warehousing – Basic Statistical descriptions of Data						
UNIT-II	DESCRIBING DATA		9			
Types of Da Describing	ta – Types of Variables -Describing Data with Tables and Graphs –De Variability – Normal Distributions and Standard (z) Scores	escribing Data with Averages –	1			
UNIT-III	DESCRIBING RELATIONSHIPS		9			
Correlation coefficient - r2 -multiple	-Scatter plots -correlation coefficient for quantitative Data -comput - Regression -regression line -least squares regression line - Standard e regression equations -regression towards the mean	tational formula for correlation l error of estimate – interpretatio	n of			
UNIT-IV	PYTHON LIBRARIES FOR DATA WRANGLING		9			
Basics of I indexing – missing da	Numpy arrays –aggregations –computations on arrays –comparisons structured arrays – Data manipulation with Pandas – data indexing ta – Hierarchical indexing – combining datasets – aggregation and gro	, masks, boolean logic – fancy and selection – operating on da uping – pivot tables	nta –			
UNIT-V	DATA VISUALIZATION		9			
Importing N legends – co Basemap –	Autplotlib – Line plots – Scatter plots – visualizing errors – density and other set of the set of	nd contour plots – Histograms - onal plotting – Geographic Data	with			
		Total Contact Hours :	45			

	List of Experiments					
1	Working with Numpy arrays					
2	Working with Pandas data frames					
3	Develop python program for Basic plots using Matplotlib					
4	Develop python program for Frequency distributions					
5	Develop python program for Variability					
6	Develop python program for Averages					
7	Develop python program for Normal Curves					
8	8 Develop python program for Correlation and scatter plots					
9	Develop python program for Correlation coefficient					
10	Develop python program for Simple Linear Regression					
	Contact Hours : 30					
	Total Contact Hours     :     75					

	Course Outcomes: On completion of the course, the students will be able						
	•	To build the model based on the analysis of data.					
	•	To differentiate the types of data.					
Ī	•	To understand the relationship and correlation between the data.					
	•	To use the python libraries and data wrangling					
		To visualize the errors and plots.					

# Text Book(s):

1	Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly, 2014.
2	Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Third Edition. ISBN
	0123814790, 2011
3	Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental Concepts and Algorithms", Cambridge University Press, 2014.

Ref	ference Books(s):
1	Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016
2	Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015
3	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

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

Ob	Objectives: 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.				
•	Learn to apply the design techniques in solving various kinds of problems in an efficient way.				
٠	Understand the limitations of Algorithm power.				
٠	Solve variety of problems using different design techniques				

UNIT-I	INTRODUCTION AND ANALYSIS OF ALGORITHMS	9
Introductio	on -Algorithm Specification -Important Problem types- Performance Analysis: Space Complexity -	Time
Comp	lexity – Asymptotic Notations – Using Limits for Comparing Orders of Growth – Basic Efficiency Cl.	asses-
Solving Re	currence Relations: Substitution methods and Master Theorem Method	
UNIT-II	BRUTE FORCE AND DIVIDE-AND-CONQUER	9
Brute Forc	e: Exhaustive Search – Travelling Salesman Problem – Knapsack Problem – Assignment problem –	Divide
and Conqu	er Method: Analysis of Binary Search, Merge sort and Quick sort Algorithms, Integer Multipli	cation-
Finding M	inimum and Maximum.	
UNIT-III	GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING	9
(	Greedy Method – Minimum Spanning Trees: Kruskals Algorithm– Fractional Knapsack – Huffman Co	des –
Dynamic		
Programm	ing: General Method – String Editing – 0/1 Knapsack – Travelling Salesman Problem.	
UNIT-IV	BACKTRACKING AND BRANCH & BOUND	9
Backtracki	ng: General Method – 8 Queen's Problem – Sum of Subsets Problem – Graph Colouring – Hamiltonia	n
Circuit Pro	blem – Branch and Bound: LC branch and bound – 0/1 Knapsack – Travelling Salesman Problem.	
UNIT-V	STRING MATCHING AND NP COMPLETE & NP HARD	9
String Mat	ching: Naive String Matching – Rabin Karp – Knuth Morris Pratt – NP Complete and NP Hard Prob	lems:
Basic Cone	cepts - Non Deterministic Algorithms - Class of NP Complete and NP Hard - Approximation Algori	thms
:: Travellin	g Salesman problem.	
	Contact Hours :	45

	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 compa- Complexities.	are algorithms with respect to	D C	

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# 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.

### **Reference Books:**

1	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms",
	Third Edition, PHI Learning Private Limited, 2012.
2	Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education,
	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.

# Web links for virtual lab:

1	https://www.geeksforgeeks.org/fundamentals-of-algorithms/

2 <u>https://www.hackerrank.com/domains/algorithms</u>

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

PO/PSO	DO	DO	DO	DO	DO	DO	DO	DO	DO	DO	DO	DO	Dio	Dio	DCO
	РО	PO	РО	PO	РО	PO	PSO	PSO	PSO 2						
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	5
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	-	-	-	-	-	-	-	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 Course)	Category	L	Т	Р	С
AD19342	INTRODUCTION TO OPERATING SYSTEM	PC	3	0	2	4

# **Objectives:**

Objectives.									
<ul> <li>To study</li> </ul>	y the basic concepts and functions of operating systems.								
<ul> <li>To learn</li> </ul>	To learn about Processes, Threads, Scheduling algorithms and Deadlocks.								
<ul> <li>To study</li> </ul>	To study various Memory Management schemes.								
<ul> <li>To learn</li> </ul>	n I/O Management and File Systems.								
<ul> <li>To learn</li> </ul>	the basics on Linux, Windows and Android OS.								
UNIT-I	INTRODUCTION	9							
Operating Sy System Prog	stems Overview — OS Structure and Operations – Virtualization - System Calls – Types of System Call rams-System Boot Process – BIOS – POST- Bootstrap Loader.	ls-							
UNIT-II	PROCESS MANAGEMENT	10							
Scheduling - Synchroniza Problems of Recovery.	- FCFS – SJF – Priority – RR – Multilevel Queue Scheduling - Multilevel Feedback Queue - Process tion – Critical Section Problem – Peterson''s Solution – Synchronization Hardware –Semaphores- Class Synchronization – Monitors – Deadlocks –Characterization-Prevention – Avoidance – Detection –	ic							
UNIT-III	MEMORY MANAGEMENT	9							
Main Memo	ry - Swapping - Contiguous Memory Allocation – Paging - Structure of a page table – Segmentation -								
Virtual Mem	ory – Demand Paging - Page Replacement-FIFO-LRU-Optimal - Allocation of Frames – Thrashing.								
UNIT-IV	I/O MANAGEMENT	9							
File System Directory Im Scheduling -	-Concepts - Access Methods- Directory Structure - Mounting - Protection - File System Implementation plementation – Allocation Methods – Free-Space Management - Mass Storage Structure - Disk Disk Management - Swap-Space Management.	_							
UNIT-V	LINUX, WINDOWS & ANDROID OS	8							
The Linux S	System – Design Principles – Kernel Modules – Memory Management – Windows 10- Overview-	Kev							
Components	- Android- Architecture - Security Model.	5							
1	Contact Hours :	45							

# List of Experiments

LISU	ast of Experiments							
1	Installation and Configuration of Linux in a Virtual Machine	Installation and Configuration of Linux in a Virtual Machine						
2	System monitoring using shell script							
3	Text processing using Awk script							
4	User-defined Signal Handler							
5	Trace system calls with systrace tool							
6	Inter-process Communication using Shared Memory							
7	Scheduling algorithms – FCFS, SJF, Priority and RR							
8	Producer Consumer Problem Solution using Semaphore							
9	Bankers Deadlock Avoidance algorithm							
10	0 Contiguous Memory Allocation - First Fit and Best Fit							
11	1 Page Replacement Algorithms - FIFO & LRU							
12	2 Customization of Linux Kernel							
13	3 Develop a Simple LKM							
	Contact Ho	urs	60					
	Total Conta	act Hours	105					

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### Course Outcomes:

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

•	Understand the concepts of Operating Systems and its structure.
•	Analyze the various Scheduling algorithms and methods to avoid Deadlock.
•	Compare and contrast various memory management schemes.
•	Mount file systems and evaluate various disk scheduling techniques.
•	Understand the basic principles of Linux, Windows and Android operating systems.

# Text Books:

1	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John
1	Wiley and Sons Inc., 2012.
2	Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android"s Security Architecture", No Starch
2	Press, 2015.

### **Reference Books:**

1	William Stallings,	"Operating Systems -	Internals and Design Principles'	', 9thEdition, Pearson, 2018.
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2 Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson, 2016.

**3** AchyutGodbole and AtulKahate, "Operating System", 3rd Edition, Tata McGraw Hill, 2017.

4 Pavel Y., Alex I., Mark E., David A., "Windows Internal Part I - System Architecture, Processes, Memory Management and More", 7th Edition, Microsoft Press, 2017.

Web	Veb links:						
1 https://www.octawian.ro/fisiere/cursuri/asor/build/html/_downloads/Russinovich_M_WinInternal							
	d.pdf						
2	https://swayam.gov.in/						
3	https://www.youtube.com/watch?time_continue=98&v=xwxgpCKo7c4						
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Linux&search_language=English						

## CO - PO - PSO matrices of course

PO/PSO	<b>DO</b> 1			<b>DO</b> 4	<b>DO 7</b>	DO (	<b>DO -</b>	DO O	DOA	<b>D</b> O	DO	DO	DGO 1	DGO A	DGO A
	POI	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	POS	PO 9	PO	PO	РО	PSO 1	PSO 2	PSO 3
CO										10	11	12			
CS19441.1	2	-	-	-	3	-	1	-	1	2	2	2	3	-	1
CS19441.2	2	2	2	1	2	-	-	-	2	-	2	2	2	3	2
CS19441.3	2	2	2	1	2	-	-	-	1	-	2	2	2	3	2
CS19441.4	2	2	-	-	2	-	-	-	2	-	2	2	3	2	1
CS19441.5	2	-	1	-	2	-	-	1	1	-	2	2	3	-	2
Average	2.0	2.0	1.7	1.0	2.2	-	1.0	1.0	1.4	2.0	2.0	2.0	2.6	2.7	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	C
AI19342	<b>OBJECT ORIENTED PROGRAMMING USING JAVA FOR AI</b>	PC	3	0	4	5

# **Objectives:**

<b>U</b> U	jeen vest
٠	To understand Object Oriented Programming concepts and characteristics of Java
٠	To know the principles of classes, abstraction and inheritance
•	To create packages, define exceptions and use strings
•	To use I/O streams in applications
-	

• 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 Architecture -Data Types - Variables- Arrays- Operators - Control Statements - Command Line Arguments. CLASSES AND INHERITANCE UNIT-II 9 Defining Classes in Java: Methods, Constructors, Garbage Collection - Access Specifiers - Method Overloading -Inheritance: Super keyword, this keyword, Method Overriding, Abstract Classes - Static Members - Final Method and Class. UNIT-III PACKAGES, EXCEPTION HANDLING AND STRINGS 9 Packages - Interfaces - Exceptions - Exception Hierarchy - Throwing and Catching Exceptions - Built-in Exceptions, User defined Exceptions - Strings - String Buffer. UNIT-IV I/O 0 Input / Output Basics - Streams - Byte streams and Character streams - Reading and Writing Console - Reading and Writing Files. UNIT-V COLLECTIONS AND REGULAR EXPRESSION 9 Generic Programming - Generic Classes - Generic Methods - Collection Interfaces - Collection Classes. Regular 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 of	or not.		
15	Program to check if an URL is valid or not using pattern matching.			
		Contact Hours	:	60
		Total Contact Hours	:	105

Course Outcomes:

On	On completion of the course, the students will be able to						
٠	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.						

# Text Books:

1	Herbert Schildt, —Java The complete reference, 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 <sup>  </sup> , 9th Edition, Prentice Hall, 2013.

## **Reference Books:**

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

# 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
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	C
MC19301	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	MC	3	0	0	0

### **Objectives:**

- This course 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
- wisdom are important in modern society with rapid technological advancements and societal disruptions. The course mainly focuses on introduction to Indian knowledge system, Indian perspective of modern science, basic principles 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	ure of the Indian Knowledge System –Veda – Upaveda - Ayurveda, I	Dhanurveda- Gandharvaveda,	
Sthapathyav	veda and Arthasasthra. Vedanga (Six forms of Veda) – Shiksha, Kalpa	a, Nirukta, Vyakarana, Jyothisł	a and
Chandas- Fe	our Shasthras - Dharmashastra, Mimamsa, Purana and Tharkashastra		
UNIT-II	Modern Science and Yoga		6
Modern Sci	ence and the Indian Knowledge System – a comparison - Merits and	demerits of Modern Science ar	d the
Indian Know	wledge System - the science of Yoga-different styles of Yoga - types	s of Yogaasana, Pranayam, Mu	dras,
Meditation t	echniques and their health benefits - Yoga and holistic healthcare - Ca	ase studies.	
UNIT-III	Indian Philosophical Tradition		6
Sarvadharsh	nan/Sadhdharshan – Six systems (dharshans) of Indian philosophy - N	yaya, Vaisheshika, Sankhya, Y	loga,
Vedanta-Otl	ner systems- Chavarka, Jain (Jainism), Boudh (Buddhism) – Case Stud	ies.	
UNIT-IV	Indian Linguistic Tradition		6
Introduction	to Linguistics in ancient India - history - Phonetics and Phone	ology – Morphology – Syntax	and
Semantics-C	Case Studies.		
UNIT-V	Indian Artistic Tradition		6
Introduction	to traditional Indian art forms – Chitrakala (Painting), Murthikala / Sl	nilpakala (Sculptures), Vaasthu	kala,
Sthaapathya	kala (Architecture), Sangeeth (Music), Nruthya (Dance) and Sahithy	ya (Literature) – Case Studies.	
		Total Contact Hours :	30

Cot On	Course Outcomes: On completion of the course, the students will be able to							
•	Understand basic structure of the Indian Knowledge System							
•	<ul> <li>Apply the basic knowledge of modern science and Indian knowledge system in practice</li> </ul>							
•	Understand the importance Indian Philosophical tradition							
•	Appreciate the Indian Linguistic Tradition.							
•	Understand the concepts of traditional Indian art forms							

# Text Book(s):

1	V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5 <sup>th</sup> 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,								
1	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.								

# CO - PO - PSO matrices of course

PO/PSO	PO	PSO	PSO	PSO											
	10	10	10	10	10	10	10	10	10	10	10	10	150	150	3
CO	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
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	Category	L	Т	Р	С
MA19456	<b>OPTIMIZATION TECHNIQUES FOR AI</b>	BS	3	1	0	4

Obj	Objectives:							
٠	• 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									
Convex sets, Conv	ex function, Linear Programming-formulation, solution by graphi	cal and simplex methods, Prir	nal -							
Penalty, Two Phase, Principles of Duality.										
UNIT-II	LINEAR PROGRAMMING EXTENSIONS		12							
Transportation Mod	lels (Minimising and Maximising Problems) – Balanced and unbala	nced Problems – Initial Basic fe	asible							
solution by N-W C	Corner Rule, Least cost and Vogel's approximation methods. Chec	k for optimality. Solution by I	MODI							
algorithm. Case of	Degeneracy.									
Assignment Model	s (Minimising and Maximising Problems) – Balanced and Unbalance	d Problems. Solution by Hungar	rian.							
Travelling Salesman	n problem.									
UNIT-III	INTEGER PROGRAMMING		12							
Cutting plan algorith	mm – Branch and bound methods, Multistage (Dynamic) programming									
UNIT-IV	NON – LINEAR PROGRAMMING		12							
Unconstrained exte	rnal problems, Newton - Ralphson method - Equality constraints	- Jacobean methods - Lagran	igian							
method – Kuhn – T	ucker conditions – Simple problems.									
UNIT-V	PROJECT SCHEDULING		12							
Network diagram representation – Critical path method – Time charts and resource leveling – PERT										
		Total Contact :	60							
		Hours								

Cou	Course Outcomes:								
On c	On completion of the course students will be able to								
•	Solve optimization problems using simplex method.								
•	Analyze problems involving materials and workforce using transportation and assignment models								
•	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								

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

Refe	Reference Books / Web links:								
1	Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008								
2	G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.								
3	Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.								
4	Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.								
5	Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case studies approach with spreadsheets, Tata Mcgraw Hill, 2005.								
6	N. D Vohra, Quantitative Techniques in Management, TataMcgraw Hill, 2010.								

# 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	РО	РО	РО	PSO 1	PSO 2	PSO 3
со										10	11	12			
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	3.0	3.0	2.0	3.0	1.0	-	-	-	-	-	-	2.0	2.4	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 (Theory course)	Category	L	Т	Р	С
AD19401	HEALTH CARE ANALYTICS	PC	3	0	0	3

Ob	Objectives:									
٠	Understand the health data formats, health care policy and standards									
•	Learn the significance and need of data analysis and data visualization									
•	Understand the health data management frameworks									
•	Learn the use of machine learning and deep learning algorithms in healthcare									
•	Apply healthcare analytics for critical care applications									

UNIT-I	INTRODUCTION TO HEALTHCARE ANALYSIS											
Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized cod sets – Data Formats – Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning and Bayes Theorem Weighted sum approach												
UNIT-II	ANALYTICS ON MACHINE LEARNING		9									
Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity, Specificity, PPV, NPV, FPR, Accuracy, ROC, Precision Recall Curves, Valued target variables –Python: Variables and types, Data Structures and containers, Pandas Data Frame :Operations – Scikit –Learn : Pre-processing, Feature Selection												
UNIT-III	HEALTH CARE MANAGEMENT		9									
IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare												
UNIT-IV HEALTHCARE AND DEEP LEARNING												
Introductio	on on Deep Learning – DFF network CNN- RNN for Sequences – Bio	medical Image and Signal Anal	ysis									
– Natural	Language Processing and Data Mining for Clinical Data - Mobile	e Imaging and Analytics - Cli	nical									
Decision S	upport System											
UNIT-V	CASE STUDIES		9									
Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis												
		Total Contact Hours :	45									

Co On	Course Outcomes: On completion of the course, the students will be able to								
•	Use machine learning and deep learning algorithms for health data analysis								
•	Apply the data management techniques for healthcare data								
•	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other criticalcare applications								
•	Design health data analytics for real time applications								
•	Design emergency care system using health data analysis								

Te	xt Book(s):
1	Chandan K.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2	Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3	Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.

Ref	Reference Books(s):									
1	Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.									
2	Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, "Big Data Analytics in HealthCare", Springer, 2020.									
W	Web link:									
1										

# CO - PO - PSO matrices of course

	PO's												PSO's			
CO's	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	3	3	3	1	3	-	-	-	3	2	1	1	2	2	2	
2	3	1	1	3	1	-	-	-	3	2	3	1	3	3	3	
3	2	1	2	1	2	-	-	-	2	2	1	3	3	2	1	
4	2	2	3	3	1	-	-	-	2	3	1	2	3	2	2	
5	1	2	2	1	1	-	-	-	1	3	3	2	2	2	2	
AVG	2.2	1.8	2.2	1.8	1.6	-	-	-	2.2	2.4	1.8	1.8	2.6	2.2	2	

1 - low, 2 - medium, 3 - high, '-' - no correlation

Subj	ect Code	Subject Name (Lab Oriented Theory Course)	Catego	ory L	Т	Р	С				
AT	103/1	DDINCIDIES OF ADTIFICIAL INTELLICENCE	PC	2	0	2					
	17541	I KINCH LES OF ANTIFICIAL INTELLIGENCE	IC	5	U	4	-				
v ह	Understand	the various characteristics of a problem solving agent									
8	Learn abou	t the different strategies involved in problem solving									
8	Learn abou	t solving problems with various constraints									
8	Apply A I t	o various applications like expert systems etc									
•	Understand	the different models of learning									
UN	NIT-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 environm											
struct	ure of agents	s, goal-based agents, utility-based agents, learning agents. Defining	the problem as	state spa	ce sea	arch	1,				
produ	ction system	, problem characteristics, issues in the design of search programs.	1	1							
UN	IT-II	Search techniques				9					
Proble	em solving	agents, searching for solutions; uniform search strategies: breadth	first search, de	pth first	searc	h, c	lepth				
limite	d search, b	idirectional search, comparing uniform search strategies. Heuristi	c search strate	gies Gre	eedy	best	-first				
search	n, A* search,	AO* search, memory bounded heuristic search: local search algorith	ıms & optimiza	tion prob	lems	Hil	1				
climb	ing search, si	mulated annealing search, local beam search.									
UN	IT-III	Constraint satisfaction problems and Game Theory				9					
Local	search for c	onstraint satisfaction problems. Adversarial search, Games, optimal d	ecisions & strat	egies in g	games	s, th	е				
minin	hax search pr	ocedure, alpha-beta pruning, additional refinements, iterative deepenin	g.								
UN	IT-IV	Knowledge & reasoning				9					
Statis	tical Reason	ing: Probability and Bays" Theorem, Certainty Factors and Rule-Ba	ase Systems, B	ayesian I	Netwo	orks	•				
Demp	ster-Shafer	Theory, Fuzzy Logic. AI for knowledge representation, rule-based kn	owledge represe	entation,	proce	dura	aland				
declar	rative knowl	edge, Logic programming, Forward and backward reasoning.			_						
UN	IT-V	Introduction to Machine Learning				9					
Explo	oring sub-dis	cipline of AI: Machine Learning, Supervised learning, Unsupervised	learning, Reinf	orcemen	t lear	ning	,,				
Classi	ification prot	blems, Regression problems, Clustering problems, Introduction to neuro	al networks and	deep lear	rnıng.						
		Contact	Hours	:		45					
List o	of Experim	ents									
1	Progra	ms on Problem Solving									
a	Write a	program to solve 8 Queens problem.									
b	Solve a	ny problem using depth first search.									
с	Implem	nent MINIMAX algorithm.									
d	Implen	nent A* algorithm									
2	Progra	ms on Decision Making and Knowledge Representation									
a	Introdu	iction to PROLOG									
b	Implen	nentation of Unification and Resolution Algorithm.									
с	Implen	nentation of Backward Chaining									
d	Implen	nentation of Forward Chaining									
3	Progra	ms on Planning and Learning									
a	Implen	nentation of Blocks World program									
b	Implen	nenting a fuzzy inference system									
c	Implen	nenting Artificial Neural Networks for an application using python									
d	Implen	nentation of Decision Tree									
e	Implen	nentation of K-mean algorithm									
		~	Contact Hour	s	:	:	30				
			Total Contact	Hours	1		75				

### Lab Specifications:

The lab can be implemented using Python or C.

Knowledge representation experiments can be performed using a PROLOG TOOL.

Course Outcomes:	
On completion of the course,	the students will be able to

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

### Text Books(s):

1	S. Russell and	d P. Norvig, Artificial I	ntelligeno	e: A M	Iodern	Approach	, Prenti	ce Hall,	Third	Edition, 20	15.
0	NT'1 T NT'1	A	A 3.T	0 .1	• /1	1 \ ) (	17	C	1000	ICDN 070	15506050

2 Nils J. Nilsson, Artificial Intelligence: A New Synthesis (1 ed.), Morgan-Kaufmann, 1998. ISBN 978-1558605350.

Refe	Reference Book(s) / Web link(s):								
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								

### CO - PO - PSO matrices of course

PO/PSO CO	РО 1	PO 2	PO 3	PO 4	PO 5	РО 6	<b>PO</b> 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
AI19341.01	3	3	1	-	2	1	1	1	1	-	2.2	1	2	1	1
AI19341.02	2	2	1	-	2	1	2	-	-	-	2	2	1	1	1
AI19341.03	3	3	1	-	3	-	1	-	-	-	3	1	2	3	2
AI19341.04	2	3	-	-	2	1	1	1	-	-	2	2	2	2	3
AI19341.05	2	2	2	2	3	-	1	2	-	-	3	3	3	3	3
Average Mapping	2.4	2.4	1.25	2.0	2.4	1.5	1.2	1.3	1.0	-	2.4	1.8	2.0	2.0	2.0

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 "-"

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

Obj	ectives:
•	To understand the role of a database management system, relational data model and successfully apply logical
	database design principles, including E-R diagrams.
•	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 10 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. 10

#### 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.

#### DEPENDENCIES AND NORMALFORMS UNIT-III

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

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

**Contact Hours** 

8

10

: 45

List of Experiments Introduction to SQL : DDL, DML, DCL, TCL. SQL clause :SELECT FROM WHERE 1 GROUPBY, HAVING, ORDERBY Using SQLite/MySQL/Oracle SQL clause :SELECT FROM WHERE GROUPBY, HAVING, ORDERBY Using SQL ite/MySQL/Oracle 2 Creation of Views, Synonyms, Sequence, Indexes, Save point. Creating an Employee database to set various constraints and sub queries. 3 Optimize a SQL query construct considering time complexity. 4 Write a PL/SQL block to specify constraints by accepting input from the user. 5 Implementation of PL/SQL Procedure (IN, OUT, INOUT) with Exception Handling. 6 7 Implementation of PL/SQL Function. 8 Implementation of PL/SQL Cursor. Implementation of PL/SQL Trigger, Packages. 9 Implementation of NoSQL basic commands using Cassandra/Mongo DB. 10

11	Implementation of Data Model in NoSQL.
12	Implementation of Aggregation, Indexes in NoSQL.
13	MINI PROJECT 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 follow the application development process. Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable frontend tool. Indicative areas include
	<ul> <li>a) Inventory Control System.</li> <li>b) Material Requirement Processing.</li> <li>c) Hospital Management System.</li> <li>d) Railway Reservation System.</li> <li>e) Personal Information System.</li> <li>f) Web Based User Identification System.</li> <li>g) Timetable Management System.</li> <li>h) Hotel Management System</li> <li>i) Library Management System</li> <li>i) Library Management System</li> <li>i) Library Management System</li> </ul>
	Contact Hours : 60
	Total Contact Hours : 105

### Course Outcomes:

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

- Understand the use of the Relational model, ER diagrams.
- Apply SQL Queries to define and manipulate the database.
- Comprehend the concept of normalization and apply as a case study.
- Know concurrency control and recovery mechanisms.
- relate the different models of NoSQL databases.

# Text Books:

1	Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", Seventh Edition, Mc Graw Hill, March 2019.
2	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2013.

### **Reference Books:**

1	RamezElmasri 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 Education, 2006.
3	AtulKahate, "Introduction to Database Management Systems", Pearson Education, New Delhi, 2006.
4	Steven Feuerstein with Bill Pribyl,"Oracle PL/SQL Programming", 6th edition, Publisher: O'Reilly, 2014.
5	Kristina Chodorow, Shannon Bradshaw, "MongoDB: The Definitive Guide", 3rd Edition, O'Reilly Media, 2019.

# Web Link for Virtual Lab

1. https://livesql.oracle.com/apex

2. https://www.jdoodle.com/online-mongodb-terminal/

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

PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО	РО	РО	PSO 1	PSO 2	PSO 3
со										10	11	12			
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	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	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 (Theory course)	Category	L	Т	P	C
AD19441	INTRODUCTION TO DATA ANALYTICS	PC	3	0	2	4

Ob	Objectives:		
٠	Understand the health data formats, health care policy and standards		
•	Learn the significance and need of data analysis and data visualization		
•	Understand the health data management frameworks		
•	Learn the use of machine learning and deep learning algorithms in healthcare		
•	Apply healthcare analytics for critical care applications		

UNIT-I	INTRODUCTION TO BIG DATA	9
Introduction scalability, a Sampling di	to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: astributions, resampling, statistical inference, prediction error	
UNIT-II	DATA ANALYSIS	9
Regression kernel meth networks: le logic: extrac	modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector ods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural arning and generalization, competitive learning, principal component analysis and neural networks; F sting fuzzy models from data, fuzzy decision trees, Stochastic search methods.	r and uzzy
UNIT-III	MINING DATA STREAMS	9
Introduction stream – Fil window – D analysis, sto <b>UNIT-IV</b>	a to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a tering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in becaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentimer text market predictions. FREQUENT ITEMSETS AND CLUSTERING	a a nt 9
Mining Free Limited Pas Clustering h in non-eucli	uent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory - s algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Mo igh dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clus dean space – Clustering for streams and Parallelism.	- eans – stering
UNIT-V	FRAMEWORKS AND VISUALIZATION	9
MapReduce Visualizatio	– Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – ns - Visual data analysis techniques, interaction techniques; Systems and applications	
	Total Contact Hours :	45

Co On	Course Outcomes: On completion of the course, the students will be able to				
•	Apply the statistical analysis methods				
•	Compare and contrast various soft computing frameworks				
•	Design distributed file systems				
•	Apply Stream data model				
•	Use Visualisation techniques				

Te	Text Book(s):				
1	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.				
2	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.				

-	
Ret	ference Books(s):
1	Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
2	Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O"Reilly, 2011.
W	eb link:
1	

### DATA ANALYTICS LABORATORY

## COURSE OBJECTIVES

To study and write simple programs using the basic packages for handling data

To do various sampling and T,Z,Anova test in various samples

To perform case study and design a system

To demonstrate Time Series Analysis in any real time application

Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Suggested Exercises:

- 1. Random Sampling
- 2. Z-test case study
- 3. T-test case studies
- 4. ANOVA case studies
- 5. Regression
- 6. Logistic Regression
- 7. Time series Analysis

Su	bject Code	Subject Name (Employability Enhancement Course)	Category	L	Т	Р		С
(	GE19421	SOFT SKILLS-I	EEC	0	0	2		1
De	scription							
•	The course	"VAP" intends to enhance the students" confidence to communicate in front o	f an audience	eff	ecti	vel	у.	
•	The empha in the corpo	sis is on improving the spoken skills of the students so that they can communica orate setting to deliver their message successfully	te both, in th	e co	lleg	ge a	ınd	
•	In today"s	echnology driven world, communicating with confidence is imperative.						
•	Hence, this	course aims at providing students with the necessary practice in the form of del	bates, discus	sion	is ai	ndı	role	
	plays.							
Pro	gram Learı	ing Goals :						
•	This progra	m will help our students to build confidence and improve their English commur	nication in or	ler	io fa	ace		
	the corporat	e world as well as providing them with opportunities to grow within an organiz	ation.					
Ob	jectives:							
•	To help stu	dents break out of shyness.						
•	To build co	nfidence.						
•	To enhance	English communication skills.						
•	To encoura	ge students" creative thinking to help them frame their own opinions.						

Week	Activity Name	Description	Objective
		The trainer and the college facilitator talk to the	To set expectations about the course
1	Introduction	students about the course and in turn the students	and the students are made aware of the
		introduce themselves.	rules and regulations involved in this
			program
		This is a quick and useful game by getting students to	The aim of this activity is to for students
2	If I ruled the world	form a circle and provide their point of view. Each	to get to know each other and also
2	II I I luied the world	student then repeats what the other has said and	develop their listening skills as well as
		comes up with their own opinion.	learning how to agree and disagree
			politely.
		This activity is based on several sequential pictures.	The aim of this activity is to make the
2		Students are asked to tell the story taking place in the	students develop creative way of
3	Picture Narrating	sequential pictures by paying attention to the criteria	thinking.
		provided by the teacher as a rubric. Rubrics can	
		include the vocabulary or structures they need to use	
		while narrating.	
		On a given topic, students can produce ideas in a	The activity aims at making the students
		limited time. Depending on the context, either	speak freely without the fear of being
4	Brainstorming	individual or group brainstorming is effective and	criticized. It also encourages students to
-	Dramstorning	learners generate ideas quickly and freely. The good	come up with their own opinions.
		characteristics of brainstorming are that the students	
		are not criticized for their ideas so students will be	
		open to sharing new ideas.	
		Is competition necessary in regards to the learning	The aim of this activity is to develop
5	Debate	process?	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.

Course On con	Poutcomes: apletion of the course, the students will be able to:									
•	• Be more confident.									
•	Speak in front of a large audience.									
•	Be better creative thinkers.									
•	Be spontaneous.									
•	Know the importance of communicating in English.									

### **Reference Books(s):**

1.

Kings Learning work sheets.

### <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	РО 12	PSO 1	PSO 2	PSO 3
GE19421.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
GE19421.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
GE19421.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
GE19421.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
GE19421.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	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: "-"

### SEMESTER V

Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С
CB19342	COMPUTATIONAL STATISTICS	BS	3	0	2	4

 Objectives:

 • 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 MULTIVARIATE NORMAL DISTRIBUTION

Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

### UNIT-II DISCRIMINANT ANALYSIS

Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

### UNIT-III PRINCIPAL COMPONENT ANALYSIS

Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

### UNIT-IV FACTOR ANALYSIS

Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

# UNIT-V CLUSTER ANALYSIS

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

9

9

9

9

9

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	Files – Reading and Writing						
2	Visualization in Python: Matplotlib package, Plotting Graphs, Control	ling Graph, Adding Text, More	e					
Ζ.	Graph Types, Getting and setting values, Patches.							
	Multivariate data analysis: Multiple regression, multivariate regressi	on, cluster analysis with variou	15					
3.	algorithms, factor analysis, PCA and linear discriminant analysis. Varie	ous datasets should be used for	eac	h				
	topic.							
	·	Contact Hours	:	30				
		Total Contact Hours	:	75				

Co On	urse Outcomes: 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., "Programming Python", O'Reilly Media ,Germany, Fourth edition, 2011.

Re	ference Books / Web links:
1	D.A. Belsey, E. Kuh and R.E. Welsch, "Regression Diagnostics, Identifying Influential Data and Sources of Collinearety"
2	Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, "Introduction to Linear Regression Analysis", 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	-	2	2	2
CB19342.3	3	3	2	3	3	1	-	-	-	1	2	-	2	3	2
CB19342.4	3	3	2	3	3	2	-	-	-	2	2	-	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

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	C
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.
٠	Learn the Transport Layer, flow control and congestion control algorithms.
٠	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

UNIT-I	FUNDAMENTALS AND DATA LINK LAYER	9
Building a	network – Requirements – Layering and protocols – Internet Architecture – Network software –	
Application	n Programming Interface (sockets) - Performance - Link layer Services - Framing – Error Detection and	d
Correction	- Reliable transmission.	
UNIT-II	MEDIA ACCESS AND INTERNETWORKING	9
Media Acc	ess Protocols - ALOHA - CSMA/CA/CD - Ethernet - Wireless LANs - 802.11- Bluetooth - Switching	z
and Forwa	rding - Bridges and LAN Switches - Basic Internetworking- IP Service Model - IP fragmentation	1 -
Global Add	Iresses – ARP - DHCP – ICMP- Virtual Networks and Tunnels.	
UNIT-	ROUTING	9
III		
Routing – I	Network as Graph - Distance Vector – Link State – Global Internet –Subnetting - Classless Routing	
(CIDR) - B	GP- IPv6 – Multicast routing - DVMRP- PIM.	
UNIT-	TRANSPORT LAYER	9
IV		
Overview	of Transport layer - UDP - TCP - Segment Format - Connection Management - Adaptiv	ve
Retransmis	sion - TCP Congestion control - Congestion avoidance (DECbit, RED) - QoS - Application	
requiremer	its.	
UNIT-V	APPLICATION LAYER	9
E-Mail (SN	MTP, MIME, POP3, IMAP), HTTP – DNS - FTP - Telnet – web services - SNMP - MIB – RMON.	
	Contact Hours :	45

List of E	xperiments					
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 tool	S.				
6.	Study & Implement the different types of Network Cables (RS 232C	).				
7.	Implementation of setup a Local Area Network (using Switches) - M	finimum 3 nodes and Internet.				
Q	Write a socket program Remote Procedure Call using connection or	iented / connectionless protoco	ols			
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 / H $$	TTP / ARP /DHCP /ICMP /D	NS			
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 ro	outing 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 too	1.				
14.	Simulation of Distance Vector Routing algorithm OPNET or NS3 to	ol.				
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.
- 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.
- Develop real time applications of networks using different tools.

### **Text Books:**

- 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	РО	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: "-"

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Subject Code	Subject Name ( Lab oriented Theory Course)	Category	L	Т	P	, ,	C
AD19541	SOFTWARE ENGINEERING METHODOLIGIES	PC	3	0	2	6	1

Obje	Objectives:					
•	Understand the phases in a software engineering					
•	Gain knowledge in fundamental concepts of software project management and quality.					
•	Obtain knowledge on requirements engineering and Analysis Modelling.					
•	Learn various testing and maintenance measures					

### UNIT-I SOFTWARE PROCESS MODELS

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – Waterfall model – Spiral Model – V shaped model – RAD model – Iterative Model – Prototype model- Introduction to Agility: Extreme Scrum, DevOps

### UNIT-II REQUIREMENTS ANALYSIS AND SPECIFICATION

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

### UNIT-III SOFTWARE DESIGN

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.-UML Diagram

### UNIT-IV | TESTING AND MAINTENANCE

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging –Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering – Software Configuration Management.

### UNIT-V PROJECT MANAGEMENT

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMM Plan.

**Contact Hours** 

:

9

9

0

9

45

Li	st of Experiments		
1	Development of requirements specification.		
2	Function oriented design using SA/SD.		
3	Object-oriented design using UML.		
4	Test case design.		
5	Implementation using JAVA.		
6	Testing.		
7	Use of CASE tools and other tools such as configuration management tools.		
8	Program analysis tools.		
	Contact Hours	:	30
	Total Contact Hours	:	75
	LAB EQUIPMENT:		
1	Hardware: Standalone desktops with minimum desktop configuration.		
2	Software: System loaded with windows Star UML or Linux to run Java, UML, CASE and Testing too	ols.	

### **TEXT BOOKS**

- 1. Roger S. Pressman, Bruce R.Maxim—Software Engineering A Practitioner's Approach, Eight Edition, McGraw-Hill International Edition, 2015.
- 2. IanSommerville, -Software Engineering, 9th Edition, Pearson Education Asia, 2011.
- 3. Gene Kim, Jez Humble, Patrick Debois, and John Willis, The DevOps Handbook- How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press, 2nd Edition, 2016

### **REFERENCE BOOKS**

- 1. Rajib Mall, -Fundamentals of Software Engineering, Third Edition, PHI Learning PrivateLimited, 2009.
- 2. PankajJalote, —Software Engineering, A Precise Approachl, Wiley India, 2010.
- 3. Kelkar S.A., -Software Engineering, Prentice Hall of India Pvt Ltd, 2007.
- 4. Stephen R.Schach, -Software Engineering, Tata McGraw-Hill Publishing Company Limited, 2007.

### **COURSE OUTCOMES**

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

- Identify the key activities in managing a software project.
- Concepts of requirements engineering and Analysis Modeling.
- Apply systematic procedure for software design and deployment.
- Compare and contrast the various testing and maintenance.
- Manage project schedule, estimate project cost and effort required.

RO/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
AD19541.1	3	2	2	2	2	2	2	2	2	2	2	1	2	2	1
AD19541.2	2	2	2	2	2	2	1	1	3	2	3	1	2	1	1
AD19541.3	1	1	1	1	1	2	2	1	3	1	2	1	1	1	1
AD19541.4	2	2	3	2	2	1	1	1	3	3	2	1	2	2	1
AD19541.5	2	2	2	3	2	1	1	2	3	3	1	2	2	2	1
Average	2.0	1.8	2.0	2.0	1.8	1.6	1.4	1.4	2.8	2.2	2.0	1.2	1.8	1.6	1.0

### CO - PO – PSO MATRICES OF THE 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 (Laboratory Course)	Category	L	Т	Р	C
AD19511	R PROGRAMMING LABORATORY	PC	0	0	4	2

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

### List of Experiments

	List of Experiments
1	Download and install R-Programming environment and install basic packages using install .packages()command in R
2	Learn all the basics of R-Programming (Data types, Variables Operators etc.)
3	Implement different data structures in R (Vectors, Lists, Data Frames)
4	Write a program to read a csv file and analyze the data in the file in R
5	Create pie charts and bar charts using R.
6	Create a data set and do statistical analysis on the data using R.
7	Write R program to find Correlation and Covariance
8	Write R program for Regression Modeling
9	Write R program to build classification model using KNN algorithm
10	Write R program to build clustering model using K-mean algorithm
11	Program to implement Filtering Mobile phone spam using Naïve Bayes
12	Program to implement Risky Bank Loans using Decision Trees
13	Program to implement Identification of frequently Purchased groceries with Apriori algorithm.
14	Program to implement Finding Teen Segments of Market
15	Program to implement Tuning stock models for better performance
	Total Contact Hours   :   60

### **Course Outcomes:**

Γ

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

## Web links for virtual lab

1	http://www.johndcook.com/R_language_for_programmers.html
2	1. https://www.r-project.org/ https://www.tutorialspoint.com/r/index.htm

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

PO/PSO	PO	РО	РО	PO	PO	PO	РО	PO	РО	PO	РО	РО	PSO	PSO	PSO
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AD19511.1	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-
AD19511.2	1	1	1	1	1	-	-	-	-	-	1	1	2	2	-
AD19511.3	2	2	3	2	1	-	-	-	1	-	2	1	2	2	-
AD19511.4	1	1	2	1	1	-	-	-	-	-	1	1	2	2	-
AD19511.5	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 (Lab Courses)	Category	L	Т	Р	С
AD19512	Mini Project on Data Science	EEC	0	0	4	2

Ob	ojectives:
	Students are expected to develop a mini project to solve real world challenges

• Students are expected to develop a mini project to solve real-world challenges.

	List of Domain Buckets (not limited)										
1.	Retail and E-commerce										
2.	Finance and Banking										
3.	Manufacturing & Supply Chain										
4.	Marketing and Advertising										
5.	Healthcare Technology										
6.	Transportation and Logistics										
7.	Social Media Analytics										
8.	Personalized Recommendations,										
	Contact Hours : 60										

Course Outcomes:
On completion of the course, the students will be able to
1. Select a problem with technical significance and social contribution.
2. Identify and explore relevant literature to gain exposure to related solutions.
3. Analyze, design, and create flexible and reusable solutions of minimal complexity by utilizing contemporary tools.
4. Implement, construct, and test solutions based on user-feasible requirements.
5. Document the project report of various phases for the future development scope of the project.

# CO - PO – PSO Matrices of Course

PO/PSO CO	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
AD22512.1	3	3	3	3	2	3	3	3	3	3	2	3	3	3	3
AD22512.2	3	3	2	2	2	1	1	1	2	2	2	3	3	3	3
AD22512.3	2	3	2	2	3	1	1	2	2	2	1	3	3	3	3
AD22512.4	3	3	2	2	3	2	2	3	3	2	2	3	3	3	3
AD22512.5	3	3	2	2	3	2	3	3	3	3	2	3	3	3	3
Average	2.8	3	2.2	2.2	2.6	1.8	2	2.4	2.6	2.4	1.8	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: "-"

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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.

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	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

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

# SEMESTER VI

Subject Code	Subject Name (Theory Courses)	Category	L	Т	Р	С
AD19651	BUSINESS ANALYTICS	PC	3	0	0	3

Ob	Objectives:								
•	To gain the basic understanding of Business Analytics Process and Decision Making								
•	To explore the importance of Descriptive Analytics								
٠	To learn about Predictive Analytics and Data Mining for Business								
٠	To visualize the various techniques of Prescriptive Analytics								
٠	To envision the future of Business Analytics								

UNIT-I	INTRODUCTION TO BUSINESS ANALYTICS		9								
Business An	nalytics - Terminologies, Importance - Business Analytics Process	- Categories of Business Anal	ytical								
methods and	d models - Relationship with Organisational Decision Making - Anal	ytics in Decision Making - Pha	ses of								
Decision Making Process. (Chapter-1,2,4 from T1 and Chapter-1 from T2)											
UNIT-II	DESCRIPTIVE ANALYTICS		9								
Introduction	to Descriptive Analytics - Visualising and Exploring Data - Visu	alization Techniques: Tables,	Cross								
Tabulations,	, Charts, Data Dashboards using Advanced Ms-Excel - Descriptive S	atistics - Sampling and Estima	tion -								
Probability I	Distribution for Descriptive Analytics - Analysis of Descriptive analytics	ics. (Chapter-3,4,5,6,7 from T	<b>(2</b> )								
UNIT-III	PREDICTIVE ANALYTICS		9								
Introduction	to Predictive Analytics - Logic and Data Driven Models - Predictive	e Analysis Modelling and Proce	edure -								
Data Mining	g for Predictive Analytics - Approaches in Data Mining - Data Expl	oration and Reduction - Data	mining								
for Business	- Analysis of Predictive analytics. (Chapter-8,9,10,11,12 from T2)										
UNIT-IV	PRESCRIPTIVE ANALYTICS		9								
Introduction	to Prescriptive analytics - Prescriptive Modelling - Linear and Non	linear Optimization - Cutting	Plane								
Algorithm -	Decision Analysis - Risk and Uncertainty methods - Text Analysis	ytics - Web Analytics. (Chap	oter-								
13,14,15,16	from T2)										
UNIT-V	FUTURE OF BUSINESS ANALYTICS		9								
The importa	ance of Business Analytics tools - Emerging Technologies - Pre-	edicting the future - Organis	ational								
Structures a	ligning BA - Managing Information policy and data quality - Ca	ase Study: Applications of Bu	isiness								
Analytics -	Retail Analytics, Marketing Analytics, Financial Analytics, Healt	hcare Analytics and Supply (	Chain								
Analytics. (	Chapter-8 from T1)										
		Total Contact Hours :	45								
L											

Cours	Course Outcomes:							
On cor	On completion of the course, the students will be able to							
CO1	Understand the framework for Business Analytics Process and Decision Making							
CO2	Demonstrate the importance of Descriptive Analytics							
CO3	Analyse the concepts of Predictive Analytics and Data Mining for Business							
CO4	Categorize the various techniques to understand the concepts of Prescriptive Analytics							
CO5	Discover the applications of Business Analytics and the future beyond technology							

Te	xt Books:
1	Marc J. Schniederjans, Dara G. Schniederjans and Christopher M. Starkey, "Business Analytics Principles, Concepts, and Applications - What, Why, and How", Pearson Ed, 2014.
2	James R. Evans, "Business Analytics - Methods, Models and Decisions", Pearson Ed, 2012.

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Ref	ference Books:
1	Christian Albright S and Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", Fifth
	edition, Cengage Learning, 2015.
2	Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education India, 2014.
W	eb link:
1	https://mrcet.com/downloads/digital_notes/AE/III/Business%20Analytics.pdf
2	https://www.simplilearn.com/what-is-descriptive-analytics-article
3	https://www.simplilearn.com/what-is-predictive-analytics-article
4	https://www.simplilearn.com/prescriptive-analytics-article
5	https://www.simplilearn.com/business-analytics-applications-and-use-cases-article

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

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
СО															
AD19651.1	1	-	-	1	1	-	-	-	1	2	2	3	3	1	3
AD19651.2	3	2	3	1	3	1	1	-	1	1	2	3	3	1	3
AD19651.3	2	1	3	1	3	1	1	-	1	1	2	3	3	1	3
AD19651.4	2	1	3	1	3	1	1	-	1	1	2	3	3	1	3
AD19651.5	3	2	3	-	3	2	3	-	3	3	3	3	3	1	3
Average	2.2	1.5	3	1	2.6	1.3	1.5	-	1.4	1.6	2.2	3	3	1	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 Courses)	Category	L	Т	Р	С
AD19652	DATA AND INFORMATION SECURITY	PC	3	0	0	3

Objectiv	Objectives:								
•	To understand the basics of Information Security, legal and ethical issues in Information Security.								
•	To understand the information security policy and concepts of access control.								
•	To learn about intrusion detection and prevention techniques and tools.								
•	To learn about auditing techniques and tools in Information Security.								
•	To Learn to analyze and validate forensics data								

# UNIT-I INTRODUCTION

History, What is Information Security?, Critical Characteristics of Information, Security Trends, OSI security architecture, Security attacks, security services, security mechanisms, Security System Development Life cycle – Legal, Ethical and Professional issues

# UNIT-II SECURITY ANALYSIS

Risk Management - Identifying and Assessing Risk - Assessing and Controlling Risk. Blueprint for Information Security - Information Security Policy.

# UNIT-III SECURITY TECHNOLOGY

Intrusion Detection and Prevention Systems(IDPS)-Terminology-Types-Detection methods.Honeypots,Honeynets and padded cell systems.Scanning and Analysis Tools-Port scanners-Firewall analysis tools,Operating system detection toolsVulnerability scanners-Packet sniffers-Wireless security tools.

## UNIT-IV AUDITING

Overview, Access control, IT Audit, Authentication. Open Web Application Security Project (OWASP), Web Site Audit and Vulnerabilities assessment-Case study: Wireshark, FAW

# UNIT-V ANALYSIS AND VALIDATION

 Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email

 Investigations – Cell Phone and Mobile Devices Forensics. -Case Study: Toolsley

 Total Contact Hours : 45

Co	Course Outcomes : On completion of the course, the students will be able							
•	Discuss the basics of information security and legal and ethical issues in Information Security.							
•	Analyse the risk management and information security policy.							
•	Implement intrusion detection and prevention techniques using different tools.							
•	Perform auditing of logs.							
•	Analyze and validate forensics data							

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Te	Text Book(s):								
1	Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, Fourth								
	Edition 2011.								
2	Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008								

Re	Reference Books(s):								
1	Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", CRC Press; 6th Edition, 2007								
2	John R. Vacca, "Computer Forensics", Cengage Learning, 2005								
3	MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3 rd Edition, Prentice Hall, 2013								

# 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
AD19652.1	3	2	2	1	1	3		3	-	-	-	2	2	1	1
AD19652.2	3	2	2	2	1	2	2	2	-	-	-	-	2	1	1
AD19652.3	3	2	2	2	2	2	2	1	-	-	-	2	2	3	3
AD19652.4	3	2	2	2	3	2	2	2	-	-	-	2	2	3	2
AD19652.5	3	2	3	2	3	2	2	1	-	-	-	2	2	3	3
Average	3	2.2	2	1.8	2	2.2	2.0	1.8	-	-	-	2.0	2.6	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	C
AI19442	FUNDAMENTALS OF MACHINE LEARNING	PC	3	0	2	4

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

### UNIT-I FOUNDATIONS OF LEARNING

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

**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.

 UNIT-V
 REINFORCEMENT LEARNING

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.

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

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# **Course Outcomes:**

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

- Understand fundamentals of machine learning.
- Apply the linear models for tuning parameters.
- Understand and explore the machine learning algorithms with classification.
- Apply machine learning algorithms with clustering and feature extraction.
- Apply reinforcement learning techniques for various applications.

# Text Books:

1	Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2 <sup>nd</sup> Edition 2019, Reilly Media, Inc., ISBN: 9781492032649.
2	Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3	Shai Shalev-Shwartz and Shai Ben-David," Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press 2014.

### **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 links for virtual lab:

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	РО	РО	РО	РО	РО	РО	РО	PO	PO	РО	РО	PO	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	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

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

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE | R2019

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	Т	P	(	
IT19541	WEB TECHNOLOGY	PC	3	0	2	4	1

Ob	<b>Objectives:</b> Broad objective of this course is to						
•	To design and create a basic webpage using HTML and Cascading Style Sheets.						
•	To have a basic idea about scripting language JavaScript and build dynamic webpage.						
•	To understand about Bootstrap and JQuery.						
•	To create dynamic web pages using server side scripting.						
•	To gain knowledge to develop Web Application for various field.						

TINIPE T	ΜΑΒΕΙΒΙΑΝΟΊΑΟΕ ΑΝΒΟΤΝΙΕΟΤΕΤ	0							
UNIT-I	MARK-UP LANGUAGE AND STILE SHEET	9							
HTML5 – E	lements,Attributes-Basic Elements-Lists-Image-Tables – Links – HTML5 control elements – Seman	tic							
elements – Audio – Video controls .CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance –									
Background	Backgrounds – Box Model – Navigation Bar-Dropdowns- Shadows – Text – Transformations – Transitions –								
Animations									
UNIT-II	CLIENT SIDE PROGRAMMING	9							
The JavaSci	ipt Language: Introduction-Syntax-Variables and Data Types-Statements-Operators-Functions-Array	/S-							
Syntax, Acc	essing elements, objects-properties and methods. Strings- Syntax, Accessing elements, objects-prope	rties							
and method	s. Built-in Objects. Regular Expressions- Introduction-Modifiers-Patterns-Quantifiers-Methods.								
Validation-	Event Handling DHTML with JavaScript.								
UNIT-III	FRONT -END FRAMEWORK	9							
Bootstrap: In	ntroduction-History- Grid System-Classes and Structure-Buttons-Button Groups-Forms-Vertical, Horiz	zontal							
and Inline-In	uputs-Input Sizing-Dropdowns-Navigation Bar-Pagination.JQUERY-Introduction-Syntax-Selectors-Ev	vents-							
Effects:Hide	and Show-Animation.								
UNIT-IV	SERVER SIDE PROGRAMMING	9							
An introduc	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number	ers							
An introduc and Math-F	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number form Validation- Regular Expressions – File handling – Cookies – Sessions- CONNECTIVITY-	ers							
An introduc and Math-F	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number orm Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- -MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code	ers							
An introduc and Math-F Introduction	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number orm Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- -MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code.	ers							
An introduc and Math-F Introduction	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number orm Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- -MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code.	ers 9							
An introduc and Math-F Introduction UNIT-V	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number orm Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- -MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code. APPLICATION DEVELOPMENT	ers 9							
An introduc and Math-F Introduction UNIT-V Creation of	tion to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-Arrays-Strings, Number orm Validation- Regular Expressions – File handling – Cookies –Sessions- CONNECTIVITY- -MySQL Database-Prepared and Select Data- Creating HTML forms by embedding PHP code. APPLICATION DEVELOPMENT simple interactive applications - Simple database applications – Multimedia applications - Design and	ers 9 d							

development of information systems - Personal Information System - Information retrieval system - Social networking applications. 45

Contact Hours	:
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	List of Experiments
1	Write a html program for Creation of web site with forms, frames, links, tables etc
2	Design a web site using HTML and DHTML. Use Basic Text Formatting, Images etc.
3	Create a web page with the following using HTML5 (i) To embed an image map in a web page (ii) To fix the hot spots (iii) Show all the related information when the hot spots are clicked.
4	Create a web page with all types of Cascading style sheets.
5	Design a Scientific calculator using Java script.
6	Design a Registration form and validate.
7	Develop a responsive web page using Bootstrap.
8	Design a webpage with Grid System using Bootstrap.
9	Design a webpage with Dropdown, Navigation bar and Pagination.
10	Design a web page using JQuery selector.
11	Create a simple web page using JQuery Effects.

12	Design a web page to calculate the factorial of a given number using PHP.		
13	Create a web page to perform arithmetic operation using PHP.		
14	Program using Regular Expression in PHP.		
15	Develop an any application using PHP with MySQL.		
	Con	tact Hours :	30
	Total (	Contact Hours :	75

Cou On c	Course Outcomes: On completion of the course, the students will be able to				
CO1	Construct a basic webpage using HTML and Cascading Style Sheets.				
CO2	Build dynamic web page with validation using Java Script objects and by applying different event handling mechanisms.				
CO3	Develop a responsive web page.				
CO4	Construct simple web pages in PHP and Create simple database applications.				
CO5	Design an interactive web-application.				

	Text Books:								
1	Paul Deitel,Harvey Deitel and Abbey Deite, —Internet and World Wide Web - How to Program, 5th Edition, 2011.								
2	Jake Spurlock, Bootstrap-Responsive Web Development Kindle Edition, O'REILLY, 2013.								
3	Robin Nixon, —Learning PHP, MySQL, JavaScript, CSS & HTML5  Third Edition, O'REILLY, 2014.								

# **Reference Book:**

Web Link

1 Jeffrey C and Jackson, —Web Technologies A Computer Science Perspectivel, Pearson Education, 2011.

CO/P	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO1 0	PO11	PO1 2	PSO	PSO	PSO	PSO
0													1	2	3	4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	-	-	3	-	-
(Avg)	3.00	2.60	2.75	2.80	-	-	-	-	-	-	3.00	-	3.00	3.00	3.00	-

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

Substantial(High) No correlation : —- $\|$ 

1. W3SCHOOL.com

Subject Code	Subject Name (Lab oriented Theory Course)	Category	L	Т	Р	C
AD19643	INNOVATION AND DESIGN THINKING FOR ARTIFICIAL	PC	3	0	2	4
	INTELLIGENCE AND DATA SCIENCE					

#### **Objectives:** The course aims to

Introduce tools & techniques of design thinking for innovative product •

• Development Illustrate customer-centric product innovation using on simple

- Use cases Demonstrate development of Minimum usable Prototypes.
- Outline principles of solution concepts & their evaluation •
- Describe system thinking principles as applied to complex systems

#### UNIT-I **DESIGN THINKING PRINCIPLES**

Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge 229 Innovation rubric] - Case studies

# UNIT-II END USER-CENTRIC INNOVATION

Importance of customer-centric innovation - Problem Validation and Customer Discovery -Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit

# UNIT-III APPLIED DESIGN THINKING TOOLS

Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition -Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design 9

# UNIT-IV CONCEPT GENERATION

Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts

# UNIT-V SYSTEM THINKING

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems

**Contact Hours** 45 :

9

9

9

9

	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	:	75						
Co	Course Outcomes:									

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

CO1	Plan a Design Thinking project	
CO2	Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching	
CO3	Empathize and experiment the methods and tools	
CO4	Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.	
CO5	Apply system thinking in a real-world scenario	
Text	Books:	
1	Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.	
2	Alexander Osterweider Vyes Dignour Gregory Pernerde Alex Smith Trich Penedekes (2014) Velue	

#### Alexander Osterwalder, Yves Pigneur, Gregory Bernarda, Alan Smith, Trish Papadakos, (2014), Value 2

Ref	ference 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 valuel, First Edition, Allworth Press, 2009

# 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
AD19643.1	1	2	2	2	2	2	2	1	2	1	2	2	3	3	2
AD19643.2	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AD19643.3	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AD19643.4	1	3	3	3	3	3	3	3	3	1	3	3	3	3	2
AD19643.5	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 (Lab Courses)	Category	L	Т	Р	С
GE19621	PROBLEM SOLVING TECHNIQUES	EEC	0	0	2	1

Ob	ojectives:Broad objective of this course is
٠	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

Cou	Course 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.								

# CO - PO – PSO matrices of course

PO/PSO	РО	PO	РО	РО	РО	РО	PO	PO	РО	РО	РО	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: "-"

Subject Code	Subject Name (Theory Courses)	Category	L	Т	P	С
AD19751	BASICS OF COMPUTER VISION	PC	3	0	0	3

### **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. •
- Interpret various CNN model for object detection in Computer Vision. •
- Identify possible solutions to Train common problems with GAN model. •

#### **UNIT-I** INTRODUCTION

Introduction : Introduction to Computer Vision-Features-Applications- 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)

#### 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)

# 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)

#### **UNIT-IV OBJECT DETECTION IN COMPUTER VISION**

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

Overview of GAN Structure-Discriminator-Discriminator Training Data-Generator-GAN Training-Convergence-Loss Functions-Minimax Loss-Modified Minimax Loss-Wasserstein Loss. Case study: Build and train a GAN for generating hand-written digits in the TF-GAN (Link 5 chapter 8,Link 6) 45

**Contact Hours** 

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

Te	xt Books:
1	Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2010.
2	D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2 <sup>nd</sup> edition, 2012 Pearson Education.

9

10

10

8

# **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. https://github.com/microsoft/computervision-recipes
- 5. https://livebook.manning.com/book/grokking-deep-learning-for-computer-vision/chapter-7/286
- 6. https://developers.google.com/machine-learning/gan/applications
- 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

PO/PSO	РО 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
AD19751.1	-	2	-	3	3	-	-	-	-	-	-	-	2	3	2
AD19751.2	-	2	2	3	2	-	-	1	-	-	-	-	2	3	2
AD19751.3	2	3	-	3	2	-	-	1	-	-	-	-	2	3	2
AD19751.4	-	2		3	3	3	1	-	2	-	-	-	2	3	2
AD19751.5	-	2	-	3	2	-	-	2	2	-	-	-	2	3	2
Average	2	2.2	2	3	2.4	3	1	1.3	2	-	-	-	2	3	2

# 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: "-"

Su	biect Co	do	Subject Name (Lab oriented Theory Courses)	Catagory	T	т	PC		
Su	A T10741	ue			2	1	$\frac{1}{2}$ $\frac{1}{4}$		
Ob	AII9/41		DIG DATA TECHNOLOGI	rt	3	U	2 4		
	To unde	retar	ad the basic concepts of big data and Hadoon						
•	To have	kno	wledge on accessing storing and manipulating the huge data from different	resources		—			
•	To have	mili	ar with working principles of hig data management using NoSOI	csources.					
To understand the working environment of Pig. Hive and HBase.									
<ul> <li>To understand the working environment of Fig, five and HDase.</li> <li>To implement queries to process the data using Squop and to be familiar on searching mechanism using Solr.</li> </ul>									
UN	IT-I	Int	roduction To Big Data And Hadoon	chanisin using	Jon	Ť	9		
Big data -concepts, needs and challenges, types and sources of big data, History of Hadoop, Apache Hadoop, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere Big Insights and Big Sheets.									
UNIT-IIHDFS (Hadoop Distributed File System)9									
The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.									
UN	IT-III	No	SQL				9		
Int	roduction	to N	oSQL, aggregate data models, aggregates, key-value and document data n	nodels, relation	nship	s, ş	graph		
dat	abases, so	chem	a less databases, materialized views, distribution models, sharding, mas	ster-slave repli	catio	n,	peer-		
pee and	r replicat l combini	ion, ng, c	sharding and replication, consistency, relaxing consistency, version stamp composing MapReduce calculations.	s, map-reduce	, part	itic	ning		
UN	IT-IV	Fu	ndamentals of Apache Pig, Hive , and HBase			Т	9		
Pig	: Introduc	ction	to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grun	t, Pig Latin, U	ser D	)efi	ned		
Fu	nctions, D	ata I	Processing operators. Hive: Hive Shell, Hive Services, Hive Meta store, Co	mparison with	Trac	litie	onal		
Da HB	tabases, H ase Versi	live( 1s RI	QL, Tables, Querying Data and User Defined Functions. HBase: HBase Co DBMS.	mcepts, Client	s, Ex	am	ple,		
UN	IT-V	Fu	ndamentals of Apache Sqoop, and Solr			Τ	9		
Sqoop- Export transfer data from Hadoop, update the data, update at the same time, export subset of columns. Import data to Hive, Import data to HBase, Apache Solr- Introduction, Information retrieval search engine, categories of data, inverted index. Design-field attributes and types. Indexing -indexing tool. Indexing operations using csv documents. Searching data-parameters, default query.									
			C	ontact Hours	Т	:	45		
					1				
	List of Experiments								

	List of Experiments								
1.	Installation of Hadoop. (3)								
	File Management tasks in Hadoop. (3)								
	• Upload and download a file in HDFS								
2	Copy a file from source to destination								
4.	• Copy to file from /to local file system to HDFS								
	Move file from source to destination								
	• Remove a file/directory in HDFS								
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	t data to Hive.(6)						
		Contact Hours	:	30				
		Total Contact Hours	:	75				
Cou	irse Outcomes:							
On	completion of the course, the students will be able to							
•	Get familiar with the concepts of big data and Hadoop							
•	Understand the process of accessing, storing and manipulating the hu	ge data from different resources.						
•	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.							

Te	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.

Re	ference 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.

# 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	PO1 0	PO1 1	PO1 2	PSO1	PS O2	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

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# PROFESSIONAL ELECTIVES (PE) Elective –I

Subject Code	Subject Name	Category	L	Т	P	С
AD19P51	KNOWLEDGE REPRESENTATION IN AI	PE	2	0	2	3

#### **Objectives:**

- To learn the concepts of knowledge Representation.
- To understand the concepts of Expressing Knowledge.
- To acquire the knowledge of Production Rules and Structured Description.
- To familiarize the fundamentals of network representation and frames.
- To understand the concept of Resolution.

# UNIT-I INTRODUCTION

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

### UNIT-II EXPRESSING KNOWLEDGE

**Expressing Knowledge:** Knowledge Engineering – Vocabulary - Basic Facts - Complex Facts - Terminological Facts Entailments- Other Sorts of Facts (Text Book 1: Chapter 3)

# UNIT-III PRODUCTION RULES AND STRUCTURED DESCRIPTION

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

# UNIT-IV NETWORK REPRESENTATION AND FRAMES

Semantic Network: Introduction- Components of Semantic Networks- Semantic Network Architecture- Examples of Semantic Network- Applications and Advantages. Frames: objects and frames - Basic frame formalism- Frame examples (Text Book 1: Chapter 8&9)

## UNIT-V RESOLUTION

**Resolution :** The Propositional Case- Handling Variables and Quantifiers – Dealing with Computational Intractability - Backward Chaining - Forward Chaining.(Text Book 1: Chapter 3, 4 & 5)

Contact Hours : 30

6

6

6

6

6

List of	List of Experiments (can be implemented using Python)							
1.	Data preprocessing and annotation and creation of datasets.							
2.	Learn existing datasets and Treebanks.							
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	models, nltk.						
		Contact Hours	:	30				
		<b>Total Contact Hours</b>		60				

Co	Course Outcomes:								
On	On completion of the course, the students will be able to								
•	Apply the concept of knowledge Representation.								
•	Apply the concept of Expressing Knowledge.								
٠	• Apply the concept of Production Rules.								
•	Analyze the concept of network representation and frames								
•	Apply the concepts of Resolution.								

Tex	Text Books:								
1	Ronald J. Brachman Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.								
2	Deepak Khemani. A First Course in Artificial Intelligence, McGraw Hill Education (India), 2013.								
Ref	ference Books:								

-	
1	Schank Roger C., Robert P. Abelson: Scripts, Plans, Goals, and Understanding: An Inquiry into Human Knowledge Structures. Hillsdale, NJ: Lawrence Erlbaum, 1977.
2	R. C. Schank and C. K. Riesbeck: Inside Computer Understanding: Five Programs Plus Miniatures , Lawrence 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 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.scribd.com/document/528678534/knowledgerepresentation-90203165228

3. https://www.analytixlabs.co.in/blog/what-is-knowledge-representation-in-artificial-intelligence/#Semantic\_Networks

# CO - PO – PSO matrices of course

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	5
AD19P51.1	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AD19P51.2	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
AD19P51.3	2	1	1	1	1	-	-	-	-	-	1	1	2	1	1
AD19P51.4	3	2	1	1	1	-	-	-	-	-	1	1	2	1	1
AD19P51.5	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	Т	P	С
AD19P52	GAME PROGRAMMING	PE	2	0	2	3

# **Objectives:**

UD,	jectives.
•	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 6 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) UNIT-II **3D GRAPHICS** 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 6 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 6 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) UNIT-V **REINFORCEMENT LEARNING AND GAMES** 6 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 E	<b>Jist of Experiments</b> (can be implemented using any tools: Play Canvas, jMonkey Engine, Direct 3D 11, Scratch,									
Python o	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	1								

# **Course Outcomes:**

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

Text	t 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.

# **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

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

PO/PSO CO	РО 1	РО 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	РО 11	PO 12	PSO 1	PSO 2	PSO 3
AD19P52.1	1	2	2	2	2	-	-	-	-	-	-	-	1	1	-
AD19P52.2	2	2	3	2	2	-	-	-	-	-	-	-	2	2	-
AD19P52.3	2	2	3	3	3	-	-	-	-	-	2	-	3	3	-
AD19P52.4	2	2	3	3	3	-	-	-	-	-	2	-	3	3	2
AD19P52.5	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

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	C
AD19P53	Mobile Application and Development	PE	2	0	2	3

<b>Objectives:</b> Broad	objective of	of this cou	rse is to
	3		

- Explain the fundamental concepts of mobile applications and Android application development framework
- Illustrate the intricacies of various user interface models.
- Elaborate the data storage and memory facets of Android applications.
- Discuss about the design aspects of interactive mobile application services.
- Describe the location related services in Android.

#### UNIT-I ANDROID FUNDAMENTALS

Mobile Application development and trends – Android overview and Versions –Android open stack, features – Setting up Android environment (Eclipse, SDK, AVD)-Simple Android application development – Anatomy of Android applications – Activity and Life cycle – Intents, services and Content Providers

## UNIT-II ANDROID USER INTERFACE

Layouts: Linear, Absolute, Table, Relative, Frame, Scrollview, Resize and reposition - Screen orientation – Views: Textview, EditText, Button, ImageButton, Checkbox, ToggleButton, RadioButton, RadioGroup, ProgressBar, AutocompleteText, Picker, Listviews and Webview– Displaying pictures with views: Gallery and ImageView, ImageSwitcher, Gridview – Displaying Menus: Helper methods, Option and Context

Activity: Simple calculator application using text view, edit view, option button and button

# UNIT-III DATA PERSISTENCE

Shared User preferences – File Handling: File system, System partition, SDcard partition, user partition, security, Internal and External Storage – Managing data using SQLite –User defined content providers

# UNIT-IV MESSAGING, NETWORKING AND SERVICES

SMS Messaging: Sending and Receiving – Sending email and networking-Downloading binary and text data files – Access Web services – Developing android services: create your own services, performing long running task in a service performing repeated task in a service

# UNIT-V LOCATION ACCESS AND PUBLISH ANDROID APPLICATION

Location based services: Display map, zoom control, view and change, Marking, Geocoding, Get location - Publish Andr applications and Deployment

Activity: 1. Display map of given location/position using map view

2. Develop a native application that uses GPS location information

Contact Hours : 30 Periods

6

6

6

6

6

## List of Experiments

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
2	Develop an application to change the font and color of the text and display toast message when the user presses the
	button
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].
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.
	a. Insert student Details
	b. Update the student Record
	c. Delete a specified record.
	d. View the details
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.
	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 (Deep
	Learning based application).
9	Develop an android app for barcode scanning (Deep Learning based application)
	Total Contact Hours : 30

Course (	Course Outcomes:				
On comp	On completion of the course, the students will be able to				
CO1	Gain basic knowledge on Android application frameworks.				
CO2	Design and implement the adaptive and responsive user interfaces of mobile applications.				
CO3	Understand the memory management schemes in Android.				
CO4	Develop and apply various mobile application services and utilities.				
CO5	Demonstrate various GPS and location based services in Android framework.				

# Text Books:

		1. WeiMeng Lee, "Beginning Android Application Development", Wrox Publications, 2012
	Refe	erences:
		1. Ed Burnette, "Hello Android: Introducing Google's Mobile Development Platform", The Pragmatic Publishers,
		3rd edition, 2010
		2. Reto Meier, "Professional Android 4 Application Development", Wrox Publications, 2012.
F		2 Zigund Madnialza Laind Domin Plaka Maika C. Magumi Nakamuna "Programming Android Java Programmin

3. ZigurdMednieks, Laird Dornin, Blake Meike G, Masumi Nakamura,"Programming Android: Java Programming for the New Generation of Mobile Devices", OReilly Media, 2011.

CO/P O	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	3	3	3	3	2	2	-	-	1	3	3	3	2	3
CO2	3	3	3	3	3	3	-	-	-	-	1	1	3	3	2	3
CO3	3	3	3	3	3	-	-	2	2	-	2	1	3	2	3	3
CO4	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3	3
CO5	3	3	3	3	3	2	2	-	-	-	2	2	3	3	3	3
CO (Avg)	3	3	3	3	3	2	1.1	0.8	0.4	-	1.6	2	3	2.8	2.6	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 : "-"

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

Ob	Objectives:		
8	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.		
•	To learn issues related to process and Security.		

UNIT-IINTRODUCTION TO DISTRIBUTED SYSTEMS6Introduction to Distributed systems – Design Goals-Challenges - Types of Distributed Systems - Architectural Styles –<br/>Middleware - System Architecture – Centralized and Decentralized organizations – Peer-to-Peer System –Focus on<br/>resource sharing -Case Study: Skype, Bittorrent.

UNIT-II	COMMUNICATIONS AND DISTRI	BUTED WEB BASED SYSTEN	1	6			
Fundamentals - Rem communication - We	Fundamentals - Remote Procedure Call – Stream oriented communication – Message oriented communication – Multicast communication - Web based system architecture-Web services-Case Study: Apache Web server, HTTP, SOAP						
UNIT-III	DISTRIBUTED OBJECTS AND FIL	LE SYSTEM		6			
Remote Invocation	- Request Reply Protocol - Java RM	I - Distributed Objects - CORB	A -Object	to component -			
Enterprise java Bear	n- Introduction to Distributed File Syst	em - File Service architecture -	- Andrew F	ile System, Sun			
Network File System	n - Case Study: Google File System						
UNIT-IV	SYNCHRONIZATION AND DISTR	IBUTED TRANSACTIONS		6			
Clock Synchronizatio	on – Physical Clocks– Clock Synchroniza	tion Algorithms-Logical Clocks-	Lamport's L	ogical Clocks-			
Vector Clocks-Elect Transaction- Locks-	Vector Clocks-Election Algorithms-Ring based Algorithm -Bully Algorithm – Distributed Transactions- Nested Transaction- Locks- Concurrency Control- Timestamp Ordering - Atomic Commit-Distributed Deadlock.						
UNIT-V SEC	URITY 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	List of Experiments						
1	Install Skype and initiate a chat between users.						
2	Write a program to add two numbers in Java RMI.						
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 Misra.						
6	Create a SOAP based web service for a simple Java calculator class with operations add and subtract. Also create web service client which consumes web service and displays the result of invoked web service.						
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 Hours						

	(DOOKS(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.

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	P O
CS19P12.1	3	2	2	2	2	1	1	1	3	1	3	2	3	2	
CS19P12.2	3	3	3	3	3	2	2	2	3	2	3	2	3	3	
CS19P12.3	3	3	3	3	3	2	3	2	2	2	3	2	3	3	
CS19P12.4	3	3	3	3	3	3	2	2	2	2	3	2	2	2	
CS19P12.5	3	3	3	2	2	2	2	2	2	2	3	2	3	2	
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

# CO - PO – PSO matrices of course

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 "-"

	Professional Elective – II					
Subject Code	Subject Name (Theory course)		Category	LJ	P	(
AD19P61	Embedded Systems and Programming		PE	3 0	0	3
<b>Objectives:</b>						
• To help the	learner to learn programming language with embedded concepts.					
• To write en	bedded programs and understand the techniques					
• To learn teo	hnologies in various languages for embedded applications					
UNIT-I Er	nbedded OS Fundamentals				9	)
Embedded OS	Fundamentals (Linux) Introduction: Operating System Fundam	entals, Gen	eral Linux A	rchite	ctur	e,
Linux Kernel, I	inux file systems, ROOTFS, Sysfs and Procfs, Embedded Lin	ux: Booting	g Process in I	_inux,	bo	эt
loaders, U-boot,	Kernel Images, Linux File systems. GNU Tools: gcc, gdb, gprof,	, Makefiles			1 -	
UNIT-II Er	nbedded C Programming				9	)
Embedded C Pro	ogramming Review of data types –scalar types-Primitive types-En	numerated t	ypes-Subrang	es, Str	uctu	ire
types-character	strings –arrays- Functions Introduction to Embedded C-Introdu	uction, Data	a types Bit m	anipu	latic	m,
Interfacing C v	7th Assembly. Embedded programming issues - Reentrancy,	Portability,	Optimizing	and 1	testi	ng
embedded C pr	ograms. Modelling Language for Embedded Systems: Modeli	ng and An	alysis of Rea	i-Tim	e an	d
Embedded syste						<u> </u>
	nbedded Applications using Data structures	0 1	1:	<u> </u>		<u>,</u>
Embedded Appl	ications using Data structures Linear data structures – Stacks and C	Queues Imp	lementation of	i stack	s an	a
Queues Linked	List - Implementation of linked list, Sorting, Searching, Insertion	and Deletic	Idad avatama	struct	ures	-
UNIT-IV Sc	rinting Languages		ided systems.		(	<u>,</u>
Scripting Langu	ages for Embedded Systems Shell scripting. Programming basic	s of Python	Comparison	ofser	intin	, 1σ
languages	ages for Embedded Systems bien serpting, i rogramming basie	s of i yulon,	comparison	01 501	pun	6
UNIT-V CA	ASE STUDY				9	,
Digital Camera-	Embedded systems in Automobile-Smart Card Reader- Automat	ed Meter Re	eading System			
U		Total C	ontact Hours	:	45	;
Course Outcom	es:					
On completion of	f the course students will be able to					
Analyze t	ne OS fundamentals.					
Implement	t using C programs and solving embedded problems.					
Analyze d	ata structure concepts.					
Critically	Analyse various programming languages					
Apply dif	ferent applications.					
Text Book(s):						
"C Programn	ning language" Kernighan Brian W Ritchie Dennis M					1

I	"C Programming language", Kernighan, Brian W, Ritchie, Dennis M
2	"Embedded C ",Michael J. Pont, Addison Wesley
3	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
4	Nikolay Elenkov, "Android Security Internals: An In-Depth Guide to Android"s Security Architecture", No Starch Press, 2015

# **Reference Books(s):**

1	Object_Oriented programming in C++, Robert Lafore, Galgotia publications
2	Operating System Concepts, Peter B. Galvin, Abraham Silberschatz, Gerg Gagne, Wiley Publishers

3	GNU/LINUX Application Programming, Jones, M Tims
4	David E. Simon, "An Embedded Software Primer", Pearson Education, 2003.
5	The Complete Reference C++, Herbert Schildt, TMH
6	C++ programming language, Bjarne Stoustrup, Addison-Wesley

## Web links for virtual lab:

1 https://www.slideshare.net/anandhd1/embedded-case-studies-234800855

2 <u>https://www.codechef.com/ide</u>

- <u>https://www.jeodeenericon/ide</u>
   <u>https://www.jeodeenericon/ide</u>
   <u>https://rextester.com/l/c\_online\_compiler\_gcc</u>
   <u>https://www.python.org/shell/</u>

- https://www.tutorialspoint.com/execute python online.php 6
- 7 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
AD19P61.1	3	3	2	2	2	1	-	-	-	-	1	2	2	3	2
AD19P61.2	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
AD19P61.3	3	3	2	2	2	1	-	-	-	-	1	2	3	3	2
AD19P61.4	3	3	2	2	3	1	-	-	-	-	1	2	2	3	2
AD19P61.5	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
AD19P62	DATA MINING TECHNIQUES	PC	2	0	2	3

Ob	Objectives:					
٠	To understand the concepts of Data mining techniques					
٠	To learn data pre-processing Techniques					
•	To understand the concepts of Classification and Clustering methods					
٠	Case studies of data mining classification methods					
•	Case studies of data mining clustering methods					

UNIT-I	INTRODUCTION		6
Data Mining	: Data mining versus Knowledge Recovery in Data Bases-Technique	es used in Data mining- Data mi	ning
Issues-Data	mining metrics-Social implications of Data miming-Data mining from	n Data Base perspective.	
UNIT-II	DATA PRE-PROCESSING TECHNIQUES		6
Data Pre-pro	ocessing: Data Cleaning-Data Integration-Data Reduction- Data Tran	sformation and Data Discretizat	ion
Methods.			
UNIT-III	CLASSIFICATION		6
Classificatio	n: Basic Concepts-Decision Tree Induction – Bayes Classification M	ethods – Rule-Based Classifica	tion-
Model Evalu	uation and Selection- Techniques to improve Classification Accuracy	•	
UNIT-IV	CLASSIFICATION ADVANCED METHODS		6
Advanced N	Aethods: Back Propagation - Support Vector Machines- Other Cla	ssification Methods: Genetic	-
Algorithms-	Rough set approach, Fuzzy set approach.		
Multiclass C	Classification: Semi-supervised classification – Active Learning – tran	sfer Learning.	
UNIT-V	CASE STUDIES		6
Data Mining	Techniques for Optimizing Inventories for Electronic Commerce, C	rime Data Mining: A General	-
Framework	and some examples.		
Mining Cust	tomer Value: from Association Rules to Direct Marketing, KDD Insur	ance Risk Assessment.	
Case Study	of Cluster Analysis – Efficient clustering of very large document Col	llections.	
		Total Contact Hours :	30
			1

	List of Experiments					
1	Working with Numpy arrays					
2	Working with Pandas data frames					
3	Develop python program for Basic plots using Matplotlib					
4	Develop python program for Data Importing and Visualization					
5	Develop python program for train and test the classifiers.					
6	Develop python program for finding the k-means clustering for a					
	dataset.					
7	Develop python program for Normal Curves					
8	Develop python program for Correlation and scatter plots					

9	Develop python program for Correlation coefficient			
10	Develop python program for Simple Linear Regression			
		Contact Hours	:	30
		Total Contact Hours	:	60
Co	urse Outcomes:	·		
On	completion of the course, the students will be able			
•	To build the model based on the analysis of data.			
٠	To differentiate the types of data.			
•	To understand the relationship and correlation between the data.			
٠	To use the python libraries and data wrangling			
•	To visualize the errors and plots.			

Te	Text Book(s):						
1	Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Third Edition. ISBN-0123814790, 2011						
2	G.K.Gupta, "Introduction to Data mining with Case Studies", ISBN-978-81-203-3035-5.						
3	Dunham, Margarate H, "Data Mining – Introductory and Advanced Topics".						

# Reference Books(s): 1 Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization , O'Reilly, 2016 2 Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.. 3 Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

# 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
AD19P62.1	2	2	2	-	-	-	-	-	1	-	-	1	2	2	-
AD19P62.2	2	2	3	3	3	-	-	-	2	1	2	1	2	1	-
AD19P62.3	2	2	2	2	2	-	-	-	2	1	2	1	1	2	1
AD19P62.4	2	2	2	2	2	-	-	-	1	1	-	-	1	2	1
AD19P62.5	2	2	2	4	2	-	-	-	2	-	2	2	1	2	3
Average	2.0	2.0	2.2	2.8	2.3	-	-	-	1.6	1.0	2.0	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 Course)	Category	L	Т	Р	С
CS19P06	HUMAN COMPUTER INTERACTION	PE	2	0	2	3

# **Objectives:**

UD,	jecu ves.
ß	Learn the foundations of Human Computer Interaction.
ß	Be familiar with the design technologies and software process.
ß	Learn human interaction models and theories
ß	Be aware of Design thinking concepts.
•	Learn the guidelines of design thinking and apply it.

UNIT-I	FOUNDATIONS OF HCI			6							
The Human: I/O	channels - Memory - Reasoning and problem solv	ving; The computer: Devices – Me	emory – Pr	ocessing							
and networks; In	and networks; Interaction: Models – Frameworks – Ergonomics – Styles – Elements – Interactivity – Paradigms.										
UNIT-II	DESIGN & SOFTWARE PROCESS			6							
Interactive Design basics - Process - Scenarios - Navigation - Screen design - Iteration and prototyping. HCI in software											
process – Software life cycle – Usability engineering – Prototyping in practice – Design rationale - Design rules –											
Principles, Stand	Principles, Standards, Guidelines, Rules – Universal Design.										
UNIT-III MODELS AND THEORIES											
Cognitive model	s-Socio-Organizational issues and stake holder req	uirements -Communication and c	ollaborati	on models							
- Task Analysis.											
UNIT-IV	MOBILE HCI			6							
Mobile Ecosyste	m: Platforms-Application frameworks- Types of N	Iobile Applications: Widgets- Ap	plications	– Games–							
Mobile Informat	ion Architecture–Mobile 2.0.										
UNIT-V WEB INTERFACE DESIGN											
Designing Web	Designing Web Interfaces - Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages.										
Contact Hours :											

List of	Experiments										
1	Design a user interface for Welcome screen.										
2	Design a user interface by applying design rules for assigning a grade to stude	ents based on the subject mar	ks.								
3	Design a user interface with Layouts for printing the numbers in ascending or	der and descending order.									
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	completion of the course, the students will be able to
g	Describe the foundations of Human Computer Interaction.
Ś	Demonstrate with the design technologies and software process.
প্ল	Apply the concepts of human interaction models and theories.
Ŕ	Design effective HCI for individuals and persons with disabilities.
Ś	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.

РО/PS О СО	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

<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: "-"

Sub	oject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	Р	С					
AD	19641	ADVANCED ARTIFICIAL INTELLIGENCE	PE	2	0	2	3					
Obj	jectives:											
•	The main ob	jectives of this course are to:										
•	Study about	uninformed and Heuristic search techniques.										
•	Learn techn	iques for reasoning under uncertainty										
•	Introduce M	Iachine Learning and supervised learning algorithms										
•	Study about	ensembling and unsupervised learning algorithms										
UN	IT-I	PROBLEM SOLVING AND PROBABILISTIC REASONING					6					
Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP, Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesia networks – exact inference in BN – approximate inference in BN – causal networks.												
UN	IT-II	SUPERVISED LEARNING					6					
Intro regr Log mac	Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model – Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests .											
UN	IT-III	UNSUPERVISED LEARNING AND REINFORCEMENT LEARN	ING				6					
Intro -Pri Mod	oduction - Clu incipal Compo del based Lear	Istering Algorithms -K – Means – Hierarchical Clustering - Cluster Validit onent Analysis – Recommendation Systems - EM algorithm. Reinforcement rning – Temporal Difference Learning.	y - Dimensiona it Learning – E	ılity lem	Rec ents	duc ; -	ction					
UN	IT-IV	NEURAL NETWORKS					6					
Pero grac grac	ceptron - Mult lient descent, lient problem)	ilayer perceptron, activation functions, network training – gradient descen error back propagation, from shallow networks to deep networks –Unit sat ) – ReLU, hyper parameter tuning, batch normalization, regularization, dro	optimization - uration (aka the pout.	- sto e va	cha nish	stio	c g					
UN	IT-V	DEEP LEARNING					6					
Hist prop nort	cory of Deep I pagation - Reg malization- V	Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Gularization: Dataset Augmentation – Noise Robustness -Early Stopping, E C Dimension and Neural Nets.	hain Rule and Agging and Dro	Bao	:k ut -	bat	tch					
		Total	Contact Hour	s	:		30					
		List of Experiments										
•	Implementat	ion of Uninformed search algorithms (BFS, DFS)										
•	Implementat	ion of Informed search algorithms (A*, memory-bounded A*)										
•	Implement n	aïve Bayes models										
•	Implement B	Bayesian Networks										
•	Build Regres	ssion models										
•	Build decision	on trees and random forests .										
•	Build SVM models.											
•	Implement clustering algorithms .											
•	Build simple NN models .											
•	Build deep le	earning NN models.		_	_							
			Contact H	Iou	:s : :	30	hours					
Co On	urse Outcom completion of	es: f the course, the students will be able										
•	CO1: Use ap	ppropriate search algorithms for problem solving and Apply reasoning und	er uncertainty									
•	CO2: Build	supervised learning models										
•	CO3: Builda	and unsupervised models and Reinforcement models										

•	CO4: Build neural network models
•	CO5: Build deep learning models

# Text Book(s):

1	Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson
	Education, 2021.
2	Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

Ref	ference Books(s):
1	Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education, 2007.
2	Kevin Night, Elaine Rich, and Nair B., "Artificial Intelligence", McGraw Hill, 2008.
3	Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006.
4	Deepak Khemani, "Artificial Intelligence", Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)
5	Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
6	Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.
7	Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014

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

PO/PSO															
СО	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
AD19641.1	3	2	3	3	1	-	-	-	1	3	3	3	2	3	2
AD19641.2	2	1	2	1	1	-	-	-	2	1	1	3	1	1	1
AD19641.3	3	1	3	1	-	-	-	-	2	1	2	1	2	2	2
AD19641.4	3	1	1	2	2	-	-	-	3	1	2	3	2	2	2
AD19641.5	3	3	1	1	1	-	-	-	2	2	1	2	2	2	2
AVERAGE	2.8	1.6	2	1.6	1	-	-	-	2	1.6	1.8	2.4	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:

# **Professional Elective – III**

Subject Code	SubjectName(TheoryCourse)	Category	L	Т	Р	С
AD19P71	<b>ROBOTIC PROCESS AUTOMATION</b>	PE	2	0	2	3

Objectives:									
& To understand the basic concepts of Robotic Process Automation.									
& To expose to the key RPA design and development strategies and methodologies.									
S To learn the fundamental RPA logic and structure.									
& To explore the Exception Handling, Debugging and Logging operations in RPA.									
To learn to deploy and Maintain the software bot.									
UNIT-I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION	6								
Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Bene	efits								
of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Too	ols -								
Templates, User Interface, Domains in Activities, Workflow Files.									
UNIT-II AUTOMATION PROCESS ACTIVITIES	6								
Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Deci	ision								
making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operat	tions								
Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events									
UNIT-III APP INTEGRATION, RECORDING AND SCRAPING	6								
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to									
perform operation, Scraping data from website and writing to CSV. Process Mining									
UNIT-IV EXCEPTION HANDLING AND CODE MANAGEMENT	6								
Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error repor	rting.								
Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commer	nting								
techniques, State Machine.	-								
UNIT-V DEPLOYMENT AND MAINTENANCE	6								
Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License									
management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA									

TotalContactHours : 30

List of	Experiments								
1	Create a sequence to obtain user inputs display them using a message box								
2	Create a flowchart to navigate to a desired page based on a condition								
3	Create a state machine workflow to compare user input with a random num	ıber							
4	Build a process in the RPA platform using UI Automation Activities								
5	Create an automation process using key system activities, variables and arg	guments							
6	Implement Automation using System Trigger								
7	Automate login to(web)Email account								
8	Recording mouse and keyboard actions								
9	Scarping data from website and writing to CSV								
10	Implement Error handling in RPA platform								
11	Web scarping								
12	Email Query processing								
		~		• •					

	Contact Hours	:	30
	<b>Total Contact Hours</b>	:	60

Curriculum and Syllabus | B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE |R2019

Co	Course Outcomes:							
8	Enunicate the key distinctions between RPA and existing automation techniques and platforms							
8	Use uipath to design control flows and work flows for the target process							
8	Implement recording, web scraping and process mining by automation							
8	Use UIPath studio to detect and handle exceptions in automation process							
8	Implement and use orchestrator for creation, monitoring, scheduling and controlling of automated bots and process							

Te	xt Book(s):
1	Learning Robotic Process Automation: Create Software robots and automate business processes with the leading
	RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2	Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress
	publications, 2020.

Reference Books(s)/Weblinks:								
1	$\mathbf{E}_{\mathbf{n}} = 1 \cdot (\mathbf{A}_{\mathbf{n}} + 1 \cdot \mathbf{n}) \mathbf{D}_{\mathbf{n}} + 1 \cdot \mathbf{n}$	•						

1	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks

& Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018 . A GerardusBlokdyk, "Robotic Process Automation Rpa A Complete Guide ", 2020

3

CO PO/PSO	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	Ps02	PS03
AD19P71.1	2	2	2	2	2	2	2	-	-	1	1	2	3	1	1.5
AD19P71.2	2	2	2	-	-	-	-	-	-	2	•	2	2	-	2
AD19P71.3	1	1	3	-	-	2	1	1	2	-	1	2	2	2	3
AD19P71.4	2	1	1.5	1	1	2	1	-	-	1	3	1	2	3	1.5
AD19P71.5	2	2	2	1	2	1.5	1	1	1	2	1	2	1.5	2	1
Average	1.8	1.6	2.1	0.8	1	1.5	1	0.4	0.6	1.2	1.2	1.8	2.1	1.6	1.8

Correlation level

1. slight(Low) 2.Moderate(Medium) 3.Substantial(High) 4.No correlation (-)
| Subject Code | Subject Name (Lab Oriented Theory Course) | Category | L | Т | Р | С |
|--------------|-------------------------------------------|----------|---|---|---|---|
| AD19P72      | PREDICTIVE ANALYTICS                      | PE       | 2 | 0 | 2 | 3 |

#### **Objectives:**

- To introduce the fundamental concepts of predictive analytics.
- To determine if current and historical data patterns are likely to emerge again.
- To impart the knowledge on various steps that are necessary before constructing the predictive model.
- To gain knowledge on the assessment of predictive models for decision making
- Help organizations allocate resources more efficiently by making informed predictions about where they will be most effective

#### INTRODUCTION TO PREDICTIVE ANALYTICS UNIT-I

Introduction to Analytics - Predictive Analytics - Parametric vs. Non-Parametric Models -Business Intelligence -Predictive Analytics vs. Business Intelligence - Predictive Analytics vs. Statistics - Predictive Analytics vs. Data Mining – Challenges in using Predictive Analytics.

#### UNIT-II PROBLEM SETTING, DATA UNDERSTANDING AND PREPARATION

Defining Data for Predictive Modelling – Defining Target Variable – Defining Measures of Success for Predictive Models - Single Variable and Multiple Variable Summaries – Data Visualization – Variable Cleaning – Feature Creation - Case study: Fraud Detection.

#### PREDICTIVE MODELING UNIT-III

Parameter Settings - Measures of Interesting Rules - Deploying Association Rules - Building Classification Rules from Association Rules – Neural Networks - Decision Trees – Linear Regression - Logistic Regression – K-Nearest Neighbor Classifier. 6

#### UNIT-IV **DESCRIPTIVE MODELING**

Data Preparation Issues with Descriptive Modelling - Principal Component Analysis (PCA) Algorithm - Applying PCA to New Data - PCA for Data Interpretation - Clustering Algorithms - The K-Means Algorithm - The Kohonen SOM Algorithm - Visualizing Kohonen Maps

#### ENSEMBLES AND ASSESSING PREDICTIVE MODELS UNIT-V

Model Ensembles - The Wisdom of Crowds - Bias Variance Tradeoff - Bagging - Boosting - Random Forests -Stochastic Gradient Boosting - Heterogeneous Ensembles. : 30

Contact Hours

6

6

6

6

#### List of Experiments

1	Clustering based data analytics using R/Python. (K-Means, SOM algorithms)				
2	Demonstrate the statistics for a sample data like mean, standard deviation, normal/uniform distribution,				
	variance and correlation.				
3	Demonstrate missing value analysis, fixing missing values and outlier analysis i	in dataset			
4	Demonstrate data visualization, histograms and multiple variable summaries				
5	Demonstrate transformation, scaling, binning, fixing skewed values and sampling	ng.			
6	Demonstration of Apriori algorithm on transaction dataset to find association rules.				
7	Demonstration of Linear and Logistic regression using various domain datasets.				
8	Demonstration of predictive models such as Decision Tree, Neural network and	l K-Nearest Neighbor ı	ısing		
	various domain datasets.				
9	Demonstration of Temporal Mining Techniques				
10	Demonstration of predictive analytics to analysis microarray data				
	Co	ntact Hours	30		
	Το	tal Contact Hours	60		

#### **Course Outcomes:**

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

- Understand the fundamental concepts of predictive analytics.
- Define the problem and prepare the data for analysis.
- Construct different predictive models for decision making.
- Apply descriptive modelling techniques for the given data.
- Assess and interpret different predictive models.

#### **Text Books:**

1 Dean Abbott, Applied Predictive Analytics: Principles and Techniques for the professional Data Analyst, John Wiley & Sons Inc. Publishers, First edition, 2014.

#### Reference Books:

- 1 Klimberg, Ron and B.D. McCullough, Fundamentals of Predictive Analytics with JMP®, Cary, NC: SAS Institute Inc., Second Edition, 2016.
- 2 Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning Data Mining, Interence and Prediction, Second Edition, Springer Verlag, 2009
- 3 L. Wasserman All of statistics
- 4 Eric Siegel, Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, John Wiley & Sons Inc. Publishers, Second edition, 2016.

#### Web links:

- 1 https://swayam.gov.in/
- 2 Predictive Modeling and Analytics Course (CU Boulder) | Coursera
- 3 Predictive Analytics Regression and Classification Course (nptel.ac.in)

PO/PSO															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	РО	РО	РО	PSO 1	PSO 2	PSO 3
со										10	11	12			
AD19P72.1	3	-	2	1	1	2	1	-	-	-	-	1	3	3	3
AD19P72.2	2	2	2	3	2	-	-	-	2	-	1	2	3	3	3
AD19P72.3	2	2	2	2	3	-	-	1	2	2	2	3	3	3	3
AD19P72.4	2	2	-	1	2	-	-	-	2	-	2	2	3	3	3
AD19P72.5	2	-	1	2	2	-	-	1	1	-	1	2	3	3	3
Average	2.2	2.0	1.4	1.8	2.0	2.0	0.2	0.4	1.4	0.4	1.2	2.0	3.0	3.0	3.0

#### 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 (Theory course)	Category	L	Т	Р	С
IT19P85	SOCIAL NETWORKS	PE	3	0	0	3

Ol	Objectives:				
•	Understand the basics of Social Networks				
•	Understand the ties and homophily				
•	Understand the market and StrategicInteraction in Networks				
•	Understand link analysis and searching				
•	Understand the concepts of modeling networks				

#### 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
 9

 Observations about the Structure of Networks;Strong and Weak Ties; Networks in Their Surrounding Contexts
 9

 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
 9

#### 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	9
The Structure	e of the Web; 4 Link Analysis and Web Search; Growing Random Networks- Uniform Randomn	ess: ar
Exponential 1	Degree Distribution- Hybrid Models- Small Worlds, Clustering, and Assortativity; Cascading Beha	avior ir
Networks; In:	stitutions 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

Total Contact Hours : 45

9

9

9

Course Outcomes:				
On completion of course students will be able to				
CO1 Remember the basics of Social Networks				
CO2 Create the ties and homophily				
CO3 Apply the market and Strategic Interaction in Networks				
CO4 Perform link analysis and searching				
CO5 Develop the model for social networks				

#### Text Book(s):

UNIT-I

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 Webl, , First Edition, Springer 2007.							
2	BorkoFurht,—Handbook of Social Network Technologies and Applicationsl, 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 Mapping:**

CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	<b>PO1</b>	<b>PO1</b>	PO1	PSO	PSO	PSO	PSO
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2	3	4
C01	3	2	-	2	-	2	1	-	-	-	2	2	-	-	1	2
CO2	3	2	-	2	-	2	1	-	-	-	2	1	-	-	1	2
CO3	2	2	-	2	-	2	2	-	-	-	3	2	-	2	2	2
CO4	1	1	-	2	2	2	1	-	-	-	2	2	-	2	2	2
CO5	-	-	-	2	2	2	-	-	-	-	2	2	-	-	2	2
CO(Av								-	-	-						
<b>g</b> )	2.25	1.75	- 1	2.00	2.00	2.00	1.25				2.20	1.80	-	2.00	1.60	2.00

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
CS19741	CLOUD COMPUTING	PC	2	0	2	3

	Objectives:
•	To learn the fundamentals of Cloud Computing and designing Private Cloud and Public Cloud Environment.
•	To learn the basic ideas and principles of Virtualization Technology.
•	To learn the dynamic programming models for Cloud.
•	To gain knowledge on various cloud components mechanism for data center design and management.
•	To learn the security and Advanced Cloud Concepts.

UNIT-I	INTRODU	INTRODUCTION						
Basic Concepts and Terminology-Roles and Boundaries-Cloud Characteristics-Cloud Delivery Model and Deployment								
Model. Case study de	esign and implementation of public and private	cloud- Open stack, AWS/Google	/Oracle					
UNIT-II VIRTUALIZATION TECHNOLOGY								
Broadband Networks	and Internet Architecture-Data Center Techno	logy-Virtualization Technology.						
Case Study: VMwar	e, Xen, KVM, Docker Container.							
UNIT-III DISTRIBUTED DYNAMIC PROGRAMMING MODEL								
Design of HDFS, Co	ncepts and Java Interface, Dataflow of File read	ad & File write, Map Reduce, Inp	out splittir	ig, map and				
reduce functions. Ca	se Study: Design and Implementation of Hive,	Pig, HBase.						
UNIT-IV	CLOUD COMPONE	NTS MECHANISM		6				
Cloud Infrastructure	Mechanism: Cloud Storage and Usage Monitor	r, Resource Replication-Specialize	ed Cloud I	Mechanism:				
Load Balancer, SLA	Monitor, Pay-per-use Monitor, Audit Monitor	, Failover System, Hypervisor, Re	esource cl	uster, Multi				
Device Broker, State	Management Database.							
UNIT-V	SECURITY AND ADVANC	CED CLOUD CONCEPTS		6				
Cloud Security Thre	ad-Cloud Security Mechanism: Encryption, H	Hashing, Digital Signature, Publi	c Key Inf	rastructure,				
Mobile Cloud Computing, Edge and Fog Computing.								
		Contact Hours	:	30				

	List of Experiments									
1.	Virtualization									
а	Find procedure to run the virtual machine of different configuration using virt-manager.									
b	Virtualize a machine and check how many virtual machine can be utilized at a particular time.									
с	Create a VM clone and attach virtual block to the cloned virtual machine and check whether it holds the data even after the release of the virtual machine.									
2	Public Cloud									
a	Develop a simple application to understand the concept of PAAS using GAE/Amazon Elastic Beanstalk/IBM Blue Mix/GCC and launch it.									
b	Test how a SaaS applications scales in response to demand.									
с	Find the procedure to launch a Cloud instance using a Public IaaS cloud like AWS/GCP.									
3	Private Cloud									
a	Setup a Private Cloud by performing the procedure using a Single node OPENSTACK implementation.									
b	Perform Creation, Management and Termination of a CirrOS instance in OPENSTACK.									

с	Show the virtual machine migration based on certain conditions from one node to the other.										
4	Hadoop - Map Reduce										
а	Setup a Single Node Hadoop cluster and show all the process through WEB UI.										
b	b Demonstrate the MAP REDUCE programming model by counting the number of words in a file. Implement the procedure to interact with Hadoop API for Accessing HDFS from local file system.										
		<b>Contact Hours</b>	:	30							
		<b>Total Contact Hours</b>	:	60							

#### **Course Outcomes:**

00	under Outcomed:
On	completion of the course, the students will be able to
•	Demonstrate the cloud, its characteristics, various delivery and deployment models.
•	The strength of virtualization and outline its role in enabling the cloud computing system mode
•	Recognize the scope of distributed file systems in cloud and their applications in industry.
•	The fundamental cloud components mechanism with which cloud data centers are managed and administered
•	Analyse the core issue of cloud such as security. Provide an insight into future prospects of computing in the cloud.

	Text Book(s):
1	Thomas Erl, ZaighamMahood, Ricardo Puttini- "Cloud Computing, Concept, Technology and Architecturel",
	Prentice Hall, First Edition, 2013.
2	Kai Hwang, Geoffery C, Fox and Jack J, Dongarra," Distributed and Cloud Computing: Clusters, Grids, Clouds and
2	the Future of Internet", First Edition, Morgan Kaufman Publisher, an Inprint of Elsevier, 2012.

#### **Reference Book(s) / Web link(s):**

1	Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models(SaaS, PaaS, and IaaS)", First Edition, Wiley, 2014.
2	Tom White, "Hadoop: The Definitive Guid". Yahoo Press, 2014.
3	RajkumarBuyya, Christain Vecchiola, and ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
4	John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

CO - PO – PSO matrices of course

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O 2	PS 0 3
CS19741.01	3	2	2	2	2	1	1	1	3	1	3	2	3	2	3
CS19741.02	3	3	3	3	3	2	2	2	3	2	3	2	3	3	3
CS19741.03	3	3	3	3	3	2	3	2	2	2	3	2	3	3	3
CS19741.04	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2
CS19741.05	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

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

#### **Professional Elective – IV**

Subject Code	Subject Name	Category	L	Т	P	С
AD19P74	ETHICS OF ARTIFICIAL INTELLIGENCE	PE	3	0	0	3

#### **Objectives:**

- To understand the need for ensuring ethics in AI
- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To evaluate the relation of ethics with nature
- To overcome the risk to Human rights and other fundamental values.

#### UNIT-I INTRODUCTION TO ETHICS OF AI

Role of Artificial Intelligence in Human Life, Understanding Ethics, Why Ethics in AI? Ethical Considerations of AI, Current Initiatives in AI and Ethics, Ethical Issues with our relationship with artificial Entities

#### UNIT-II FRAMEWORK AND MODELS

AI Governance by Human-right centered design, Normative models, Role of professional norms, Teaching Machines to be Moral

#### UNIT-III CONCEPTS AND ISSUES

Accountability in Computer Systems, Transparency, Responsibility and AI. Race and Gender, AI as a moral right-holder

#### UNIT-IV PERSPECTIVES AND APPROACHES

Perspectives on Ethics of AI, Integrating ethical values and economic value, Automating origination, AI a Binary approach, Machine learning values, Artificial Moral Agents

#### UNIT-V CASES AND APPLICATION

Ethics of Artificial Intelligence in Transport, Ethical AI in Military, Biomedical Research, Patient Care, Public Health, Robot Teaching, Pedagogy, Policy, Smart City Ethics

Contact Hours : 45

9

9

#### **Course Outcomes:**

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

- Understand the ethical issues in the development of AI agents
- Learn the ethical considerations of AI with perspectives on ethical values.
- Apply the ethical policies in AI based applications and Robot development
- To implement the AI concepts to societal problems by adapting the legal concepts by securing fundamental rights.
- This study will help to overcome the evil genesis in the concepts of AI.

# Text Books: 1 Markus D. Dubber, Frank Pasquale, Sunit Das, "The Oxford Handbook of Ethics of AI", Oxford University Press Edited book, 2020. 2 Paula Boddington, "Towards a Code of Ethics for Artificial Intelligence", Springer, 2017

Re	ference Books:
1	S. Matthew Liao, "Ethics of Artificial Intelligence", Oxford University Press Edited 99 Book, 2020.
2	N. Bostrom and E. Yudkowsky. "The ethics of artificial intelligence". In W. M. Ramsey and K. Frankish, editors, The Cambridge Handbook of Artificial Intelligence, pages 316–334. Cambridge University Press, Cambridge, 2014.
3	Wallach, W., & Allen, C, "Moral machines: teaching robots right from wrong", Oxford University Press, 2008.

Subject Code     Subject Name     Category     L     T     P												
A	AD19P75 ENGINEERING ECONOMICS AND MANAGEMENT PE 3 0 0											
Ob	jectives:				I	<u> </u>						
•	To identify t	ne micro and macro -economics and national income calculations										
٠	To impart knowledge on the enterprise and ownership of businesses											
• To learn the appropriate management concepts and apply in businesses.												
٠	• To prepare the accounting statements.											
٠	• To learn the marketing management and entrepreneurship functions.											
UNIT-I Fundamentals of Economics 9												
We	alth, Welfare	and Scarce Definitions of Economics; Micro and Macro Economi	cs; Demand- L	law (	of Dem	and,						
Ela	sticity of Der	nand, Types of Elasticity and Factors determining price elasticity	y of Demand:	Utili	ty- Lav	v of						
Dir	ninishing Mar	ginal Utility, its limitations and exceptions.										
UN	IT-II For	ns of Business Organizations			9							
Fea thei	tures, merits a ir types.	and demerits of Sole Proprietorship, Partnership and Joint Stock Co	mpany- Public	Ente	rprises	and						
UN	IT-III Intr	oduction to Management			9							
Fur	ctions of Ma	nagement- Taylor's Scientific Management; Henry Fayol's Princ	iples of Mana	geme	ent; Hu	man						
Res	ource Manag	ement -Basic functions of Human Resource Management. Produ	ction Managen	nent:	Produc	tion						
Pla	nning and Con	trol, Plant Location, Break-Even Analysis- Assumptions, limitations	and applications	5								
UN	IT-IV Fina	uncial Management			9							
Тур	bes of Capital	Fixed and Working Capital and Methods of Raising Finance; Fin	al Accounts- T	radir	ig Acco	ount,						
Sta	tement of Prof	it and Loss and Balance Sheet (simple problems)										
UN	IT-V Mai	keting Management and Entrepreneurship			9							
Ma	rketing Mana	agement: Functions of marketing and Distribution Channels.	Entrepreneurs	hip:	Definit	tion,						
Cha	aracteristics an	d Functions of an Entrepreneur	~			-						
			Contact Hours	:	4	5						
C	0-4											
Co	arse Outcome	S:										
	identify mer	the course, the students will be able to	nicouoc									
	choose a suit	able business ownership for their enterprise and illustrate managerial	functions									
	enply eppror	rists operation management concept in business situations	Tunctions									
	interpret fing	ncial and accounting statements and evaluate new proposals										
	infer marketi	ng management decisions and entrepreneurial functions										
•	inter market	ing management decisions and entrepreneuriar functions										
Tey	xt Book(s):											
	A.R. ArvaSr	. Managerial Economics and Financial Analysis, TMH Publications.	new Delhi.									
1	2014 (UNIT-	-I,II,IV & V)	,									
•	S.C. Sharma	and Banga T. R., Industrial Organization & Engineering Economics,	khanna									
2	Publications.	Delhi-6, 2006 (UNIT– III & IV)										
•	S.N.Mahesw	ari, SK Maheswari, Financial Accounting Fifth Edition, Vikas Publish	hing House									
3	Pvt. Ltd., Ne	w Delhi, 2012 (UNIT-V)	C									
Ref	ference Books	(s) / Web links:										
1	Geetika, Piy	ali Ghosh and Purba Roy Choudhury, "Managerial Economics", 3	rd Edition, Mc	Grav	/-Hill, I	New						
	Delhi, 2018.											
2	William G. I	Nickels, James M. McHugh, Susan M. McHugh, "Understanding Bu	siness", 12th E	ditio	i, McGi	raw-						
4	Hill Education	on, New York, 2019										

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

PO/PSO CO	PO 1	PO2	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
AD19P75.1	1	2	-	2	-	2	-	-	2	-	-	-	-	-	1
AD19P75.2	-	2	-	-	-	-	-	-	2	-	-	-	-	-	-
AD19P75.3	-	3	-	3	-	2	-	-	-	-	2	-	-	-	1
AD19P75.4	-	-	-	1	-	-	2	-	2	-	-	-	-	-	
AD19P75.5		2	2	2	-	2	-	-	2	-	1	-	-	-	1
AVERAGE	1	2.25	2	2	-	2	2	-	2	-	1.5	-	-	-	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	Р	С
		PE	3	0	0	3
IT19P76	IMAGE PROCESSING AND VISION TECHNIQUES					

Ob	Objectives: 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-	Median Filters- Mode Filters- Rank Order Filters- The Role of Filters in Industrial Applications of Vi	sion-								
Thresholdin	g- Adaptive Thresholding-Edge detection techniques - corner and interest point detection - mathemat	ical								
morphology	– Some Basic Approaches to Texture Analysis.	1								
UNIT-II	IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN	9								
Image enha	ncement by point processing-Image enhancement by neighbourhood processing- Basic Gray Level	1 20%								
Transformat	tions-Histogram Processing-Enhancement Using Arithmetic and Logic Operations-Zooming- Bas	ics of								
Spatial Filte	rs- Smoothening and Sharpening Spatial Filters-Combining Spatial Enhancement Methods. Introduct	ion to								
Fourier Trai	isform and the frequency Domain-Smoothing and Sharpening Frequency Domain Filters- Homomorp	ohic								
Filtering.										
UNIT-III	IMAGE RESTORATION AND IMAGE COMPRESSION	9								
Model of T	he Image Degradation / Restoration Process-Noise Models- Restoration in the presence of Noise	• Only								
Spatial Filte	ring- Periodic Noise Reduction by Frequency Domain Filtering-Linear Position-Invariant Degrad	ations-								
Estimation of	of Degradation Function- Inverse Filtering-Wiener filtering- Constrained Least Square Filtering-Geon	netric								
Theory Los	Geometric Transformations. Data Redundancies-Image Compression Models-Elements of Information	)II odina								
LZW Codin	g-Run Length Coding-Loss less predictive Coding- Bit Plane Coding- Image compression standards	Jung-								
	3D VISION	9								
2 D Vision	Methods for 2D vision projection schemes, shape from shading relationstrie stores. Surface									
Smoothness	- Methods for 5D vision – projection schemes – shape from shading – photometric stered – surface	10								
Transformat	ions and Camera Calibration	Smoothness– shape from texture – use of structured lighting- three-dimensional object recognition schemes- Image								
IINIT_V										
	A PPL ICATION	9								
Automoted 1	APPLICATION	9								
Automated	APPLICATION Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E	9 igen								
Automated faces – Acti particle filtr	APPLICATION Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human	9 igen ation –								
Automated faces – Acti particle filtr analysis Ap	APPLICATION Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human g plication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestri	9 igen ation – gait ans.								
Automated faces – Acti particle filtr analysis App	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separates         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human golication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestric         Contact Hours       :         45 Per	9 igen ation – gait ans. iods								
Automated faces – Acti particle filtr analysis App	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human g         plication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestri         Contact Hours       :         45 Per         comes:	9 ation – gait ans. iods								
Automated faces – Acti particle filtr analysis App Course Out On completi	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human g         plication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestri         Contact Hours       :         45 Per         comes:         .on of the course, the students will be able to	9 igen ation – gait ans. <b>iods</b>								
Automated faces – Acti particle filtr analysis Apj Course Out On completi	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human g         plication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrice         Contact Hours       :         45 Per         comes:       on of the course, the students will be able to         ment fundamental image processing techniques required for computer vision.	9 iigen ation – gait ans. iods								
Automated faces – Acti particle filtr analysis App Course Out On complete CO1 Imple CO2 Unde	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separates – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human gelication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrice         contact Hours       :         dot for the course, the students will be able to         rement fundamental image processing techniques required for computer vision.         rstand the image enhancement in the Spatial and Frequency Domain.	9 igen ation – gait ans. iods								
Automated faces – Acti particle filtr analysis App Course Out On complete CO1 Imple CO2 Unde CO3 Apply	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human generation- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrice         Contact Hours       :         45 Performance         comes:         ion of the course, the students will be able to         ment fundamental image processing techniques required for computer vision.         rstand the image enhancement in the Spatial and Frequency Domain.         / Image Restoration and Image Compression.	9 iigen ation – gait ians. iods								
Automated faces – Acti particle filtr analysis App Course Out On complete CO1 Imple CO2 Unde CO3 Appl CO4 Appl	APPLICATION         Visual Inspection: Process- Types- Application: Photo album – Face detection – Face recognition – E         ve appearance and 3D shape models of faces Application- Surveillance-foreground-background separa         es – Chamfer matching- tracking- and occlusion – combining views from multiple cameras – human g         plication- In-vehicle vision system: locating roadway – road markings – road signs – locating pedestrice         Contact Hours       :         45 Performs:         ion of the course, the students will be able to         ement fundamental image processing techniques required for computer vision.         rstand the image enhancement in the Spatial and Frequency Domain.         y Image Restoration and Image Compression.         y 3D vision techniques.	9 iigen ation – gait ians. iods								

CO5 Develop applications using computer vision techniques.

Te	Text Books:							
1	E. R. Davies, -Computer & Machine Vision <sup>II</sup> , Fourth Edition, Academic Press, 2012.							
2	Rafael C. Gonzalez & Richard E. Woods, —Digital Image Processingl, 2nd edition, Pearson Education.							

Re	eference Books:
1	R. Szeliski, —Computer Vision: Algorithms and Applicationsl, Springer 2011.
2	Simon J. D. Prince, —Computer Vision: Models, Learning, and Inferencel, 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 Processingl, PHI.

CO/P	PO1	PO2	PO3	PO 4	PO5	<b>PO6</b>	<b>PO7</b>	PO 8	PO9	PO10	PO11	PO1 2	PSO	PSO	PSO	PSO
0													1	2	3	4
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	3	2	-	-	-	-	-	-	-	-	3	-	3	-
CO3	-	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO4	-	3	2	3	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	3	3	-	-	-	-	-	-	3	-	-	3	-	-
CO					-	-	-	-	-	-						
(AVg)	3.00	2.60	2.75	2.80							3.00	-	3.00	3.00	3.00	-

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
AD19P76	Video Processing	PE	2	0	2	3

Obj	ectives:									
•	To have a better knowledge about video representation a	and its formats.								
•	To provide the overview of video enhancement and segn	nentation.								
•	To familiarize with functionalities such as edge and bou	ndary calculations	s.							
•	To provide details about video tracking.									
	To deal with the applications of video processing.					6				
Do	in Concepts and Terminology Analog Video Standards	Digital Vidao	Pasios	Analog to Digital		0				
Con	Dasic Concepts and Terminology – Analog video Standards – Digital video Basics – Analog to Digital Conversion – Colour Representation and Chroma Sub Sampling – Video Sampling Pata and StandardsConversion									
– Di	- Dioital Video Formats - Video Features - Colour. Shape and Textural features									
UN	IT-II VIDEO ENHANCEMENT AND SEGMENT.	ATION				6				
Bas	ics of the lattice theory-Sampling of video signals over la	ttices-Filtering op	perations	in displaydevices-Vi	deo					
segr	nentation algorithms-Median cut algorithms-graph cut and	l EM algorithms-								
Seg	mentation & Feature Extraction: Model-based and probabi	listic methods and	d Image (	Classification Optima	1					
and	Multilevel Thresholding, Gray Image Segmentation, Wate	rshed Algorithm.								
UN	IT-III EDGE AND BOUNDARY DETECTION					6				
Firs	t and Second Order Edge Operators, Multi-scale Edge I	Detection, Canny	Edge De	tection Algorithm,						
Hou	gh Transform: Line and Edge Detection, Morphological Op	perations and Appl	lication: I	Boundary, Skelton, C	onve	ex-				
Hul	l, Thinning, Pruning.									
UN	IT-IV MOTION ESTIMATION AND TRACKING	, ,				6				
Fun	damentals of Motion Estimation – Optical Flow – 2	D and 3D Mot	ion Estir	nation – Block Bas	sed	Point				
Cor	ion Tracking in Video Rigid Object Tracking (2D&3D) Ar	ture Matching – I	Frequenc	y Domain Motion Es	stim	ation-				
3D)	-video mining-video search engine retrievals-visual event of	letection.	lacking (							
UN	UNIT-V RECENT TRENDS AND APPLICATIONS									
Ima	ge video processing analysis-image segmentation and clus	tering-image swit	tching-sp	oof face identification	n-					
obje	ect motion segmentation-object motion tracking-forensic	investigation-sem	nantic an	dcontextual						
min	ing of video-video based content retrieval-abnormal event	detection.								
		-		Contact Hours	:	30				
	List of Expe	riments								
1	Load a video file, play it, and display its frames.									
2	Experiment with basic operations like resizing, rotating,	and saving frame	es as imag	jes.						
2	Apply different filters to each frame (e.g., Gaussian blur	, Sobel edge detec	ction), an	d display the						
3	filtered video.									
4	Add visual effects (e.g., colour manipulation, text overlay, frame blending) to a video.									
5	5 Enhance the quality of a video (e.g., histogram equalization, denoising).									
6	6 Segment objects or regions of interest in a video.									
-	annotate a video with bounding boxes around detected objects or with text labels indicating specific									
'	information (e.g., object names, timestamps).									
8	8 Detect and track objects or motion in a video.									
9	9 Automatic video trailer generation									
10	Abnormal event detection in traffic video surveillance									
			Contac	t Hours	:	30				
			Total C	Contact Hours	:	60				

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Co On	Course Outcomes: On completion of the course, the students will be able to:						
•	Compute basic video processing functions.						
•	Segment video based on its features.						
•	Familiarity with edge and boundary detection techniques.						
٠	Compute optical flow and motion estimation.						
•	Design applications for video analytics in current trend.						

Te	fext Book(s):								
1	A. Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015.								
2	Alan C. Bovik, "Handbook of Image and Video processing", Second Edition, Academic Press, 2005.								
3	S.Sridhar,"Digital Image Processing", Second Edition, 2016.								

#### **Reference Books(s):**

1	Oges Marques, "Practical Image and Video Processing Using MATLAB", Wiley and Sons (IEEEPress), 2011.
2	Anand Rajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.

#### Suggested Activities:

- External learning Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis.
- Practical Automatic video trailer generation.

#### **Suggested Evaluation Methods:**

- Assignments on affective video content analysis.
- Quiz on forensic video analysis.
- Evaluation based on demonstration.

#### CO – PO – PSO matrices of course

PO/PSO	P	P	P	P	P	P	P	P	P	P	P	P	PS	PS	PS
СО	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
AD19P76 1	1	1	1	-	-	-	-	-	-	-	1	1	1	1	1
AD19P76 2	2	2	2	-	-	-	2	-	2	2	-	2	2	2	2
AD19P76 3	3	2	3	2	-	-	-	-	-	2	-	3	2	3	2
AD19P764	3	2	3	2	-	-	-	-	-	2	-	3	3	2	2
AD19P76 5	2	3	3	2	3	2	2	2	2	2	2	3	3	3	3
Average	2.2	2	2.4	1.2	0.6	0.4	0.8	0.4	0.8	1.6	0.6	2.4	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 : "-"

Elective	_	V
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Subject Code	Subject Name (Lab oriented Theory Courses)	Category	L	Т	P	C
AD19P77	Cyber Security Systems	PE	2	0	2	3

Objec	tives: Broad objective of this course is to
٠	Learn the basics of Security Trends.
•	Know the operational and organizational security.
•	Study the fundamentals of cryptography.
•	Explore Authentication methods and Tools.
•	Identify the purpose of Intrusion Detection Systems.

UNIT-I	UNIT-I INTRODUCTION TO SECURITY TRENDS AND CONCEPTS						
The Computer Security Problems - Approaches to Computer Security - Ethics - Basic Security Terminologies - Security							
Models, Cyl	per Security, Need for Cyber Security – History of Cyber Crime; Cybe	rcriminals - Classificati	on of				
Cybercrime	Cybercrimes – A Global Perspective on Cyber Crimes						
UNIT-II	OPERATIONAL AND ORGANIZATIONAL S	ECURITY		6			
Policies, Procedures, Standards and Guidelines – Security Awareness and Training – Interoperability Agreements –							
The security	Perimeter - Physical Security - Environmental Issues - Wireless - El	ectromagnetic Eavesdrop	pping – [	The			
Role of Secu	urity in People.						
UNIT-III	UNIT-III AUTHENTICATION AND REMOTE ACCESS						
User, Group	User, Group and Role Management – Password Policies – Single Sign-On – Security Controls and Permissions –						
Preventing I	Data Loss or Theft – The Remote Access Process – Remote Access Me	ethods.					
UNIT-IV INTRUSION DETECTION				6			
Host -Based	Intrusion Detection - Network -Based Intrusion Detection - Distribut	ed or Hybrid Intrusion E	Detection	1 —			
Intrusion De	etection Exchange Format – Honeypots – Example System Snort.	-					
UNIT-V INTRUSION PREVENTION		6					
Firewalls an	d Intrusion Prevention Systems: Need for Firewalls - Firewall Charact	eristics and					
Access Polic	cy - Types of Firewalls - Firewall Basing - Firewall Location and Cor	ifigurations –					
Intrusion Prevention Systems – Example Unified Threat Management Products.							
	Contact Hours : 30 Perio						

	List of Experiments				
1	Install Kali Linux on Virtual box				
2	Explore Kali Linux and bash scripting				
3	Understand the nmap command d and scan a target using nmap				
4	Install metasploitable2 on the virtual box and search for unpatched vulnerabilities				
5	Use Metasploit to exploit an unpatched vulnerability				
6	Install Linus server on the virtual box and install ssh				
7	Use Fail2banto scan log files and ban Ips that show the malicious signs				
8	Launch brute-force attacks on the Linux server using Hydra.				
9	Perform real-time network traffic analysis and data pocket logging using Snort				

Course O	utcomes:
On compl	etion of the course, the students will be able to
CO1	Learn the basics of Security Trends.
CO2	Know the operational and organizational security.
CO3	Explain the fundamentals of cryptography.
CO4	Apply Authentication methods and Tools.
CO5	Demonstrate the Intrusion Detection Systems.

	Reference Books:
1	W.A.Coklin, G.White, Principles of Computer Security: Fourth Edition, McGrawHill, 2016.
2	William Stallings, Cryptography and Network Security Principles and Practices, Seventh Edition, Pearson.
3	Achyut S. Godbole, Web Technologies: TCP/IP, Web/Java Programming, and Cloud Computing, Tata McGraw- Hill Education, 2013.

## **CO-PO-PSO** Mapping

CO/P	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	<b>PO 8</b>	PO9	PO1 0	PO11	PO1 2	PSO	PSO	PSO	PSO
0													1	2	3	4
CO1	1	-	2	-	-	-	-	1	-	-	-	-	1	-	-	-
CO2	2	-	-	2	-	-	-	-	ı	-	-	-	1	3	-	-
CO3	2	-	-	3	-	-	-	-	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	1	-	-	-	-	-	-	-	2	2	-
CO5	-	2	-	-	-	-	-	-	-	-	-	-	1	-	2	3
CO										-	-	-				
(Avg)	1.67	2.00	2.00	2.50	2.00	1.00	-	1.00	-				1.25	2.50	2.00	2.50

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
AI19P75	INFORMATION RETRIEVAL	PE	2	0	2	3

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

UNIT-I	Introduction to Information retrieval	6
Information	retrieval process- Indexing- Information retrieval model- Boolean retrieval model Tokenization-	Stop
words- Sten	uming- 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 correction-	Edit
distance- Jac	ccard coefficient- Soundex Parametric and zone indexes Term frequency and weighting The vector sp	bace
model for sc	coring 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 - Evaluation	ion
of ranked re	trieval results - Assessing relevance - A broader perspective: System quality and user utility- Releva	ince
feedback and	d pseudo relevance feedback -Query reformulation(Chapter 8,9)	
UNIT-IV	XML retrieval using Probability Ranking Principle	6
XML retriev	al - Challenges in XML retrieval - A vector space model for XML retrieval - Evaluation of XML retrieval	eval
- Text-centr	ric vs. data-centric XML retrieval - The 1/0 loss case - The PRP with retrieval costs- The 1	Binary
Independent	ce Model - Deriving a ranking function for query terms - Probabilistic approaches to relevance feed	back -
An appraisa	l of probabilistic models - Tree-structured dependencies between terms - Okapi BM25: a non-	binary
model - Bay	esian 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 architectu	ure -
DNS resolu	tion - The URL frontier- Distributing indexes - Connectivity servers- Link analysis - web as a gra	.ph-
Anchor text	and the web graph -PageRank - Markov chains - The PageRank computation -Hubs and Author	ities-
Choosing th	e 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

Co	urse Outcomes:					
On	On completion of the course, the students will be able to					
ષ્ટ	Understand the fundamental of the Information Retrieval					
જ	Get the understanding different Information retrieval model.					
ଷ	Evaluate methods of the information retrieval model.					
ଷ	Acquire knowledge of retrieval from XML					
8	Familiarize with the working of search engines					

Text 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.					

Ref	ference Books:
1	Bruce Croft, Donald Metzler and Trevor Strohman, Search Engines: Information Retrieval in
2	Practice, 1 st Edition Addison Wesley, 2009. Mark Levene, An Introduction to Search Engines and Web Navigation, 2 nd Edition Wiley, 2010
4	Mark Levele, All flux diduction to Scaleff Englises and web Pavigation, 2 in Clinton wiley, 2010.
3	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:

- http://www.tartarus.org/martin/PorterStemmer/
   http://www.searchenginewatch.com
   http://www.google.ca/intl/en/corporate/tech.html
   CO PO PSO matrices of course

PO/PSO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO	PSO 2
со	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
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	Р	С
AI19P76	SUPPLY CHAIN ANALYTICS	PE	3	0	0	3

Objectives:					
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	e-Data Analytics-Supply Chain Analytics Components-Supply Chain Pa	rtners and Analytics-P	roblem				
solving, dec	ision making and analytics-Supply chain analytics relevance to service an	d manufacturing-Supply	/ chain				
analytics life	ecycle-Overview of four process SCM framework- Overview of the three SC	analytics categories.					
(T1-CHAP	(T1-CHAPTER 1,2)						
UNIT-II	Role of Modelling in the Supply Chain		9				
Defining the	e supply chain-The supply chain as a complex system-Supply chain mode	els and modelling-The u	ise of				
computer m	odeling in the supply chain. Data in supply chain-data analytics methodology	Data type-small and big	g data				
in supply ch	ain-Challenges in working with data. (T2-CHAPTER 2, 3)						
UNIT-III	Visualization Techniques and Performance Measurement Systems in Su	ıpply Chain	9				
Data visual	zation-process, information and network visualization-The development	of supply chain perfor	mance				
measuremen	t systems: Current applications- Analytical tools used in connection with	h performance measure	s -The				
future of per	formance measurement systems. (T2-CHAPTER 4, 5)						
UNIT-IV	Supply Chain Analytics for Supply Chain Strategy Processes		9				
Supply chai	n strategy processes-PESTLE analysis- Strength, weakness, opportunities an	d threats (SWOT) analy	sis-				
supply chair	strategy alignment- supply chain strategy implementation planning - supply	chain strategy risk ana	lysis-				
Financial an	alysis of projects- Case study: using analytics to improve operation performan	ce.(T1-CHAPTER 4)					
UNIT-VSupply Chain Analytics: Prescriptive models9							
Optimization models using linear programming-Facility location problem-Vehicle routing problem-Future							
opportunitie	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 supply						
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	xt 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.

Re	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.
3	Feigin G. (2011). Supply Chain Planning and Analytics: The right product to the right place at the right time, Business Expert Press, New York, USA.
4	Handfield R. (2006). Supply Market Intelligence: A managerial handbook for building sourcing strategies, Taylor and Francis Group, Auerbach Publications, New York, USA.

Web link:

1. https://alison.com/courses/an-introduction-to-modelling-and-analytics-in-supply-etworks/content

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

3. <u>https://onlinecourses.nptl.c.in/noc20\_mg27/preview\_CO - PO - PSO</u>

#### matrices of course

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
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	-	-	I	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 (Theory course)	Category	L	Т	Р	С
IT19P78	SOFTWARE TESTING	PE	3	0	0	3

#### **Objectives:**

- ★ Know what is software quality and various defect removal processes.
- Know various testing terminologies and techniques.  $\star$
- ★ Understand various levels and types of testing
- Learn to manage automation in testing
- Learn the Quality Metrics associated with software testing \*

#### UNIT-I **INTRODUCTION** 9 Introduction to Software Quality - Challenges - Objectives - Quality Factors - Components of SQA - Contract Review - Development and Quality Plans - SQA Components in Project Life Cycle - SQA Defect Removal Policies - Reviews. UNIT-II **TESTING TECHNIQUES** 9

Using White Box Approach to Test design - Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs -Using Black Box Approaches to Test Case Design - Random Testing - Requirements based testing –Decision tables –State-based testing – Cause-effect graphing – Error guessing.

#### UNIT-III

#### **TEST LEVELS AND METHODOLOGIES**

Levels of Testing - Unit Testing - Integration Testing - Defect Bash Elimination- System Testing- System and Acceptance Testing – Testing Strategies – White Box and Black Box Approach- Compatibility testing-Performance Testing - Regression Testing - Internationalization Testing - Ad-hoc Testing - Website Testing - Usability and Accessibility Testing - Configuration Testing - Compatibility Testing - MC/DC Testing, Mutation testing, Case study fo White box testing and Black box testing techniques.

#### UNIT-IV

#### **TEST AUTOMATION AND MANAGEMENT**

Test plan – Management – Execution and Reporting – Software Test Automation – Test Automation framework - Agile Testing - End-to-end test automation - Automated Testing tools - Hierarchical Models of Software Quality Configuration Management – Documentation Control.

#### **UNIT-V**

## SQA IN PROJECT MANAGEMENT

Project progress control - costs - quality management standards - project process standards - management and its role in SQA - SQA unit, Software Process Assessment Cycle, SCAMPI. :

**Total Contact Hours** 

#### **Course Outcomes:**

On completion of course students will be able to

CO1 Differentiate between different testing methodologies.

CO2 Apply suitable types of testing methodologies

CO3 Test the product with white and black box testing strategies.

CO4 Perform automated test and configuration management with documentation.

CO5 Understand various quality management standards

9

9

9

45

Te	xt Book(s):
1	Daniel Galin, —Software Quality Assurance from Theory to Implementation, Pearson Education, 2009
2	Yogesh Singh, —Software Testing, Cambridge University Press, 2012
3	Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing – Principles and Practices, Pearson Education, 2006
4	William Perry, —Effective Methods of Software Testing, Third Edition, Wiley Publishing 2007
5	Automated Software Testing: Foundations, Applications and Challenges, Ajay Kumar Jena, Himansu Das, Durga
	Prasad Mohapatra, I Edition, Springer, 2020.
6	Agile Testing: A Practical Guide for Testers and Agile Teams, Crispin Lisa, Gregory Janet, Addison-Wesley
	Signature Series, 2008

Reference I	Books(s):
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1 Aditya Mathur, -Foundations of Software Testing, Pearson Education, 2008

 2 Ron Patton, Software Testing, Second Edition, Pearson Education, 2007
 3 Robert Furtell, Donald Shafer and Linda Shafer, —Quality Software Project Management, Pearson Education Asia, 2002.

### **CO-PO Mapping:**

CO/P O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
CO1	2	2	3	-	2	-	2	-	2	2	-	2	1	3	-	2
CO2	2	3	-	2	2	1	-	1	-	1	2	-	-	2	-	-
CO3	2	-	1	-	1	1	-	-	1	1	-	1	2	-	-	2
CO4	2	2	-	2	-	2	1	-	-	2	2	-	-	-	1	-
CO5	2	-	-	1	1	-	1	-	-	1	1	-	2	1	-	2
CO(Av	0.00	0.00	0.00	4 ( 7	1 50	1.00	1.00	1.00	1 50	1.40	4 / 7	1 50	4 / 7	0.00	1.00	0.00
g)	2.00	2.33	2.00	1.67	1.50	1.33	1.33	1.00	1.50	1.40	1.67	1.50	1.67	2.00	1.00	2.00

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

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

Subj	ectCode	SubjectName	Category	L	ſ	Р	С				
AD1	9P78	SPEECH PROCESSING AND ANALYTICAL	PE	3	0	0	3				
Obje	ctives: Thestu	Identshouldbemade									
•	To understa	nd the need for morphological processing and their representation									
•	To know ab	out the various techniques used for speech synthesis and recognition									
•	To apprecia	e the syntax analysis and parsing that is essential for natural language processing	5								
•	To learn abo	ut the various representations of semantics and discourse									
•	To have kno	wledge about the applications of natural language processing									
UNI	Г-І	SPEECH PROCESSING				9					
Norr Reco Eval Com UNIT	Normalization –Phonetic and Acoustic Analysis -Diphone Waveformsynthesis –Evaluation-Automatic Speech         Recognition –Architecture -Hidden Markov Model toSpeech-MFCCvectors-AcousticLikelihoodComputation-         Evaluation.Triphones–DiscriminativeTraining-ModelingVariation.ComputationalPhonology-Finite-StatePhonology–         ComputationalOptimalityTheory-Syllabification-LearningPhonologyandMorphology         INIT-II       SPEECH ANALYSIS         Ceatures, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual og Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization –										
Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths UNIT-III SPEECH MODELING 9											
Hidd	en Markov M	odels: Markov Processes, HMMs – Evaluation. Optimal State Sequence – Viterb	i Search. Baun	n-We	lch	-					
Parar	neter Re-estir	nation, Implementation issues.									
LINIT		SDEECH DECOCNITION			-	0					
UNI	L-LV	SPEEch RECOGNITION		•		,					
Large	tics and lang	Continuous Speech Recognition: Architecture of a large vocabulary continuous s	peecn recognii	10n s	syste	em	-				
		SPEECH SYNTHESIS	sent status.			9					
Tovt	to Speech Sv	thesis: Concatenative and waveform synthesis methods, sub word units for TTS	intelligibility	and		,					
natur	alness – role (	of prosody. Applications and present status	, interingionity	anu							
		TotalCo	ntact Hours		:	45					
Cour	seOutcomes	Oncompletion of course students will be able to				-					
• 1	dentify the di	fferent linguistic components of natural language									
• I	Design a morr	hological analyser for a given natural language									
• I	Decide on the	appropriate parsing techniques necessary for a given language and application									
• I	Design new ta	gset and a tagger for a given natural language									
• I	Design applica	ations involving natural language									
Text	Books:										
1	Jur	nfskyandMartin."SpeechandLanguageProcessing", PearsonPrenticeHall.SecondF	dition.2008.								
1 2 I	awrence Rah	inerandBiing-Hwang Juang "Fundamentals of Speech Recognition" Pearson Fo	lucation 2003								
- 1 Refe	renceBooks.										
	teven W Smi	th "The Scientist and Engineer's Guide to Digital Signal Processing" California	Technical Pul	hlich	'nσ						
1 3				511511	mg.						
2 1	nomas F Qua	tieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearso	on Education.								

## **Elective – VI**

3 Claudio Becchetti and LucioPrinaRicotti, "Speech Recognition", John Wiley and Sons, 1999.

4 Ben gold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, Wiley- India Edition, 2006 Edition.

## **CO-PO Mapping:**

PO/PSO CQ	PO 1	PO 2	PO 3	РО 4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
AD19P78.1	3	1	-	3	2	1	3	2	1	2	-	1	3	2	2
AD19P78.2	3	3	2	2	3	2	2	2	1	2	-	1	3	3	2
AD19P78.3	3	3	2	3	3	3	2	2	1	2	-	1	3	3	2
AD19P78.4	3	3	2	2	3	3	2	2	1	2	-	1	3	3	3
AD19P78.5	3	3	3	3	3	3	2	2	3	3	-	1	3	3	2
Average	3	2.6	1.8	2.6	2.8	2.4	2.2	2	1.4	2.2	0	1	3	2.8	2.2

Correlation level

1.slight(Low) 2.Moderate(Medium) 3.Substanti

3.Substantial(High)

4.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	jectives:
•	To understand the framework for Business Intelligence
•	To explore the phases of the Decision-making process
•	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

6

6

6

6

#### List of Experiments

1	Import the legacy data from different sources such as (Excel, Sql Server, Oracle etc.) and load in the target system.
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sql server / 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 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

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	urse Outcomes:							
On	In completion of the course, the students will be able to							
•	Jnderstand 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							

Te	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 edition.							
3	Cindi Howson,"Successful Business Intelligence-Secrets to making BI a killer App",McGraw Hill,2008.							
Ref	Reference Books:							
1	Rick Sherman,"Business Intelligence Guidebook: From Data Integration to Analytics", 1st Edition, Kindle Edition.							
2	Ahmed Sherif, "Practical Business Intelligence Kindle Edition".							
3	Cindi Howson, "Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data", 2nd Edition, Kindle Edition.							

### <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
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

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	C
IT19P74	INTERNET OF THINGS	PE	3	0	0	3

|--|

To understand about the IoT Design methodology.

To understand about IoT elements.

To Understand State of the Art - IoT Physical servers and cloud

To introduces some of the application areas where Internet of Things can be applied.

UNIT-I	INTRODUCTION	9
Introduction -	– Definition and characteristics of IoT – How IoT Works? – IoT Applications- Challenges of IoT –	
Advantages a	nd Disadvantages of IoT - IoT Protocols - Logical Design of IoT: IoT Functional blocks - IoT	
Communicati	ion Models – IoT Communication APIs.	
UNIT-II	IOT DESIGN METHODOLOGY	9
IoT Architect	ure – IoT Reference Architecture – IOT Design Methodology: Domain Specification- Functional	
View, Inform	nation View, Operation and deployment, Device and Component Integration, Application	
development	and deployment	
UNIT-III	<b>IOT ELEMENTS</b>	9
Building blo	ocks of an IoT Device – Raspberry Pi, Arduino – Sensors, Communication Modules:	
Bluetooth, 2	Zigbee, RFID - Power Sources – Data Management, Business Processes in IoT	
UNIT-IV	IOT PHYSICAL SERVERS CLOUD	9
Physical ser	vers and cloud - XaaS, M2M, WAMP- AutoBahn for IoT – Xively Cloud for IoT – Django –	
Designing a	RESTful Web API –Google cloud for IoT.	
UNIT-V	APPLICATIONS	9
Retail, Health	h care, Transportation, Agriculture and environmental, Smart city, Government and military,	
Smart home.		
	Contact Hours : 45 Pe	eriods

Course Outcomes:
On completion of the course, the students will be able to
CO1 Know about IoT and its functionalities.
CO2Interpret IoT Architecture.
CO3 Implement the various IoT elements and design the system.
CO4 Understand the IoT physical servers and cloud integration
CO5 Design and develop the various applications in IoT

	Text Books:
1	Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012.
2	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet Of Things, Springer, 2011.
3	David Easley and Jon Kleinberg, —Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
4	Olivier Hersent, David Boswarthick, Omar Elloumi, — The Internet of Things – Key Applications and Protocols,
	wiley, 2012.

	Reference Books:
1	Vijay Madisetti and ArshdeepBahga, -Internet of Things (A Hands-on-Approach) ,1st Edition,VPT, 2014.
2	Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to ConnectingEverything, 1st Edition, Apress Publications, 2013.
3	CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493-9357-1

CO/P	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	<b>PO 8</b>	PO9	PO1 0	PO1 1	PO1 2	PSO	PSO	PSO	PSO
0													1	2	3	4
CO1	2	-	-		-	1	1	I	١		_	_	2	١	-	2
CO2	_	2	3	2	-	1	1	Ι	١	1	_	_	l	١	3	_
CO3	-	2	2	_	-	I	I	-	-	_	_	_	1	-	2	Ι
CO4	1	2	3	-	-	-	-	_	-	_	_	_	2	2	-	1
CO5	-	-	3	-	_	-	-	-	-	-	-	-	3	_	-	-
CO (Avg)	0.75	1.20	2.75	0.50	_	_	_	_	_	_	_	_	1.60	0.40	1.00	0.75

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	C
IT19P84	PARALLEL COMPUTING	PE	3	0	0	3

Ob	pjectives: Broad objective of this course is
$\star$	To study the scalability and clustering issues and the technology necessary for them.
$\star$	To understand the technologies enabling parallel computing.
$\star$	To study the different types of interconnection networks.
$\star$	To study the different parallel programming models.
$\star$	To study the software support needed for shared memory programming.

UNIT-I	SCALABILITY AND CLUSTERING	9
Evolution of	Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of	f
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 Dev	elopment Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchi	cal
Memory Te	chnology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory	
Architecture	e – Latency Tolerance Techniques – Multithreaded Latency Hiding.	
UNIT-III	SYSTEM INTERCONNECTS	9
Basics of In	terconnection Networks - Network Topologies and Properties - Buses, Crossbar and Multistage Switcl	hes,
Software M	ultithreading – Synchronization Mechanisms.	
UNIT-IV	PARALLEL PROGRAMMING	9
Paradigms A	And Programmability – Parallel Programming Models – Shared Memory Programming.	
UNIT-V	MESSAGE PASSING PROGRAMMING	9
Message Pa	ssing Paradigm – Message Passing Interface – Parallel Virtual Machine.	-
	Contact Hours : 45 Pe	eriods

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	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 & OpenMPI, Tata McGraw-Hill, New Delhi, 2003.									
3	Kai Hwang, —Advanced Computer Architecturel Tata McGraw-Hill, New Delhi, 2003.									

CO/P	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	<b>PO 8</b>	PO9	PO10	PO11	PO1 2	PSO	PSO	PSO	PSO
0													1	2	3	4
CO1	3	2	-	3						-	-	-	3	-	3	-
CO2	-	3	3	2						-	3	-	3	-	3	-
CO3	-	3	(T)	3						-	3	-		-	1	-
CO4	-	3	2	3			-			-	3	-	3	-	-	-
CO5	-	2	3	3			-			-	-	-	-	3	-	-
CO							-			-						
(Avg)	3.00	2.60	2.75	2.80							3.00	-	3.00	3.00	3.00	-

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

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