M.E. (Computer Science and Engineering) 2024 Regulations, Curriculum & Syllabi



BANNARI AMMAN INSTITUTE OF TECHNOLOGY An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with 'A+' Grade SATHYAMANGALAM - 638401 ERODE DISTRICT TAMILNADU INDIA Ph: 04295-226000/221289 Fax: 04295-226666 Email: stayahead@bitsathy.ac.in Web: www.bitsathy.ac.in

CONTENTS

Page No.

Vision of the Department	i
Mission of the Department	ii
PEOs	iii
POs	iv
Mapping of PEOs with POs	V
Curriculum 2024	1
Syllabi	4
Electives	36

M.E – COMPUTER SCIENCE AND ENGINEERING

Vision of the Department

To excel in the field of Computer Science and Engineering, to meet the emerging needs of the industry, society and beyond.

Mission of the Department

- I. To impart need based education to meet the requirements of the industry and society.
- II. To equip students for emerging technologies with global standards and ethics that aid in societal sustainability.
- III. To build technologically competent individuals for industry and entrepreneurial ventures by providing infrastructure and human resources.

M.E. COMPUTER SCIENCE AND ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- I. Analyse, design, and develop creative products and solutions for real-world problems.
- II. Critically analyse the current literature in a field of study and ethically develop innovative and research-based methodologies to fill the gaps.
- III. Participate in lifelong multidisciplinary learning as skilled computer engineers, including working in teams, investigating and implementing research problems, and presenting technical reports.

iv

PROGRAMME OUTCOMES (POs)

The Graduate will be able to

- 1. An ability to independently carry out research / investigation and development work to solve practical problems.
- 2. An ability to write and present a substantial technical report/document.
- 3. Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.
- 4. Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
- 5. Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
- 6. Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.

POs	1	2	3	4	5	6
PEO I	Х	Х	Х	Х		Х
PEO II		Х	Х	Х	Х	Х
PEO III			Х	Х	X	Х

MAPPING OF PEOs WITH POs

	ME COMPUTER Minimum Ci					EERING	-R2024			
	Winning Ci				. / 1					
Course		1.				Hours/	Max	imum M	arks	
Code	Course Title	L	Т	Р	C	Week	CA	SEE	Total	Category
24CS11	Research Methodology and IPR	2	0	0	2	2	40	60	100	ES
24CS12	Engineering Mathematics and Applications	3	0	0	3	3	40	60	100	BS
24CS13	Applications of Data Structures and Algorithms	3	0	0	3	3	40	60	100	PC
24CS14	Database Engineering	3	0	0	3	3	40	60	100	PC
24CS15	Network Technologies	3	0	0	3	3	40	60	100	PC
24CS16	Principles of Programming Languages	3	0	0	3	3	40	60	100	PC
24CS17	Applications of Data Structures Laboratory	0	0	4	2	3	60	40	100	PC
24CS18	Database Engineering Laboratory	0	0	4	2	3	60	40	100	PC
	Audit course I*	2	0	0	-	2	100	0	100	EEC
	Total	19	0	8	21	25	-	-		
		II	SEMI	ESTER						
Course		T	т	D		Hours/	Max	imum M	arks	
Code	Course Title	L	Т	Р	C Week		CA	SEE	Total	Category
24CS21	Internet of Things	3	0	0	3	3	40	60	100	PC
24CS22	Machine Learning	3	0	0	3	3	40	60	100	PC
24CS23	Advanced Software Engineering	3	0	2	4	5	50	50	100	PC
24CS24	Cloud Computing Technologies	3	0	3	3	3	40	60	100	PC
	Program Elective I	3	0	0	3	3	40	60	100	PE
	Program Elective II	3	0	0	3	3	40	60	100	PE
24CS27	Machine Learning Laboratory	0	0	4	2	4	60	40	100	PC
24CS28	Mini Project	0	0	4	2	4	100	0	100	PC
	Audit course II*	2	0	0	-	2	100	0	100	EEC
	Total	20	0	10	23	30	-	-	-	-
G		III	SEM	ESTEF	2					1
Course Code	Course Title	L	Т	Р	С	Hours/	Max	imum M	larks	Category
2340						Week	CA	SEE Total		
	Program Elective III Program Elective IV	3	0	0	3	3	40	60 60	100 100	PE PE
	Program Elective IV Program Elective V	3	0	0	3	3	40	60	100	PE PE
24CS33	Dissertation Phase I	0	0	12	6	12	60	40	100	EEC
	Total	9	0	12	15	21	-	-		-

	IV SEMESTER									
Course	Comme Title	т	т	Р	С	Hours/ Week	Maximum Marks			Cotogomy
Code	Course Title	L	Т				CA	SEE	Total	Category
24CS41	Dissertation Phase II	0	0	24	12	24	60	40	100	EEC
Total		0	0	24	12	24	-	-	-	-

ELECTIV										
Course	ONAL ELECTIVES									
Code	Course Title	L	Т	Р	С	Hours/		imum M	1	Category
						Week	CA	SEE	Total	
	PROFESIONAL ELECTIVES		0				10		100	22
24CS51	Agent Based Intelligent Systems	3	0	0	3	3	40	60	100	PE
24CS52	Soft Computing	3	0	0	3	3	40	60	100	PE
24CS53	Multicore Architecture and Programming	3	0	0	3	3	40	60	100	PE
24CS54	Data Science	3	0	0	3	3	40	60	100	PE
24CS55	Agile Methodologies	3	0	0	3	3	40	60	100	PE
24CS56	Software Quality Assurance	3	0	0	3	3	40	60	100	PE
24CS57	Digital Image Processing	3	0	0	3	3	40	60	100	PE
24CS58	Information Retrieval Techniques	3	0	0	3	3	40	60	100	PE
24CS59	Natural Language Processing	3	0	0	3	3	40	60	100	PE
24CS60	Deep Learning Techniques	3	0	0	3	3	40	60	100	PE
24CS61	Big Data Mining and Analytics	3	0	0	3	3	40	60	100	PE
24CS62	Data Visualization Techniques	3	0	0	3	3	40	60	100	PE
24CS63	Blockchain Technologies	3	0	0	3	3	40	60	100	PE
24CS64	Full Stack Web Application Development	3	0	0	3	3	40	60	100	PE
24CS65	Cyber Physical Systems	3	0	0	3	3	40	60	100	PE
24CS66	Mixed Reality	3	0	0	3	3	40	60	100	PE
24CS67	DevOps and Micro Services	3	0	0	3	3	40	60	100	PE
24CS68	Mobile and Pervasive Computing	3	0	0	3	3	40	60	100	PE
24CS69	Optimization techniques	3	0	0	3	3	40	60	100	PE
LIST OF	AUDIT COURSES I & II	•		•				•	•	
24XE01	English for Research Paper Writing	2	0	0	-	2	100	0	100	EEC
24XE02	Cost Management of Engineering Projects	2	0	0	-	2	100	0	100	EEC
24XE03	Stress Management	2	0	0	-	2	100	0	100	EEC
24XE04	Disaster Management	2	0	0	-	2	100	0	100	EEC
24XE05	Value Education	2	0	0	-	2	100	0	100	EEC

24XE06	Pedagogy Studies	2	0	0	-	2	100	0	100	EEC
24XE07	Business Analytics	2	0	0	-	2	100	0	100	EEC

SUMMARY OF CREDIT DISTRIBUTION

S.No	CATEGORY		CREDI SEMI	TS PE ESTEF		TOTAL	CREDITS	Range of To	tal Credits
		Ι	Π	III	IV	CREDIT	in %	Min	Max
1	BS	3	-	-	-	3	4.22	2%	10%
2	ES	2	-	-	-	2	2.81	2%	10%
3	HSS	-	-	-	-	-	-	-	-
4	РС	12	12	-	-	24	33.80	30%	40%
5	PE	-	6	9	-	15	21.12	20%	30%
6	EEC	5	4	6	12	27	38.02	30%	40%
	Total	22	22	15	12	71	100	-	-

BS - Basic Sciences

ES - Engineering Sciences

HSS - Humanities and Social Sciences

- PC Professional Core
- PE Professional Elective

EEC - Employability Enhancement Course

CA - Continuous Assessment

ES - End Semester Examination

24CS11	RESEARCH MET	THODOLOGY AND IPR	L	T P	C
			2	0 0	2
	Pre-requisite	Assessment Patter		-1.4	(0/)
	Knowledge of research process.	Mode of Assessment Continuous Internal Assessment	weig	ghtage 40	:(%)
• 1	Research ethics.	Semester End Examinations		60	
⁷ ourse (Objectives	Semester End Examinations		00	
	Inderstand the techniques for research pro	oblem formulation analysis and solution			
	Analyze literature surveys and prepare rep	-			
	Develop research proposals and apply asse	•			
	Develop patents using the IPR & PCT guid				
	Adapt the licensing process for patents and	d analyse the developments of IPR.			
Program	nme Outcomes (POs)				
PO2	practical problems. An ability to write and present a substant	-			
PO3	· ·	ate a degree of mastery over the area	of Co	ompute	er
PO4		op system application software for covering domains and platforms.	listribut	ed an	ıd
PO5	software components and design solu effectively working with professionals	Industry trends, the new hardware an ations for real world problems by Com- in various engineering fields and pursue velopment in computer and automation arer	munica e resear	ting a	
PO6		on system and design algorithms that		ore th	ne
Course (Dutcomes (COs)				
The stude	ents will be able to				
CO1	Formulate the research problems and ide	entify the approaches to solve the problems.			
	nalyze literature surveys and prepare re				
	evelop research proposals and apply as				
	1 $(1$ IDD 0 DOT 1	11			
CO4 D CO5	evelop patents using the IPR & PCT guid Adapt the licensing process for patents a				

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	3	2	2	3	2	3
2	3				1	3
3	3			1	1	2
4	3				1	1
5	3			1	1	1

Unit I INTRODUCTION TO RESEARCH PROBLEM

Meaning of research problem - Sources of research problem - Criteria characteristics of a good research problem- errors in selecting a research problem-scope and objectives of research problem-Approaches of Investigations of solutions for research problem-Data collection-Analysis-Interpretation-Necessary instrumentations.

Unit II LITERATURE REVIEW

Effective Literature studies approaches-analysis-Plagiarism-Research ethics- Review of the literature, Searching the existing literature, reviewing the selected literature, developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Unit III TECHNICAL WRITING/PRESENTATION

Effective technical writing-how to write report-paper-Developing a research proposal-Format of Research proposal-a presentation and assessment by a review committee.

Unit IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS(IPR)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: Technological research, Innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grant Patents, Patenting under Patent Cooperation Treaty(PCT).

UNIT V INTELLECTUAL PROPERTY RIGHT(IPR)

Patent Rights: Scope of Patent Rights, Licensing and transfer of Technology, Patent information and databases-Geographical Indications. New Developments in IPR: Administration of Patent system, IPR of Biological systems, Computer Software-Traditional knowledge - Case studies.

References

- 1. Wayne Goddard and Stuart Melville, Research methodology-An Introduction, 2nd Edition, Juta and Company Ltd, 2007.
- 2. Halbert, Resisting Intellectual Property, Taylor & Francis Ltd, 2007
- 3. Robert P.Merges, Peter S.Menell, Mark.A.Lemley, Intellectual property in new technological age, 2016.
- 4. T.Ramappa, Intellectual Property Rights under WTO, S.Chand, 2008.
- 5. Ranjit Kumar, 2nd Edition, Research Methodology: A Step by Step Guide for beginners, 2010.
- 6. C.R.Kothari, Gaurav Garg, Research Methodology, Methods and Techniques, 4th Edition, New Age International Publishers, 2018.

5

6 Hours

6 Hours

6 Hours

6 Hours

6 Hours

30 Hours

Total

24CS12	ENGINEERING MATHEMAT	ICS AND APPLICATIONS	L	Т	P	C
			3	0	0	3
	Pre-requisite	Assessment Pattern		-1.4-		0/
	Basic Statistics inference techniques.	Mode of Assessment	vve	ighta		70
	Hypothesis testing and analysis of variance to	Continuous Internal Assessment	40 60			
	engineering problems.	Semester End Examinations		60)	
	Objectives					
	To acquire knowledge of vector spaces and its ap		•	•		
	To understand the basics of random variables, so of computers.	tandard distributions, and their applica	tions i	in the	e fie	ld
•	To apply testing of hypothesis to infer the outc	come of experiments and the design o	f expe	rime	nts	in
	Computer Science and Engineering.		-			
Program	mme Outcomes (POs)					
PO1	An ability to independently carry out resear	rch / investigation and development	work	to s	solv	-
101	practical problems.	in , myesugaton and development	work			-
PO2	An ability to write and present a substantial tec	chnical report/document.				
PO3	Students should be able to demonstrate a		of C	lomp	uter	
1 00	Science and Engineering.			r		
PO4	Efficiently design, build and develop sy	stem application software for d	istribu	ted	and	
	centralized computing environments in varying					
PO5	Understand the working of current Indus	try trends, the new hardware are	chitect	ures,	th	e
	software components and design solutions					
	effectively working with professionals in va	arious engineering fields and pursue	resea	rch		
	orientation for a lifelong professional developr	nent in computer and automation aren	as.			
PO6	Model a computer based automation sy		expl	ore	the	;
	understanding of the tradeoffs involved in digit	tal transformation.				
Course	Outcomes (COs)					
The stud	lents will be able to					
CO1	Demonstrate the properties and applications of	of vector spaces in computer science an	nd Eng	inee	ring	
	Understand the concept of decomposition of t	the matrices into the required form.				
CO2						
CO2 CO3	Apply the concepts of probability distribution		d engi	neeri	ing.	
	 Apply the concepts of probability distribution Identify the hypothesis to analyze the nature of Organize a calculation for identifying the suit 	of the data.	d engi	neeri	ing.	

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	1	2	3			1
2	3		2	2		3
3			1		3	2
4	2	1	3	2	2	2
5	2	2	1		1	2

	es - Subspaces - Linear dependence - Basis and dimension of a vector space - R	ank -Change
of basis - Inner p	roduct space - Norm - Gram-Schmidt process - Linear transformation.	
Unit II	EIGENVALUES AND EIGENVECTORS	9 Hours
U	l eigenvectors - Diagonalization - Eigenvectors and linear transformations - Co	1 0
	dynamical systems - Iterative estimates for Eigen values - Singular value decomp	position - QR
decomposition.		
Unit III	PROBABILITY THEORY	9 Hours
Axioms of proba	bility - Addition and multiplication theorems on probability - Conditional prob	ability Bayes
theorem (problem	ns only) - Random variable: Continuous and discrete random variables Discrete	distributions:
Binomial and Po	isson - Continuous distributions: Normal, Exponential and Weibull - Simple p	problems and
properties.		
Unit IV	TESTING OF HYPOTHESIS	9 Hours
	·	
Company of the second	aling Matheda of compling Compling distributions and algorifications. Stor	adand Dunan

Concepts of sampling - Methods of sampling - Sampling distributions and classifications - Standard Error -Tests of hypothesis: Tests of hypothesis about proportion, mean and their differences - Chi-square distributions: Test of goodness of fit and test of independence of attributes.

UNIT V DESIGN OF EXPERIMENTS AND CONTROL CHARTS

VECTOR SPACES

One way and two-way classifications - Completely randomized design - Randomized block design - Latin square design - 2X2 factorial design - Control Charts of Variable and Attributes.

References

Unit I

- D. C. Lay, Linear Algebra and its Applications, Addison Wesley, Massachusetts, Fourth edition, 1. 2012.
- Johnson R.A., Miller & Freunds: Probability and Statistics for Engineers, Pearson Education, 8th 2. Edition, 2013.
- Walpole R.E, Myers R.H, Myers R.S.L and Ye K, Probability and Statistics for Engineers and 3. Scientists, Pearsons Education, Delhi, 2002.
- 4. Lipschutz S and Schiller J, Schaums outline Series: Introduction to Probability and Statistics, McGraw Hill Publications, New Delhi, 1998.
- Ross. S, A first Course in Probability, 8th Edition, Pearson Education, New Jersey, 2010. 5.

7

9 Hours

9 Hours

45 Hours

Total

24CS13	A	PPLICA	TIONS	OF DA	TA ST	RUCT	TURES	AND A	ALGORITHM	IS	L 3	T P 0 0	C 3
		Pre-requ	isite						Assessment P	Pattern	5	UU	5
•	Introductio	-	Data	Structu	ires	and N	Mode of	f Asses			Wei	ghtage	(%
	Algorithm		- un	20000			Continu	ous Inte	ernal Assessme	nt		40	
	-	olving Skil	ls.			S	Semeste	r End E	xaminations			60	
•	Basics of C	Graph Theo	ry.										
Course	Objectives	5											
• ′	To underst	and the usa	ge of a	lgorithr	ns in co	omputir	ıg.						
		nd use hiera					s operat	ions.					
		e usage of											
		nd design o bout NP Co					s that is	approp	riate for proble	ems.			
		omes (POs	-	liess of	proble	115.							
PO1	-		-	1	a out m	acarat	. / inv	stigati	on and develop	nmont v	vork	to col	10
FUI		problems.	endent	ly call	y Out I	esearci	1 / 11106	sugan		pinent v	VOIK	10 501	/e
PO2		y to write a	nd pres	ent a su	bstanti	al techr	nical rep	ort/doc	cument.				
PO3				to der	nonstra	te a d	legree	of mas	stery over the	area o	of C	ompute	r
		and Engine	-										
PO4									on software	for dist	tribut	ed an	d
PO5		ed computing						-	new hardwa	no onob	itaati		
PU5									problems by				
													Iu
	effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.												
PO6									rithms that exp				
	understanding of the tradeoffs involved in digital transformation.												
Course	Outcomes	(COs)											
The stud	lents will b	e able to											
CO1	Design	data structu	res and	algorit	hms to	solve c	omputi	ng prob	lems.				
CO2	Ų	ent efficien		0				U 1					
CO3									g-matching al	gorithms	s to	real-lif	e
	problem												
CO4	•	one's own a				-							
CO5	11.5	uitable desi	gn stra	tegy for	proble	m solv	ing.						
Articula	ation Matr	TX CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	3	2	2	3	1	3					
		2	3	1				3					
		3	3		1	1		2					
		4	2		1		2	1					
		4	3	2	1		2	1					
		5	3	3	1	1		1					
				I			1						

Unit I ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY 10 Hours ANALYSIS 10 Hours

Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms Asymptotic analysis-Average and worst-case analysis-Asymptotic Notation-Importance of efficient algorithms- Program performance measurement.

Unit II HIERARCHICAL DATA STRUCTURES

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B -trees – Basic operations on B-Trees- Heap –Heap Implementation.

Unit III GRAPHS

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim-Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: The Floyd-Warshall Algorithm.

Unit IV ALGORITHM DESIGN TECHNIQUES

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.

UNIT V NP COMPLETE AND NP HARD

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.

References

- 1. S.Sridhar," Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
- 2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.
- 3. T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.
- 4. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009.
- 5. Barbara A.Plog, Patricia J.Quinlan, MPH, CIH and Jennifer Villareal Fundamentals of Industrial Hygiene, 6th edition 2012, National Safety Council, 2012.
- 6. E. Horowitz, S. Sahni and S. Rajasekaran, "Fundamentals of Computer Algorithms", University Press, 2nd Edition, 2008.

10 Hours

9 Hours

9 Hours

9 Hours

45 Hours

Total

24CS14			J	DATA	BASE	ENGIN	EERIN	NG		L	,	T P	C
										3		0 0	3
	Р	re-requis	site						Assessment Patter	'n			
• I	ntroduction to	o Databas	ses.				ode of			We	eig	htage	(%)
• F	Basics of Rela	ational Da	ıtabase	Manag	gement	-			rnal Assessment			40	
	Systems (RDI					Se	emester	End Ex	xaminations			60	
	Fundamental	Programn	ning Sl	cills.									
Course (Objectives												
• E	Exemplify the	e data moo	lels an	d to coi	nceptua	lize a d	atabase	system	n using ER diagram	s.			
• I	nterpret the c	oncepts o	f paral	lel and	distribu	ited dat	abases.						
• (Comprehend (the use of	object	and ob	ject rel	ational	databas	ses.					
	Jnderstand th		U						logies				
	Explore about	•				51115 44	uuouse	teenno	105105.				
	me Outcom			labases	•								
Tugran		cs (I Os)											
PO1	An ability t	to indepe	ndently	y carry	out re	search	/ inves	stigation	n and developmen	t worl	k t	o sol	ve
	practical pro												
PO2	An ability to write and present a substantial technical report/document.												
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer												
DO 4	Science and	Ū.	0	1	1 1			1	<u> </u>	11		1	1
PO4	centralized c								n software for a	11str1b	ute	a an	a
PO5			-						new hardware a	chitec	•	res f	he
105									problems by Com				
									g fields and pursue				
									and automation area				
PO6									gn algorithms tha	at exp	plo	re th	e
	understandi	-	radeof	fs invol	ved in	digital t	ransfor	mation					
	Dutcomes (C												
The stude	ents will be a	ble to											
CO1	Design a R												
CO2									allel and distributed	databa	ase	s.	
CO3	Apply the r									1			
CO4	Multimedia			l-world	applica	ations v	vith the	use of	f Spatial Database	e and			
CO5				e svete	ms and	manini	ilate the	data a	ssociated with it.				
005	Implement	105QL (c syste		manipe							
Articula	tion Matrix												
ai ucuia		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6	1				
		CO. 110.	101	102	103	104	105	1.00					
		1	2	2	1	3	1	2	1				

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	2	2	1	3	1	2
2	2	2		2	1	1
3	3	1	2	1		1
4	3	2	2	1	1	1
5	5 2		1	1		1

DATABASE SYSTEM CONCEPTS Unit I

Purpose of Database systems - Data Storage and Querying - Database architecture - Data models: Relational model - Entity relationship model: Constraints- Removing redundant attributes in entity sets - Entity relationship diagrams - Reduction to relational schemas - Entity relationship design issue - Extended E-R features - Normalization and database design.

Unit II PARALLEL AND DISTRIBUTED DATABASES

Parallel Databases - I/O Parallelism - Inter-Query and Intra-Query Parallelism-- Inter-Operation and Intraoperation Parallelism - Performance evaluation for Parallel DB Systems -Distributed Database Architecture - Distributed Data Storage - Distributed Transactions - Distributed Query Processing -Distributed Transaction Management - Load balancing tools for DDB - DDB Security.

OBJECT AND OBJECT RELATIONAL DATABASES Unit III

Concepts for Object Databases: Object Identity - Object structure - Type Constructors - Encapsulation of Operations - Methods - Persistence - Type and Class Hierarchies - Inheritance - ODMG Model - ODL -OQL - Object Database Conceptual Design.

Unit IV SPATIAL AND MULTIMEDIA DATABASES

Spatial database concepts, Spatial data types, and models, Spatial operators and queries, Indexing in spatial databases, Multimedia database concepts, Automatic Analysis of Images, Object Recognition in Images, Semantic Tagging of Images.

UNIT V **NOSQL DATABASES**

NoSQL - CAP Theorem - Sharding - Document based - MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment - Using MongoDB with PHP / JAVA/ Python - Cassandra: Data Model - Key Space - Table Operations - CRUD Operations - CQL Types -HIVE : Data types – Database Operations – Partitioning – HiveQL - OrientDB Graph database - OrientDB Features.

	Total	45 Hours
References		

- 1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2016.
- 2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Seventh Edition, McGraw Hill Education 2020.
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- 4. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007.
- 5. V.S.Subramanian, "Principles of Multimedia Database Systems", Harcourt India Pvt. Ltd., 2001.
- 6. C.J.Date, A.KannanandS.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
- 7. ShashankTiwari, "Professional NoSQL", Wiley, 2011.
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11

9 Hours

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. D	Pre-requ				м	ode of .		Assessi	ment	Patt		Wai	ahi	togol	0/
	asic Networking co etworking hardwar		wora			ontinuo			secon	ent		Wei		40	70)
	asic Network Confi		ware.			mester								50	
Course O		8			20		2110 211								
• To	o understand the ba	sic conce	pts of n	etwork	s.										
• Te	o explore various te	echnologie	es in th	e netwo	ork dom	ain.									
• Te	o understand the pa	radigm of	SDN a	and NF	V.										
• Te	o study about 4G ar	nd 5G cell	ular ne	tworks											
• Te	o learn about Netwo	ork Functi	ion and	Orches	stration										
Program	me Outcomes (PO	s)													
PO1	An ability to ind	lependent	lv carr	v out r	esearch	/ inve	stigatio	n and	deve	lopm	ent v	vork	to	solv	ve l
	practical problems.			5 0 40 1		.,	51184110			Topin				501	
PO2 A	An ability to write a	nd presen	t a sub	stantial	technic	al repo	rt/docu	ment.							
	Science and Engine												_		1
	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.														
	nderstand the wo							new ł		uara	arah	itooti	uro	o tl	
	software compone														
	effectively workin														
	orientation for a life														
PO6 M	lodel a compute	r based	autor	nation	systen	n and	desig	n algo					lor	e tł	ie
1	understanding of th	e tradeoff	s invol	ved in o	ligital t	ransfor	mation.								
Course O	utcomes (COs)														
The stude	nts will be able to														
CO1	Understand the ad	vanced co	ncents	of netv	vorking	routin	g and s	witchin	<u>וס</u>						
CO2	Analyze the differ				0		0		<u>.</u> 8.						_
CO3	Apply the concept	• •		•				•	rk						_
CO4	Analyze the impor														
CO5	Apply the mechan									rld ap	plica	tions	5.		
											_				
Articulati	ion Matrix			1	1	1	1	1	٦						
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6							
		1	1	3	2		1		1						
		2	1	3	3	3			-						
		۷	1	5	5	5									

1	1	3	2		1	
2	1	3	3	3		
3	1	3	3	2	2	2
4	1	2	2	1	2	1
5	1	3	1	1	1	2

Unit I **NETWORKING, ROUTING AND SWITCHING** 9 Hours

Advanced Networking Concepts: Overview of computer networks - Network topologies - Network protocols and communication models - OSI model and TCP/IP stack - Routing and Switching: Basics of routing algorithms - Switching techniques and VLANs - Introduction to routing protocols RIP, OSPF, BGP.

NETWORK TECHNOLOGIES Unit II

Introduction: Overview of networking technologies landscape - Historical perspective and evolution of networking - Emerging trends in networking - Internet of Things (IoT) Technologies: IoT architecture and components - Protocols used in IoT - Cloud Computing Technologies: Cloud service & Deployment models (IaaS, PaaS, SaaS) - Virtualization and hypervisor technologies.

Unit III SOFTWARE-DEFINED NETWORKING (SDN) & NETWORK FUNCTION VIRTUALIZATION (NFV)

SDN: SDN architecture and components - OpenFlow protocol - SDN use cases and applications, NFV: Introduction to NFV - NFV architecture and components - NFV use cases.

Unit IV **4G AND 5G TECHNOLOGIES**

Introduction to 4G: Evolution of Mobile Communication - Goals and Objectives of 4G - LTE (Long-Term Evolution) Technology: LTE Architecture and Components - LTE Physical Layer - LTE Radio Access Network (RAN) - 5G: Evolution from 4G to 5G - Key technologies enabling 5G - Applications and use cases of 5G.

UNIT V NETWORK AUTOMATION AND ORCHESTRATION

Introduction to network automation - Configuration management tools - Orchestration and its role in modern networks - Case Studies: Analysis of real-world implementations - Experience with a Globally-Deployed Software Defined WAN.

References

- Olivier Bonaventure, "Computer Networking: Principles, Protocols and Practice", 2016. 1.
- "Routing and Switching Essentials v6 Companion Guide", Cisco Networking Academy, 2017. 2.
- 3. Jeffrey S. Beasley and Piyasat Nilkaew, "Networking Essentials", 2022.
- 4. B. S. Soni, "Internet of Things (IoT): Technologies, Applications, Challenges and Solutions", 2020.
- 5. Ricardo Puttini, Zaigham Mahmood, Thomas Erl, "Cloud Computing: Concepts, Technology & Architecture", 2013.
- 6. Abhishek Ranjan, "Software-Defined Networking: Anatomy of OpenFlow", 2015.
- 7. Rajendra Chayapathi, Syed Hassan, Paresh Shah, "Network Function Virtualization (NFV) with a Touch of SDN", 2016.
- Johan Skold, Erik Dahlman, Stefan Parkvall, "5G NR: The Next Generation Wireless Access 8. Technology", 2018.
- 9. Jason Edelman, Matt Oswalt, and Scott Lowe, "Network Programmability and Automation", 2018.

13

9 Hours

9 Hours

45 Hours

Total

- 9 Hours
- 9 Hours

24CS16	PRIN	CIPLE	SOF	PROG	RAMN	IING I	ANGU	JAGES			L	T P	C
											3	0 0	3
	Pre-requisi								nent Pa				
	undamental Programm						Assessr				Wei	ghtage	(%)
	asic understanding of l	anguag	ge desi	gn and					essment	,		40	
	nplementation.				Se	mester	End Ex	aminati	lons			60	
	·	•1		1				1					
	o understand and descr	-				1 0	mming	langua	ges.				
	o understand data, data	• -											
• T	o understand call-retur	n archi	tecture	and wa	ays of i	npleme	enting th	hem.					
• T	o understand object-or	ientatio	on, con	currenc	y, and	event h	andling	in prog	grammir	ng lang	uage	s.	
	o develop programs in	non-pr	ocedui	al prog	rammiı	ng para	ligms.						
Program	me Outcomes (POs)												
	An ability to indepertue of the practical problems.						Ū.		develop	ment v	vork	to sol	ve
PO2 An ability to write and present a substantial technical report/document.													
	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.												
	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms. Understand the working of current Industry trends, the new hardware architectures, the												
	nderstand the workin software components effectively working orientation for a lifelor	and o with p	design profess	solutic ionals	ons for in var	real v ious e	vorld j ngineer	problem ring fie	ns by (elds an	Commu d pur	inica sue	ting a	nd
Course O	understanding of the tr Dutcomes (COs)												
I he stude	nts will be able to												
CO1	Describe syntax and s												
CO2	Explain data, data typ					progran	nming l	anguag	es				
CO3 CO4	Design and implement		0			ndling	program	nmina	constru	ata			
C04 C05	Apply object-oriented Develop programs programming languag	in S									ado	pt ne	W
Articulat	ion Matrix	-											
	C). No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	1					1					
		2	1		1		1	2					
		3	1	1	1	1	1	2					
		4 5	1	2 2	1	1	2	2					
		5	1	2	1		Z	3					

Unit I	SYNTAX AND SEMANTICS	9 Hours							
	· · · · · ·								
	ogramming languages – describing syntax – context – free grammars								
grammars – desci	ribing semantics – lexical analysis – parsing – recursive-descent – bottom- up pars	sing.							
Unit II	DATA, DATA TYPES, AND BASIC STATEMENTS	9 Hours							
	les – binding – type checking – scope – scope rules – lifetime and garba								
	types-strings-array types- associative arrays-record types- union types - the three types - type conversions - relational								
	signment statements – mixed- mode assignments – control structures – selection								
- branching - gua		in iterations							
		0.11							
Unit III	SUBPROGRAMS AND IMPLEMENTATIONS	9 Hours							
- design issues f	esign issues – local referencing – parameter passing – overloaded methods – gene for functions – semantics of call and return – implementing simple subprog- nic local variables – nested subprograms – blocks – dynamic scoping.								
Unit IVOBJECT-ORIENTATION, CONCURRENCY, AND EVENT9 HourHANDLING									
concurrency – se	n – design issues for OOP languages – implementation of object-oriented c emaphores – monitors – message passing – threads – statement level concurre ng – event handling.								
UNIT V	FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES	9 Hours							
	· · · · · · · · · · · · · · · · · · ·								
with Scheme -	ambda calculus – fundamentals of functional programming languages – H Programming with ML – Introduction to logic and logic programming – H lti-paradigm languages	• •							
	Total	45 Hours							
References	10tai	45 Hours							
	W. Sebesta, "Concepts of Programming Languages", Eleventh Editio 012.	n, Addison							
2. W. F. Cl Springer,	ocksin and C. S. Mellish, "Programming in Prolog: Using the ISO Standard", F 2003.	ifth Edition,							
3. Michael	L.Scott, "Programming Language Pragmatics", Fourth Edition, Morgan Kauf	mann,2009.							
4. R.KentD	ybvig,"TheScheme programming language", Fourth Edition, MIT Press, 2009.								
5. Richard	5. Richard A. O'Keefe, "The craft of Prolog", MIT Press, 2009								

6. W.F.Clocksinand C.S.Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

24CS16	AP	PLICATI	ONS O					ND AL	GORITHMS	L		P C
			-	L	ABOR	ATOR	Y			0	0	4 2
		Pre-requis							ssessment Pattern			
	Proficiency i	÷	•	0 0				ssessm		Wei		ge(%)
	Understandir	ng of basic	Algori	thm des	sign				al Assessment		60	
	echniques.						nester I	End Exa	aminations		40)
	Basic unders ools.	tanding of	Lab en	vironme	ent and							
Course	Objectives											
• 7	Fo develop a	pplications	using a	advance	ed data	structu	res.					
	Fo enhance t	••	0									
			•	0		•	· .	1 .	1 11 11			
•	l o implemen	it state-oi-t	ne-art a	Igorithi	m desig	in techn	iques to	or solvi	ng real world problem	ms.		
Progran	nme Outcon	nes (POs)										
PO1	PO1 An ability to independently carry out research / investigation and development work to solve practical problems.											
PO2	PO2 An ability to write and present a substantial technical report/document.											
PO3												uter
100	Science and Engineering.											
PO4												and
	centralized computing environments in varying domains and platforms.											
PO5	Understand the working of current Industry trends, the new hardware architectures, the											
	software components and design solutions for real world problems by Communicating and											
	effectively working with professionals in various engineering fields and pursue research											
	orientation for a lifelong professional development in computer and automation arenas.											
PO6									algorithms that	expl	ore	the
	understand	-	adeoff	s involv	red in d	igital tr	ansforn	nation.				
	Outcomes (
	ents will be											
CO1		d implemer						s extens	ively.			
CO2		gorithms us	•	•	^							
CO3						lgorith	ms, unc	lerstand	the ADT/libraries,	and	use	t to
	design alg	orithms for	a spec	ific pro	blem.							
Articula	tion Matrix											
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	1	1		1	1					
			1		1	-	2	1				
		2	1		1	2	2	1				
		3	1	1	1	1	2	1				
		5	1	1	1	1	2	1				
Unit I	F	xperiment	1								61	Hours
	152	-per mient	-								01	.ivui s
Impleme	nt the recurr	ence relation	on for th	ne recur	sive an	d non-r	ecursiv	e proble	ems.			
	he nth term o							_				
		that use bo	th recu	rsive an	d non-i	recursiv	ve funct	ions for	implementing the	follo	wing	
	g methods:											
i) Linear	search											

ii) Binary searchc) Write a program to find merge sort analysis.

Unit II	Experiment 2	6 Hours
Implement th	e following data structures: a) Leftist heaps b) Skew heaps	
•		
Unit III	Experiment 3	3 Hours
Create two bi	nomial queue structures and perform merging of two binomial queues.	
Unit IV	Experiment 4	3 Hours
Write a progr	am to perform the following:	
	nary tree of integers	
	he binary tree using pre-order, in-order and post-order traversals	
UNIT V	Experiment 5	6 Hours
Write a progr Double Rotat	am to perform the insertion and deletion operations in AVL Tree using a) Single Rotation.	tion b)
		_
UNIT VI	Experiment 6	5 Hours
	insertion, deletion and search operations in Red-Black Tree ogram to implement B-Tree operations.	
UNIT VII	Experiment 7	5 Hours
path problem	t Dijkstra's algorithm and Floyd Warshall's algorithm for solving single source s s. ogram to detect Hamiltonian cycles in a Hamiltonian graph.	
UNIT VIII		
	Experiment 8	5 Hours
a) Write a pro b) Write a pro	Experiment 8 ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs.	5 Hours
b) Write a pro	bgram to implement graph coloring algorithms.	5 Hours
 b) Write a pro UNIT IX a) Solve rod of 	ogram to implement graph coloring algorithms. Ogram to find chromatic index of cyclic graphs.	
 b) Write a pro UNIT IX a) Solve rod o b) Implement 	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique.	
 b) Write a pro UNIT IX a) Solve rod o b) Implement UNIT X 	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique. the Huffman coding algorithm to decode the given text.	5 Hours
 b) Write a pro UNIT IX a) Solve rod o b) Implement UNIT X 	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique. the Huffman coding algorithm to decode the given text. Experiment 10	5 Hours
 b) Write a pro UNIT IX a) Solve rod o b) Implement UNIT X Simulate Tic- References 	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique. the Huffman coding algorithm to decode the given text. Experiment 10 Tac-Toe game using backtracking strategy Total	5 Hours 5 Hours 60 Hours
 b) Write a pro UNIT IX a) Solve rod o b) Implement UNIT X Simulate Tic- References 	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique. the Huffman coding algorithm to decode the given text. Experiment 10 Tac-Toe game using backtracking strategy Total y Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition	5 Hours 5 Hours 60 Hours
b) Write a pro UNIT IX a) Solve rod o b) Implement UNIT X Simulate Tic- References 1. Anan 2014 2. Alfre	ogram to implement graph coloring algorithms. ogram to find chromatic index of cyclic graphs. Experiment 9 cutting problem using dynamic programming technique. the Huffman coding algorithm to decode the given text. Experiment 10 Tac-Toe game using backtracking strategy Total y Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition	5 Hours 5 Hours 60 Hours h, Pearson,

Algorithms, Third Edition, Prentice Hall of India, Reprint 2012.

- 4. Mark Allen Weiss, Data Structures and Algorithms in C++, Fourth Edition, Pearson, 2014
- 5. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms, University Press, 2008.
- 6. Adam Drozdek, Data Structures and Algorithms in C++, 4th Edition, Cengage Learning, 2013.

24CS17	,		DATA	BASE	ENGIN	EERI	NG LA	BORA	TORY	L T P C 0 0 4 2
		Pre-req	nicito						Assessment Pattern	0 0 4 2
•	Droficion	cy in Progra		2 100 000			Mode	of Asse	ssment	Weightage(%)
		atabase con			•				ternal Assessment	60
	skills.	adase con	cepts a	nu uata	1 mode	B			Examinations	40
		d SQL tech	niques				Semest		Examinations	40
	Objectiv	-	inques.							
	0									
	•	and implen			-					
•	To imple	ment the da	tabase	design	in an O	bject or	iented of	latabas	e.	
•	To imple	ment distrib	outed da	atabases	s and pa	arallel d	latabase	es.		
Program	mme Out	comes (PO	s)							
PO1				tly car	ry out	researc	h / inv	vestigat	ion and development v	vork to solve
		al problems.								
PO2		ity to write								
PO3		s should b and Engine		to de	monstr	ate a	degree	of ma	astery over the area of	or Computer
PO4	Efficier	ntly design	, builc						on software for dist	tributed and
PO5		zed comput								:
P05									e new hardware arch	
									l problems by Comm	
									ng fields and pursue r and automation arenas	
PO6									sign algorithms that	
FUU		anding of th								explore the
Course	Outcom	-		0115 1110	orveur	n uigita	ii transi	orman	л.	
		be able to								
CO1	Execu	te the basic	SOL co	omman	ds in O	RACLE	Ξ.			
CO2		nent a paral						RACLE	Э.	
CO3	-	op an object					•			
CO4						•		terprise	using MongoDB.	
Articula	ation Ma									
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6		
		1	2	2	1	3	1	2		
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		2	2	2		2	1	1		
		3	3	1	2	1		1		
		4	3	2	2	1	1	1		
Unit I		Experime	ent 1							12 Hours
Working	g basic So	QL commar	ıds, Sin	gle Rov	w and C	iroup fu	unction	8		
Unit II		Experime	ent 2							6 Hours
		- aper inte								0 110010
								ineering	g colleges and improve	the data access
from the	e database	es through p	aralleli	zation o	of vario	us oper	ations.			

Unit III	Experiment 3	6 Hours
Design a Distr	ibuted Database to store and retrieve data efficiently.	
Unit IV	Experiment 4	6 Hours
Create ODL se	chema to store the data and ODL Queries to access the data from Object Oriented Dat	tabase.
UNIT V	Experiment 5	6 Hours
MySQL Datab	base Creation, Table Creation, Query	
UNIT VI	Experiment 6	6 Hours
Spatial Databa	ase Query Processing using open source DB (MongoDB/MySQL etc)	
UNIT VII	Experiment 7	6 Hours
MongoDB - C	RUD operations and Indexing	
UNIT VIII	Experiment 8	6 Hours
Cassandra - Ta	able Operations, CQL Types.	
UNIT IX	Experiment 9	6 Hours
HIVE: Databa	se Operations, Partitioning - HiveQL OrientDB Graph database - OrientDB Features.	
	Total	60 Hours
References		
Educa 2. Henry	 Database Operations, Partitioning - HiveQL OrientDB Graph database - OrientDB I tion/Addison Wesley, 2016. F. Korth, Abraham Silberschatz, and S. Sudharshan, Database System Concepts Ne McGraw Hill, 2010. 	
3. Vijay	Kumar, Mobile Database Systems Wiley Series on Parallel and Distributed Comput Wiley-Interscience, 2006.	ting,
4. C.J.Da Pearso	ate, A.Kannan and S.Swamynathan, An Introduction to Database Systems, Eighth Ed on Education, 2006.	
	Dayley, Teach Yourself NoSQL with MongoDB in 24 Hours, Sams Publishing, Seco n, 2015.	nd

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		re-requ					1 -]/	C A	Assessment Pattern	XX 7 - *	-1.4	$(0/\mathbf{)}$		
	Basics of Emb		•	5.				f Asses		Weightage(%)				
	 Networking fundamentals. Data Communication and IoT Protocols. Continuous Internal Assessment Semester End Examinations 													
Data Communication and IoT Protocols. Semester End Examinations 60 Course Objectives														
	,	4100 106				ting of	Lат							
	To understand							1						
	I o understand in the context		are De	fined I	Networ	ks (SD	N) and	d Netw	ork Function Virtual	izatic	on (NFV	V)		
• ′	Γο explore var	rious se	nsors a	nd their	applica	ations i	n IoT.							
	• To understand the basics of networking, explore a variety of sensors and computing in the context of IoT.													
• To apply data analytics tools such as Apache Hadoop, Chef, and Puppet for IoT.														
Program	nme Outcome	es (POs)											
	An ability to independently carry out research / investigation and development work to solve practical problems.													
PO2	An ability to		nd prese	ent a su	bstantia	l techn	ical rep	ort/doc	ument.					
PO3									astery over the area	of (Comput	er		
	Science and						-							
PO4	centralized c	omputi	ng envi	ronmen	its in va	rying d	lomains	s and pl				nd		
PO5	Understand													
									problems by Comm					
									ering fields and pur and automation arenas		resear	cn		
PO6						-		-	gn algorithms that		lore t	he		
100	understandin									•np				
		-												
C	$\overline{\mathbf{O}}$	•												
	Outcomes (Co ents will be at													
			1.00	,		<i>.</i> .	1 1	1						
CO1 CO2									rious protocols.					
CO2 CO3	Use Arduin					0		Ų	<u> </u>					
CO4			-						etworking and comput	ing r	rinciple	es		
	pertinent to				0			~r		<i>0</i> r	r-			
CO5	Develop W	eb Serv	ers and	REST	ful Web	APIs f	for IoT	applica	tions.					
Articula	tion Matrix						_							
		CO.	PO1	PO2	PO3	PO4	PO5	PO6						
		No.	PUI	rU2	PUS	PU4	P05	PU0						
			1	1		1	1							
		1	1	1	2	1	1	3						
		2	3	2	1	2	3	2						
		3	1	1	2	1	3	3						
		4	2	3	2	1	2	2						
		5	1	2	1	2	1	1						

Unit I INTRODUCTION TO IoT

Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Unit II IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER.

Unit III IOT PHYSICAL DEVICES AND HARDWARE

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C) – Controlling Hardware-Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors.

Unit IV SENSORS, NETWORKING AND COMPUTING

Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor- File Handling, Python Packages for IoT, IoT Physical Servers – Cloud Storage Models, Communication APIs.

UNIT V IoT CLOUDS AND DATA ANALYTICS

Introduction to Cloud Storage models and communication- APIs Web Server – Web server for IoT - RESTful Web API, Amazon Web Services for IoT, Apache Hadoop, Batch Data Analysis, Chef, Chef Case Studies, Puppet. Case studies: smart cities, smart home, connected vehicles, Industrial IOT.

Total	45 Hours
References	
1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Ur Press, 2015, ISBN: 9788173719547.	iversities

- 2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.
- 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895.
- 4. Kamal, R.,"Internet of Things Architecture and Design Principles," 1st Edition, Mcgraw Hill, 2017.
- 5. Simone Cirani," Internet of Things- Architectures, Protocols and Standards", WILEY, 2018.
- 6. Alessandro Bassi," Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Model", Springer, 2013.

9 Hours

9 Hours

9 Hours

9 Hours

9 Hours

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										3 0 0	3			
	Pre-req		•		M	doof	Assessn		nent Pattern	Weightage	<u></u>			
	Mathematics for Ma		0	G					essment	Weightage(
• 1	Basics of Machine L	earning an	d Data	Scienc	••			aminati		60				
Course (Objectives				50			amman	0115	00				
• (Jnderstand the con- ackled by machine l	-	mather	natical	founda	tions of	f mach	ine lear	ming and type	es of proble	ems			
	Explore the different	-	d learn	ing tech	nniques	includi	ing ense	emble n	nethods.					
	earn different aspec	-		-	-		-							
	Learn the role of pro		•		U U				e					
	Analyze the advance					louining	⊳.							
	me Outcomes (PO	0	memo	45.										
		-)												
PO1	An ability to indepractical problems.		·				U		evelopment w	vork to sol	ve			
PO2	An ability to write	A				^								
PO3	Students should b		demo	onstrate	a deg	gree of	f maste	ery ove	er the area of	of Compute	er			
DOA	Science and Engine	ç							2 11					
PO4	Efficiently design centralized comput								are for dist	ributed an	ıd			
PO5	Understand the v software compone effectively workin orientation for a life	ents and o g with pr	design ofessio	solutio nals in	ons for variou	real v s engin	world p neering	oroblem fields	s by Commu and pursue re	unicating a esearch				
PO6	Model a comput understanding of th	er based	auton	nation	system	n and	design	n algo			ne			
	Dutcomes (COs)													
The stude	ents will be able to													
CO1	Formulate the nec								ıg.					
CO2	Implement superv													
CO3	Apply clustering suitable problems						ľ			learning fo	or			
CO4	Design and imple	-							-					
CO5	Analyze the adva				and id	lentify t	the suit	able ap	plications for	solving using	ng			
Articulo	these advanced least tion Matrix	arning tech	iniques	•										
AI ticula		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6]					
		CO. 110.	101	102	105	104	105	100						
		1	1	2	1	3	1	1						
		2	2	3	1	2	1	2						
		2	2	5	1	2	1	2						
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		4	2	2				3						
		1			1		I	1	1					
		5	3	3	1	1	1	3						

INTRODUCTION AND MATHEMATICAL FOUNDATIONS 9

Machine Learning -Machine Learning Foundations – Design of a Learning system - Types of Machine Learning –Applications - Mathematical Foundations of Machine Learning - Random Variables and Probabilities -Probability Theory – Bayesian Conditional Probability - Decision Theory - Bayes Decision Theory - Information Theory.

Unit II SUPERVISED LEARNING

Discriminative and Generative Models -Linear Regression - Least Squares -Under-fitting / Overfitting - Cross-Validation – Lasso Regression- Classification - Logistic Regression- Gradient Linear Models -Support Vector Machines –Kernel Methods -Instance based Methods - K-Nearest Neighbors - Tree based Methods – Decision Trees –ID3 – CART - Ensemble Methods –Random Forest – Bagging and Boosting - Evaluation of Classification Algorithms.

Unit III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9 Hours

Clustering Algorithms – K-Means – Hierarchical Clustering - Cluster Validity - Dimensionality Reduction – Principal Component Analysis – Recommendation Systems- EM Algorithm - Mixtures of Gaussians. Reinforcement Learning – Elements -Model based Learning – Temporal Difference Learning.

Unit IV PROBABILISTIC GRAPHICAL MODELS

Graphical Models - Undirected Graphical Models - Markov Random Fields -Directed Graphical Models - Naïve Bayes Algorithm -Maximum Likelihood -Maximum Apriori -Bayesian Belief Networks - Conditional independence properties - Inference –Learning - Generalization - Hidden Markov Models - Conditional random fields(CRFs).

UNIT V ADVANCED LEARNING

Sampling –Basic sampling methods –Monte Carlo. Exploration Strategies - Deterministic and Non-Deterministic Rewards and Actions Computational Learning Theory -Mistake Bound Analysis, Sample Complexity Analysis, VC Dimension. Occam Learning, Accuracy and Confidence Boosting.

References

Unit I

- 1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014.
- 2. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- 3. EthemAlpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
- 4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
- 5. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, Second Edition.
- 6. Tom Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
- 7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
- 8. Stephen Marsland, "Machine Learning An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

9 Hours

9 Hours

9 Hours

9 Hours

45 Hours

Total

24CS23 ADVANCED SOFTWARE ENGINEERING							NG	L T P C 3 0 2 4							
			Pre-requi	uisite						Assessment Pattern	0 0 2 4				
•	Ba	asic Softwa	-		Concept	s.	M	Mode of Assessment Weights							
٠		sage of bas								rnal Assessment	40				
	-				r			emester	End Ex	kaminations	60				
Course	e O	bjectives									-				
•	То	o understar	nd the ratio	nale fo	r softw	are dev	elopme	ent proc	ess mo	dels.					
•		o understar					•	•							
•	• To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.														
•	To understand the basic notions of agile software development and devops tools.														
•	To understand the different stages of testing from testing during development of a software system.														
Progra	• To understand the different stages of testing from testing during development of a software system.														
PO1 An ability to independently carry out research / investigation and development work to solve practical problems.															
PO2		An ability to		.				-							
PO3					to den	nonstra	te a d	egree	of mas	stery over the area	of Computer				
		Science an	-	-	1 1	1		1.	·	<u> </u>	·1 (1 1				
PO4		centralized									ibuted and				
PO5										new hardware arch	vitectures the				
										problems by Comm					
										ring fields and put					
										and automation arenas					
PO6										n algorithms that					
	1	understand	ing of the	tradeof	fs invol	ved in	digital	transfor	mation						
Course	e O	utcomes (COs)												
The stu	ıdeı	nts will be	able to												
CO1		Identify a	ppropriate	proces	s mode	ls based	l on the	Projec	t requir	ements.					
CO2			id the impo												
CO3					ons of	softwa	re depe	ndabili	ty, nam	nely, availability, relia	ability, safety,				
			and resilier				_			-	-				
CO4			nd the basi	c notio	ons of d	levelop	ing a so	oftware	by usi	ng Agile methodolog	y and Devops				
<u> </u>		tools.	10.0			1									
CO5			nd Softwar	e testin	g appro	aches.									
Articu	lati	on Matrix		DOI		DOA	701		DO (1					
			CO. No.	PO1	PO2	PO3	PO4	PO5	PO6						
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				2		1		1							
			3	1	1		1		1						
			4	1		1	1		1						
			5	1	1			1		-					
			5	1	1			1							

Unit I SOFTWARE PROCESS & MODELING

Prescriptive Process Models – Agility and Process – Scrum – XP – Kanban – DevOps – Prototype Construction – Prototype Evaluation – Modelling – Principles –Requirements Engineering – Scenariobased Modelling – Class-based Modelling – Functional Modelling – Behavioural Modelling.

Unit II SOFTWARE DESIGN

Design Concepts – Design Model – Object Oriented Design using the UML Data Flow Diagrams- Software Architecture – Architectural Styles – Architectural Design – Component-Level Design – User Experience Design – Design for Mobility – Refactoring.

Unit III SYSTEM DEPENDABILITY AND SECURITY

Dependable Systems – Dependability Properties – Sociotechnical Systems – Redundancy and Diversity – Dependable Processes – Formal Methods and Dependability – Reliability Engineering – Availability and Reliability – Reliability Requirements – Fault-tolerant Architectures – Programming for Reliability – Reliability Measurement – Safety Engineering – Safety-critical Systems – Safety Requirements – Safety Engineering – Security Engineering – Security and Dependability Cybersecurity – Sociotechnical Resilience.

Unit IV AGILE METHODOLOGIES AND DEVOPS

Understanding Agile Values - The Agile Manifesto, Purpose Behind Each Practice. Individuals and Interactions Over Processes and Tools, Working Software Over Comprehensive Documentation - The 12 Principles of Agile Software - The Rules of Scrum - Daily Scrum, Feedback and the Visibility- Inspection-Adaptation Cycle, The Last Responsible Moment - Understanding DevOps - DevOps Lifecycle - DevOps Tools - Integrating Agile and DevOps - Continuous Integration and Continuous Deployment (CI/CD) - Case Studies.

UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

9 Hours

Software Testing Strategy – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Software Configuration Management (SCM) – SCM Repository – SCM Process – Configuration Management for Web and Mobile Apps.

Total	45 Hours
EXPERIMENT 1	6 Hours
Program Analysis and Project planning. Thorough study of the problem – Identify project scope, Objectives, Infrastructure – PROJECT PLAN DOCUMENTATION	
EXPERIMENT 2	6 Hours
Software Requirement Analysis Describe the individual Phases / Modules of the project. Identify deliverables - SRS DOCUMENTATION	0 110015
EXPERIMENT 3	6 Hours
Data Modeling Use work products Data dictionary. Use case diagrams and activity diagrams, build and test class diagrams, Sequence diagrams, add interface to class diagramsDESIGN DOCUMENTATION	
EXPERIMENT 4	6 Hours
Software Development and Debugging Use technology of your choice to develop and debug the application-CODE DOCUMENTATION	
EXPERIMENT 5	6 Hours
Software Testing Perform validation testing, Coverage analysis, memory leaks, develop test case	

9 Hours

9 Hours

9 Hours

9 Hours

Regul	lations	2024

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1	hierarchy and Site monitor	- TEST CASE DOCUMENTATION	

inerately and site monitor - TEST CASE DOCUMENTATION		
	Total	30 Hours
	Total	75 Hours
References		
	D 1D	М.

- 1. Software Engineering: A Practitioner's Approach, 9th Edition. Roger Pressman and Bruce Maxim, McGraw-Hill 2019.
- 2. Software Engineering, 10th Edition, Ian Somerville, Pearson Education Asia 2016.
- 3. Software Architecture In Practice, 3rd Edition, Len Bass, Paul Clements and Rick Kazman, Pearson India 2018.
- 4. An integrated approach to Software Engineering, 3rd Edition, Pankaj Jalote, Narosa Publishing House, 2018.
- 5. Fundamentals of Software Engineering, 5th Edition, Rajib Mall, PHI Learning Private Ltd, 2018.
- 6. Andrew Stellman, Jill Alison Hart, Learning Agile, O'Reilly, 2015.
- 7. Kim, Gene, Jez Humble, Patrick Debois, John Willis, and Nicole Forsgren. The DevOps handbook: How to create world-class agility, reliability, & security in technology organizations. IT Revolution, 2021.

4CS24		CI	LOUD	COMP	UTIN	G TEC	HNOL	OGIES	5			Г Р) 2	C
		Pre-						As	sessment Patter		5 (J <u>2</u>	4
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	asic knowledg			omputin	ig and				ll Assessment			40	
	yber security p	principl	es.			Sem	ester Er	nd Exar	ninations			60	
Course O	bjectives												
• Te	o articulate th	e diffe	rences	betwee	n depl	oyment	model	and s	ervice model of	f clou	id co	mputi	ing
	o impart virtua oud environme		n techn	ologies	, resour	ce man	agemer	nt techr	niques and sched	luling	g sche	emes	in
	o enhance kno ith security in			fferent	types of	of prog	rammin	g mode	els to deploy we	eb app	plicat	tions	
	me Outcomes												
PO1	Apply 1	mathem	natical f	foundat	ions, al	gorithn	nic prin	ciples.	and computer so	cience	e theo	orv	
									f varying comple)	
PO2									lems in the fiel				
	Compu	ter Sci	ence an	d Engii	heering	, consid	lering re	ecent an	nd future trends.				
PO3	Design	a syste	em, con	nponen	t, or pr	ocess t	o meet	desire	ed needs within	ı real	istic		
			h as ec	conomic	c, socia	l and et	hical in	the fiel	ld of Computer S	Scienc	ce an	d	
	Enginee												
PO4									or computing p				
		strate advanced knowledge of a selected area within the Computer Science and											
	Enginee												
PO5									rofessional devel	lopme	ent ar	nd	
	function									1 1	1		
PO6									cialization and gaps identified.		lop		
	IIIIovat	ive and	1 Tesear	cn- one		emodo	logies u		gaps identified.				
Course O	utcomes (CO	s)											
	nts will be able	,											
110 30000													
CO1	Elaborate the	e com	ponents	of cl	oud co	omputir	ng to i	understa	and how busine	ess a	gility	/ in	an
	organization					1	0				0 5		
CO2									environments.				
CO3	Evaluate the	deploy	ment c	of web	service	s from	cloud a	architec	ture with schedu	uling	sche	mes a	anc
~~ (resource man				_								
CO4	Analyze clou	d progr	ammin	g mode	ls to so	lve issu	es on cl	loud.	•				
CO5	Design a secu	ire clou	id to de	ploy an	applica	ation ba	sed on o	differen	nt security concer	rns.			
rticulati	ion Matrix												
		CO.											
		No.	PO1	PO2	PO3	PO4	PO5	PO6					
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		5	3	2									
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Unit I INTRODUCTION - CLOUD INFRASTRUCTURE

Cloud computing - Cloud computing delivery models and services - Ethical issues - Cloud vulnerabilities - Cloud computing at Amazon - Cloud computing the Google perspective - Microsoft Windows Azure and online services - Open-source software platforms for private clouds.

Unit II CLOUD VIRTUALIZATION TECHNOLOGIES

Introduction - Virtualization Defined-Virtualization Benefits - Server Virtualization-Virtual Machine -Virtualization technologies-Hardware Virtualization- OS Virtualization Virtualization for x86 Architecture - Paravirtualization - Virtual Infrastructure Requirements - Server Virtualization Sustainability Assessment.

Unit III CLOUD RESOURCE MANAGEMENT AND SCHEDULING

Policies and Mechanisms for Resource Management - Stability of a Two-Level Resource Allocation Architecture - A Utility-Based Model for Cloud-Based Web Services - Resource Bundling: Combinatorial Auctions for Cloud Resources - Scheduling Algorithms for Computing Clouds - Fair Queuing - Start – Time Fair Queuing - Borrowed Virtual Time.

Unit IV CLOUD PROGRAMMING MODEL

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job -Developing Map Reduce Applications - Design of Hadoop file system-Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

UNIT V CLOUD SECURITY

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

	Total	45 Hours
		40 1100115
Deferences		

References

- 1. Peter S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2021.
- 2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011.
- 3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw Hill, 2003.
- 4. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
- 5. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015.

29

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9 Hours

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9 Hours

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	·	Pre-req	uisite						Assessment Pattern			
•]	Fundame	ental Program	nming	Skills.					ssment	Weig	htage((%
		experience	with n	nachine	learnii	ng	Continu	ious Int	ernal Assessment		60	
	framewo					1	Semest	er End I	Examinations		40	
Course	Objectiv	/es										
• 1	Understa	and the imple	ementat	ion pro	cedures	s for the	e machi	ne leari	ning algorithms.			
• 1	Use tool	s to solve the	e classit	fication	proble	ms usir	ig mach	ine lea	rning techniques.			
					•		•		ife applications.			
	-	tcomes (PO		igoriun	in uesig	n teenn	Iques I	Ji icai i	ne applications.			
l Togran	inne Ou	icomes (1 O	5)									
PO1	An abi	lity to inde	penden	tly car	ry out	researc	h / inv	estigati	ion and development	work to	o solv	ve
		al problems.	1	5				U	1			
PO2	An abi	lity to write	and pre	sent a s	ubstant	ial tech	nical re	port/do	ocument.			
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Course		es (COs)				0						
		be able to										
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	comp	ite accuracy	of the	classifi	ers.							
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CO3		clustering a										
CO4	Select	appropriate	algorit	hms/ te	chniqu	es to so	lve con	puting	problems in real-world	•		
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set of tra	ining da	ta samples. l	Read th	e traini	ng data		•		· specific hypothesis of		U	

IIn:4 II	Experiment 2	6 Hours
Unit II	Experiment 2	o Hours
	et of training data examples stored in a .CSV file, implement and demonstrate the gorithm to output a description of the set of all hypotheses consistent with the training	
Unit III	Experiment 3	9 Hours
	ram to demonstrate the working of the decision tree based ID3 algorithm at set for building the decision tree and apply this knowledge to classify a ne	
Unit IV	Experiment 4	3 Hours
	im to implement the naïve Bayesian classifier for a sample training data set stored as accuracy of the classifier, considering few test data sets.	a .CSV file.
UNIT V	Experiment 5	6 Hours
	et of documents that need to be classified, use the naïve Bayesian Classifier model to t-in Java classes/API can be used to write the program. Calculate the accuracy, pre- your data set.	
UNIT VI	Experiment 6	3 Hours
demonstrate th ML library cla		•
UNIT VII	Experiment 7	9 Hours
clustering usin	orithm to cluster a set of data stored in a .CSV file. Use the same data set for g k-Means algorithm. Compare the results of these two algorithms and comment on to You can add Java/Python ML library classes/API in the program.	
UNIT VIII	Experiment 8	6 Hours
	m to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both ions. Java/Python ML library classes can be used for this problem.	correct and
UNIT IX	Experiment 9	9 Hours
	e non-parametric Locally Weighted Regression algorithm in order to fit data points. So ta set for your experiment and draw graphs	elect
UNIT X	Experiment 10	6 Hours
Case Study of	Disease Prediction on google Colab.	
	Total	60 Hours
References	on Marsland "Mashing Learning: An Algorithmia Deservedine" Charmer 9 H-11/	
2nd E	en Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/O dition, 2014.	LKU,
	P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012. Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.	

- 4. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
- 5. Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman,"Mining of Massive Datasets", Cambridge University Press, Second Edition.
- 6. Tom Mitchell, "Machine Learning", McGraw-Hill Education, 2013.
- 7. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition, 2011.
- 8. Stephen Marsland, "Machine Learning -An Algorithmic Perspective", Chapman and Hall/CRC Press, Second Edition, 2014.

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	practical prob											
PO2	An ability to v										~	
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PO4 I	Science and I Efficiently de centralized co Understand th software cor	sign, bui omputing workin mponents	ld and environing of c and de	develop s nents in var urrent Indu sign solution	rying d ustry ons fo	applic omains trends, or real	cation and pla the world	software fo atforms. new hard problems	or dis lware ar by Com	stribute chitect	d ures, ating	and the
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PO5 U PO6 M Course C The stude CO1 CO2 CO3 CO4 CO5	centralized computing er Inderstand the working software components a effectively working witorientation for a lifelong Model a computer base understanding of the trace Dutcomes (COs) ents will be able to Develop the solutions for Identify the suitable strate Use of required new too Test and validate the de Prepare a standard projet tion Matrix 1 2 3	nvironments in g of current and design set ith professional of g professional of ased automat deoffs involved For the real word ategies and technic eveloped proof ect report with 1 2 1 1 1 1	n varyir Industrolutions nals in develop tion sy d in dig rld prob ethodolo ques to f of con n demor	ng domains and ry trends, t ry trends, t s for real way various enorment in component in	nd platfe he n vorld pr ngineerin puter an design nation.	orms. new hardware roblems by Co ng fields and ad automation and algorithms project.	architect ommunica pursue renas.	tures, ating a resea	the and arch
PO5 U PO6 M Course C The stude CO1 CO2 CO3 CO4 CO5	centralized computing er Inderstand the working software components a effectively working with orientation for a lifelong Model a computer bas understanding of the trade Dutcomes (COs) ents will be able to Develop the solutions for Identify the suitable strate Use of required new tool Test and validate the de Prepare a standard project tion Matrix Image: CO. 1 2	nvironments in g of current and design serith professional end g professional end ased automate deoffs involved for the real word ategies and technic eveloped proof ect report with 1 2 2 1	n varyir Industrolutions nals in develop tion sy d in dig rld prob ethodolo ques to f of con n demor	ng domains and ry trends, t ry trends, t s for real way various ender the component in c	nd platfe he n vorld pr ngineerin puter an design nation.	orms. new hardware roblems by Co ng fields and ad automation and algorithms project.	architect ommunica pursue renas.	tures, ating a resea	the and arch

			DISS	ERTAT	ION P	PHASE	II				L T P 0 0 0 24 1
	Pre-requ	isite						Assess	ment Pat		
• 1	Develop skills to ider		d conv	ert a rea	1- M	lode of	Assess		incht i u		Veightage(
	world problem into a t				.1				sessment		60
	······ I····		- r		Se	emester	r End E	xamina	tions		40
Course (Objectives										
• 7	To develop skills to id	entify a	nd con	vert a rea	al wor	ld prob	lem int	o a tech	nical prol	olem.	
	To provide knowledge	•				-			•		
						-	•	-			
	To teach use of new to			• •		•	out the	e projec	t.		
• [To make familiar in de	evelopir	ng the p	proof of c	concep	ot.					
• [To provide guidelines	to prepa	are star	ndard pro	ject re	eport.					
Progran	nme Outcomes (POs))									
PO1	Apply mathematical	founda	ations,	algorith	mic p	rincipl	es, and	l comp	uter scie	nce the	eory in the
	modelling and design		-	•			-	-			
PO2	Identify, formulate,					•	ms in	the fie	ld of Co	mputer	Science
DOA	and Engineering, con						1	1 1			
PO3	Design a system, co										nstraints
PO4	such as economic, s Use current techniqu								-	-	atroto
r04	advanced knowledge										
PO5	Demonstrate an abili										
100	effectively on teams						proress		e veropine		
PO6	Critically analyse ex						ecializa	ation a	nd develo	op inno	vative and
	research- oriented m									•	
PSO1	-										
PSO2	-										
Course	Outcomes (COs)										
	lents will be able to										
<u>CO1</u>	Develop the solutio	C 1									
	1	ns tor fl	ie real-	world pr	oblem	1					
CO1 CO2	α			1			TV OUT 1	he proi	ect		
CO2	Identify the suitable Use of required new	e strateg	ies and	l method	ologie	s to car			ect.		
CO2 CO3	Use of required new	e strateg v tools a	ies and ind tecl	l methode	ologie o carr	s to car y out th			ect.		
CO2 CO3 CO4	Use of required new Test and validate th	e strateg v tools a e devele	ies and and teclopped pr	l method hniques t roof of co	ologie o carr oncept	s to car y out th			ect.		
CO2 CO3 CO4 CO5	Use of required new	e strateg v tools a e devele	ies and and teclopped pr	l method hniques t roof of co	ologie o carr oncept	s to car y out th			ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e devele	ies and ind tecl oped pi report v	l method hniques t roof of co with dem	ologie o carr oncept onstra	s to car y out th tion.	ne proje	ect.	ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e develo project i	ies and and teclopped pr	l method hniques t roof of co with dem	ologie o carr oncept	s to car y out th			ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e develo project 1 CO.	ies and and tecl oped pr report v PO1	I method hniques t roof of co with dem PO2	ologie o carr oncept onstra	s to can y out th tion. PO4	ne proje PO5	PO6	ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e develo project 1 CO. No. 1	ies and and tecl oped pro- report v PO1	I method hniques t roof of co with dem PO2	ologie o carr oncept onstra PO3	s to can y out th tion. PO4	PO5	PO6	ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e develo project 1 CO. No. 1 2	ies and ind tecl pped pr report v PO1 1 2	I method hniques t roof of co with dem PO2 2 1	ologie o carr oncept onstra PO3	s to can y out th tion. PO4 1 1	PO5 1 1	PO6 2 1	ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	co. CO. No. 1 2 3	ies and ind tecl oped pr report v PO1 1 2 1	PO2 1 1 1 1 1 1 1 1 1 1 1 1 1	ologie o carr oncept onstra PO3	s to car y out th tion. PO4 1 1 2	PO5 1 2	PO6	ect.		
CO2 CO3 CO4 CO5	Use of required new Test and validate th Prepare a standard j	e strateg v tools a e develo project 1 CO. No. 1 2	ies and ind tecl pped pr report v PO1 1 2	I method hniques t roof of co with dem PO2 2 1	ologie o carr oncept onstra PO3	s to can y out th tion. PO4 1 1	PO5 1 1	PO6 2 1	ect.		

24CS51	AGENT BASED INTEL	LIGENT SYSTEMS	L 3	T P 0 0	C 3
	Pre-requisite	Assessment Pattern	-	0 0	3
•	Fundamentals of Artificial Intelligence.	Mode of Assessment		htage	(%)
	Operating Systems and Networking.	Continuous Internal Assessment		40	
	Introduction to Multi-Agent Systems.	Semester End Examinations		60	
Course	Objectives	1			
• ′	Γο introduce the fundamental concepts of a	rtificial intelligence.			
• ′	Γο explore the different paradigms in know	ledge representation and reasoning.			
• ′	Γο solve the problem using artificial intelligenc	e and machine learning algorithms.			
	Γο introduce the notions of AI ethics and Expla	inable AI.			
Progran	nme Outcomes (POs)				
PO1	Apply mathematical foundations, algorithmic modelling and design of computer-based systemeters and the systemeter of the		ry in tł	ne	
PO2	Identify, formulate, critically analyse, and sol and Engineering, considering recent and futur		ter Sci	ence	
PO3	Design a system, component, or process to such as economic, social and ethical in the fie	eld of Computer Science and Engineerin	ıg.		
PO4	Use current techniques, skills, and tools nece advanced knowledge of a selected area within	essary for computing practice and demo the Computer Science and Engineering	onstrat discip	e line.	
PO5	Demonstrate an ability to engage in lifelong le effectively on teams to accomplish a common		d funct	ion	
PO6	Critically analyse existing literature in an area research- oriented methodologies to tackle gap	a of specialization and develop innovati	ive and	l	
Course	Outcomes (COs)				
	ents will be able to				
CO1	Apply the searching techniques, heuristic problems.	algorithms and game playing to sol	lve rea	al tim	e
CO2	Analyze the logical inference in first o	rder logic and the logical language	e to o	expres	s

CO2	Analyze the logical interence in first order logic and the logical language to express
	knowledge about complex worlds.
CO3	Examine basic ideas of planning types and monitoring for the successful completion of the plan.
CO4	Apply utility theory and probability theory for handling uncertain worlds.
CO5	Examine the ethical considerations of Artificial Intelligence and interpret the concepts of
	explainable Artificial Intelligence.

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	1	2	1	3	1	1
2	2	3	1	2	1	2
3	1	1	2	1		2
4	2	2				3
5	1		2	1		1

Unit I INTELLIGENT AGENTS AND SEARCH TECHNIQUES 9 Hours

Definitions - Intelligent agents: Nature of environment-Structure of agents-problem solving- Searching: uninformed search strategies-Searching with partial information -Heuristics: Local search algorithms - Constraint satisfaction problems: Backtracking search - Game playing: Optimal decisions-Alpha, Beta pruning.

Unit II KNOWLEDGE REPRESENTATION AND REASONING

9 Hours

9 Hours

Logical Agents: Propositional logic-Reasoning patterns in propositional logic-Agent based propositional logic-First order logic: Syntax and semantics-First order inference: Unification- Chaining- Resolution strategies-Knowledge representation: Objects-Actions-Events- Techniques.

Unit III PLANNING AGENTS

Planning problem: STRIPS- State space search-Partial order planning-Graphs-Hierarchical network planning-Nondeterministic domains-Conditional planning-Execution monitoring and replanning- Continuous planning-Multi agent planning.

Unit IV AGENTS AND UNCERTAINTY

Acting under uncertainty - Probability notation-Baye's rule and use -Probabilistic reasoning: Bayesian networks-Other approaches-Time and uncertainty: Temporal models-Simple decisions: Utility theory - Decision network - Complex decisions: Value iteration-Policy iteration.

UNIT V AI ETHICS AND RESPONSIBLE AI

Ethical considerations in AI development and deployment – Discrimination, bias and fairness-Algorithmic decision making- Interpretable versus explainable models - Newly emerging paradigms - Case studies and discussions on ethical dilemmas in AI.

References

- 1. Stuart Russell and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson Education Limited, 2016.
- 2. Elaine Rich, Kevin Knight and Shivashankar B Nair, Artificial Intelligence, Tata McGraw Hill, 2019.
- 3. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publisher, 2010.
- 4. Animesh Mukherjee, AI and Ethics AI and Ethics, A computational perspective, IOP Science, 2023.
- 5. David L. Poole, Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, Second Edition, 2017.
- 6. Sohom Ghosh, Dwight Gunning, Natural Language Processing Fundamentals, Packet Publisher, 2019.

37

9 Hours

9 Hours

45 Hours

Total

24CS52				SOF	т сом	IPUTI	NG				T P	
	Pre	e-requisit	0					٨	sessment Pattern	3	0 0	
• F	Fundamentals of	-		igence		Mod	le of As	sessme		Wei	ghtage	<u>.</u> (%
	asic knowledge								ll Assessment		40	
	Fuzzy Logic.	50 01 1 00		UN OILD	unu				ninations		60	
	Objectives											
•]	To conceptualiz	ze the fund	ctioning	g of the	human	brain u	sing ne	ural ne	tworks.			
	To analyze and problems effect	•		-	ting an	d optii	nizatio	n techr	niques in order to	o solv	/e	
	To analyze and problems effect				ting an	d optii	nizatio	n techr	niques in order to	o solv	/e	
Progran	nme Outcomes	s (POs)										
PO1	An ability to practical prob		lently of	carry o	ut rese	arch /	investig	gation a	and development	work	to sol	ve
PO2	An ability to v											
PO3	Students shou Science and E			demon	strate	a degr	ee of	master	y over the area	of C	ompute	er
PO4				develop	system	n appli	cation s	softwar	e for distributed	and		
	centralized co											
PO5	software com effectively w	nponents orking wi	and death the property of the	esign s fessiona	olution als in v	s for a various	eal wo	orld provering f	w hardware arcl oblems by Comm fields and pursue d automation arena:	nunica resea	ating a	
PO6	Model a co	mputer l	based	automa	ation s	ystem	and	design	algorithms that		ore th	ne
<u> </u>	understanding		deoffs	involve	d in dig	gital tra	nsforma	ation.				
	Dutcomes (CO ents will be abl	,										
				1 '	1.	1 0	·' 1'	· c	····· 1 1 ··	1		
CO1									rtificial neural netw			
CO2	working prin	e supervis	ed and	unsup network	ervised	learnir	ig netw	orks ai	nd illustrate the ar	chited	cture a	na
CO3		concept				desig	n an e	expert	system by applyin	ng th	e fuzz	zy
CO4		features a	nd ope	erators i	n genet	tic algo	rithms	and app	bly the genetic algo	orithn	n for re	eal
CO5							multi	spectra	al image fusion r	nodel	ing an	d
Articulo	optimization	of traveli	ng sale	sman pi	roblems	5.						
AI ucuia		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	2	2	1	3	1	1				
		2	2	2	1	2	2	2				
		2	2	3	1	2	2	2				
		3	1	2	2	1		2				
		4	2	1				3				
		5	2		2	1		3				

Introduction to	Soft Computing- Difference between soft computing and hard computing	g - Various
types of soft c	computing techniques - Applications of soft computing - Biological N	leuron-Nerve
structure and syn	apse - Artificial Neuron and its model - Activation functions - Neural netw	vork
architecture - sing	le layer and multilayer feed forward networks – McCullochPitt's neuron model.	
Unit II	NEURAL NETWORKS	9 Hours
Supervised Learn	ing Networks: Perceptron Networks - Adaptive Linear Neuron- Multiple Ad	daptive
Linear Neuron - E	Back-propagation Network. Unsupervised Learning Networks: Counter propagati	on network -
architecture & fur	actioning – Adaptive Resonance Theory - Architecture & functioning.	
Unit III	FUZZY SYSTEMS	9 Hours
Introduction to F	uzzy logic - Crisp sets - Fuzzy sets - Crisp relations - Fuzzy relations - Fuz	zy
membership func	tions - Operations on Fuzzy sets - Fuzzification - Defuzzification techniques	-Fuzzy logic
controller design	- Applications of Fuzzy logic.	
Unit IV	GENETIC ALOGORITHMS	9 Hours
Genetic algorithm	ns: Basic concepts - Encoding, Fitness function, Reproduction- Encod	ing- Binary,
Ū.	nal, Permutation, Value, Tree Encoding - Selection - Roulette wheel,	•

Genet Octal. Random, Tournament, Rank, and Steady state selections - Crossover - Mutation- Convergence of GA -Applications of GA.

UNIT V HYBRID SOFT COMPUTING TECHNIQUES

INTRODUCTION

Neuro-fuzzy hybrid systems - Genetic neuro hybrid systems - Genetic fuzzy hybrid and fuzzy genetic hybrid systems - Applications: A fusion approach of multispectral images with SAR - optimization of traveling salesman problem using genetic algorithm approach.

References

Unit I

- J.S.R. Jang, C.T. Sun and E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI / Pearson 1. Education, 2015.
- 2. S. Rajasekaran and G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications, Prentice-Hall of India Pvt. Ltd., 2017.
- 3. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education India, 2013.
- 4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, 3rd Edition, Wiley Publisher, 2018.
- 5. Timothy J.Ross, Fuzzy Logic with Engineering Application, McGraw Hill, 2016.

9 Hours

9 Hours

45 Hours

Total

24CS53		MUL	ГICOR	EARC	CHITE	CTUR	E AND	PROG	RAMMING	L T P C
		D	• • /			I				3 0 0 3
		Pre-req						0.4	Assessment Pattern	
	Basic knov	-	-	ter Arc	hitectur	_			ssment	Weightage(%
•]	Parallel Co	mputing I	Basics.						ternal Assessment	40
Common	Ohioding	_					Semest	er End	Examinations	60
	Objectives									
•	Γo underst	and the ne	ed for n	nulti-co	ore proc	essors,	and the	ir archi	tecture.	
• ′	To underst	and the ch	allenge	s in par	allel an	d multi	threade	d progr	amming.	
• ′	Го learn ab	out the va	rious pa	arallel p	orogran	nming p	aradigi	ns.		
• ′	To develop	multicor	e progra	ams and	l design	paralle	el soluti	ons.		
Progran	nme Outco	omes (PO	s)							
PO1	An abilit	v to inde	ependen	tlv car	rv out	researc	ch / inv	estigati	ion and development w	ork to solve
	practical	, problems.	•	•	•			U	L.	
PO2	An ability			sent a s	ubstant	ial tech	nical re	port/do	cument.	
PO3				to dem	onstrate	e a deg	ree of a	mastery	v over the area of Con	nputer
		nd Engine								
PO4	Efficientl centralize	y design ed comput	, build	l and ironme	develo nts in v	op sys arying (tem a domain	pplicati s and pl	on software for dist latforms.	ributed and
PO5		_	-					_	e new hardware arch	itectures, the
									d problems by Comm	
									ng fields and pursue re	
DO(r and automation arenas.	
PO6									orithms that explore the	e
Course	understar Outcomes		ie trade	ons inv	olved 1	n digita	u transi	ormatic	DII.	
	ents will b	· ,								
C01	Describe	multicor	e archit	ectures	and ide	entify th	eir cha	racteris	tics and challenges.	
CO1 CO2		the issues								
CO3		ograms us			0					
CO4		barallel pr					non pro	blems.		
CO5	Compar	e and cont	rast pro	gramm	ing for	serial p	rocesso	ors and	programming for paralle	l processors.
Articula	tion Matr	ix		-	-					
		CO.								
			PO1	PO2	PO3	PO4	PO5	PO6		
		No.								
		1	1	2	3	3	3	3		
		2	1	1	1	2	1	2		
		3	2	1			2	2		
		4	1		2	1	1	2	•	
			1				1			

Unit I	MULTI-CORE PROCESSORS	9 Hours
	o Multi-core architectures - SIMD and MIMD systems - Interconnection	
Symmetric an	d Distributed Shared Memory Architectures - Cache coherence - Performan	ice Issues –
Parallel progra	m design.	
T T • / T T		0.11
Unit II	PARALLEL PROGRAM CHALLENGES	9 Hours
primitives (mu	Scalability – Synchronization and data sharing – Data races – Synchronization bettexes, locks, semaphores, barriers) – deadlocks and livelocks – communication beto variables, signals, message queues and pipe	
Unit III	SHARED MEMORY PROGRAMMING WITH OpenMP	9 Hours
Library function	cution Model – Memory Model – OpenMP Directives – Work-sharing Coons – Handling Data and Functional Parallelism – Handling Loops – Performance	onstructs –
Considerations	•	
Unit IV	DISTRIBUTED MEMORY PROGRAMMING WITH MPI	9 Hours
	execution – MPI constructs – libraries – MPI send and receive – Point-to-point munication – MPI derived datatypes – Performance evaluation.	and
UNIT V	PARALLEL PROGRAM DEVELOPMENT	9 Hours
Case studies -	- n-Body solvers - Tree Search - OpenMP and MPI implementations and com	parison.
	Total	45 Hours
References		
1. Peter	S. Pacheco, "An Introduction to Parallel Programming, Morgan-Kauffman/Elsevi	ier. 2021.
2. Darryl	Gove, "Multicore Application Programming for Windows, Linux, and Oracle S n, 2011.	
	el J Quinn, "Parallel programming in C with MPI and OpenMP, Tata McGraw	Hill,2003.
	Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts gies in Multicore Application Programming, Morgan Kaufmann, 2015.	and
	ses in Multicole Application Programming, Morgan Raumann, 2015.	

24CS54		DAT	FA SCIEN	CE				L		T P	
							<u> </u>	3		0 0	3
T	Pre-requisite	1 0 1	1 M.	do of /	Assessn		nent Pat			htag	<u>~(0/</u>
	Understanding of linear alg Probability and Statistics.	ebra, Calcu	,				essment	vv	eig	40	e(70
	Basic knowledge of m	achina la			End Exa					60	
	concepts, data processing and					amman	0115			00	
	Objectives	a unurysnig.									
	To introduce the fundamenta	l concepts o	f data scien	ce							
	To apply statistical methods	•			v concl	usions	from date	9			
			•					u.			
	To utilize probability theory			•			•			1	
	Fo employ basic machine lea	irning algori	thms for bo	th supe	rvised a	ind uns	upervise	d learnin	g t	asks.	
Program	nme Outcomes (POs)										
DO1	A 1'1', , ' 1 1 ,	1	· 1			1 1	1		1 /		
PO1	An ability to independent practical problems.	iy carry ou	research .	invest	ugation	and d	evelopm	ent wor	кt	U SO	ve
PO2	An ability to write and pres	ent a substa	ntial technic	al repo	rt/docu	ment.					
PO3	Students should be able						er the a	rea of	Co	mput	er
	Science and Engineering.					5				1	
PO4	Efficiently design, build						are for	distrib	ute	d aı	nd
	centralized computing envi										
PO5	Understand the working										
	software components and										ind
	effectively working with orientation for a lifelong pr								arc	n	
PO6	Model a computer base								nlo	re t	he
100	understanding of the tradeo					i uigo	i i i i i i i i i i i i i i i i i i i	unat enj	P10	10 1	
Course (Dutcomes (COs)		0								
The stude	ents will be able to										
CO1	Understand the growing i	mportance (of data scie	nce in t	todav's	world	by evalu	ating its	im	nact	on
COI	various industries.		n uata sere		iouay s	wonu	by evalu	ating its	1111	paci	on
CO2	Apply core probability con	ncepts and re	1								
			elevant stati	stical d	istribut	ions to	analyze	and mod	el 1	netwo	ork
002	mobilization patterns.	1	elevant stati	stical d	istribut	ions to	analyze	and mod	el 1	netwo	ork
CO3	Evaluate the validity of c	laims and h	ypotheses	using a	ppropria	ate stat					
CO3	Evaluate the validity of c intervals, considering pote	laims and h ntial limitat	ypotheses to solve the second	using aj wer of t	ppropria the tests	ate stat	istical te	sts and o	con	fiden	ice
CO3 CO4	Evaluate the validity of c intervals, considering pote Examine relationships bet	laims and h ential limitat ween variab	ypotheses ions and po les using co	using aj wer of t rrelatio	ppropria the tests on analy	ate stat sis and	istical te linear al	sts and o	con chn	fiden	ice
CO3	Evaluate the validity of c intervals, considering pote Examine relationships bet Create basic machine lear	laims and h ential limitati ween variab rning model	ypotheses ions and po les using co s using sup	using aj wer of t rrelatio	ppropria the tests on analy	ate stat sis and	istical te linear al	sts and o	con chn	fiden	ice
CO3 CO4 CO5	Evaluate the validity of c intervals, considering pote Examine relationships bet Create basic machine lear solve real-world data scien	laims and h ential limitati ween variab rning model	ypotheses ions and po les using co s using sup	using aj wer of t rrelatio	ppropria the tests on analy	ate stat sis and	istical te linear al	sts and o	con chn	fiden	ice
CO3 CO4 CO5	Evaluate the validity of c intervals, considering pote Examine relationships bet Create basic machine lear	laims and h ential limitati ween variab rning model	ypotheses ions and po les using co s using sup	using aj wer of t rrelatio	ppropria the tests on analy	ate stat sis and	istical te linear al	sts and o	con chn	fiden	ice
CO3 CO4 CO5	Evaluate the validity of c intervals, considering pote Examine relationships bet Create basic machine lean solve real-world data scien tion Matrix	laims and h ential limitati ween variab ming model nce problema	ypotheses to ions and po les using co s using sup s.	using aj wer of t rrelatio ervised	ppropria the tests on analy and ur	ate stat s. sis and superv	istical te linear al	sts and o	con chn	fiden	ice
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Unit I INTRODUCTION TO DATA SCIENCE AND STATISTICS

Data Science- Big Data and Data Science – Datafication – Current landscape of perspectives, Matrices – Matrices to represent relations between data, and necessary linear algebraic operations on matrices - Approximately representing matrices by decompositions (SVD and PCA); Statistics: Descriptive Statistics and Data Visualization – Statistical Inference: Populations and samples- Measures of Central Tendency - Measures of Variation-Measures of Shape-Data Visualization.

Unit II NETWORK MOBILIZATION AND SAMPLING STATISTICS

9 Hours

Probability Theory - Terminology - Axioms of Probability -Bayes' Theorem-Random Variables - PDF & CDF of Continuous-Random Variable-Binomial Distribution-Poisson Distribution-Geometric Distribution-Uniform Distribution-Exponential Distribution-Normal Distribution-Chi-Square Distribution - Student's t-Distribution - F: Distribution – Population Parameter & Sample Statistic - Probabilistic Sampling - Non-Probability Sampling - Sampling Distribution - Central Limit Theorem - Sample Size Estimation for Mean of the Population - Estimation of Population Parameters - Method of Moments - Estimation of Parameters Using Maximum Likelihood Estimation.

Unit III INFERENCE STATISTICS AND ADVANCED ANALYSIS TECHNIQUES

9 Hours

Confidence Intervals (CI) : CI for Population Mean - CI for Population Proportion - CI for Population Mean when Standard Deviation is unknown - CI for Population Variance - Hypothesis Testing : Setting up a Hypothesis Test - One-Tailed and Two-Tailed Test - Type I Error, Type II Error, and Power of the Hypothesis Test - Hypothesis testing for Population Mean with Known Variance: Z-Test - Hypothesis testing for Population Proportion: Z-Test - Hypothesis test for Population Mean under Unknown Population Variance: t-test – Paired Sample t-test - Two-Sample Z and t-test - Two-Sample Z-Test for Proportions - Effect Size: Cohen's D - Hypothesis Test for Equality of Population Variances - Nonparametric Tests: Chi-Square Tests - Analysis of Variance: Multiple t-Tests for Comparing Several Means - One-way ANOVA - Two-way ANOVA.

Unit IV CORRELATION ANALYSIS AND APPLIED LINEAR ALGEBRA

9 Hours

Correlation Analysis : Pearson Correlation Coefficient - Spearman Rank Correlation – Point Bi-Serial Correlation - The Phi-Coefficient - Applied Linear Algebra : Why do we need Linear Algebra? - Matrix Algebra and Operations - EigenValues and EigenVectors – Linear Algebra in Dimensionality Reduction - Linear Algebra in Natural Language Processing - Linear Algebra in Machine Learning.

UNIT V BASIC MACHINE LEARNING ALGORITHMS

9 Hours

Data Cleaning and handling - Supervised Learning : Linear regression - The bias-variance tradeoff - LASSO, Ridge and Elastic Net - An overview of classification - Decision trees and k-nearest neighbors -Ensemble methods (Bagging, Random Forests and Boosting) - Unsupervised learning : Clustering (kmeans, spectral clustering and overview of other methods) - Principal Component Analysis.

	Total	45 Hours
Refere	nces	
1.	Cathy O'Neil and Rachel Schutt, " Doing Data Science, Straight Talk From The Front O'Reilly, 2014.	line",
2.	Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", Edition. ISBN 0123814790, 2011.	Third
3.	Mohammed J. Zaki and Wagner Miera Jr, "Data Mining and Analysis: Fundamental (Algorithms", Cambridge University Press, 2014.	Concepts and

43

9 Hours

- 4. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, O'Reilly, 2016.
- 5. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media, 2015.
- 6. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly Media, 2012.

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CO2	Develop the softw	are produc	ct using	g Agile-	based r	nethodo	ology.					
CO3	Plan and execumanagement.							proces	ss based o	on k	nowled	lge
CO4	Choose the better techniques.	er proces	ss bet	ween	require	ment	gatherin	ng and	l requireme	ent e	licitatio	on
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9 Hours	nit I AGILE SOFTWARE DEVELOPMENT
e Manifesto and ams -Agility in derstand as	undamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, - evelopment -Traditional Model vs. Agile Model - Classification of Agile Methods -Agile rinciples -Agile Project Management -Agile Team Interactions -Ethics in Agile Team esign, Testing - Testing plan links between testing, roles and key techniques, principles, unde means of assessing the initial status of a project -Agile Documentations - Agile Drivers, C alues.
9 Hours	nit II AGILE PROCESS
pment - Extreme	ean Production -SCRUM, Crystal, Feature Driven Development- Adaptive Software Developr rogramming: Method Overview -Lifecycle -Work Products, Roles and Practices.
9 Hours	nit III AGILITY AND KNOWLEDGE MANAGEMENT
KM in Software	gile Information Systems -Agile Decision Making -EarlS Schools of KM -Institutional Knowl ycle -Development, Acquisition, Refinement, Distribution, Deployment, Leveraging -KM ngineering -Managing Software Knowledge -Challenges of Migrating to Agile Methodolog nowledge Sharing -Role of Story-Cards -Story-Card Maturity Model (SMM)
9 Hours	nit IV AGILITY AND REOUIREMENTS ENGINEERING
9 Hours - Using Agile -	nit IV AGILITY AND REQUIREMENTS ENGINEERING npact of Agile Processes in RE-Current Agile Practices -Variance -Overview of RE -
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•	Fundamentals of Softwar	e testing.	igineering					essment			40	()
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Course	Objectives											
•	To introduce the important	nce of Qua	lity of So	ftware	Produc	ts.						
•	To elicit, analyze, prioriti	ize, and ma	nage botl	h functi	ional ar	nd quali	ty requ	irements	s.			
•	To plan for Software qua	litv assurar	nce.									
•	To learn the concepts of I	•										
•	To understand and apply	•	tion and	anality	manao	rement	technio	ues in s	oftware	e der	velonm	er
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PO2	An ability to write and p	present a su	bstantial	technic	al repo	rt/docu	ment					
PO3	Students should be a							ver the	area	of C	Compu	er
	Science and Engineerin	ıg.			C		•				•	
PO4	Efficiently design, buil							for	distri	buted	d a	nc
	centralized computing e		-	-		-						
PO5	Understand the working		ent Indu	istrv tr	rends	tho	now	ardware	archi	tecti	ires, t	he
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Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3 2 2 2	n solution ssionals nal developmation plved in d ftware qu uality ass andardiza pplying s oftware rec PPO2 3 2	ns for in var opment systen ligital tr ality a urance ation in oftware cliabilit PO3 3 2	real violations of the second	world pengineen nputer a desig mation. ee in soft s in soft are proje y and re iques. PO5 2 2	problem ring fit and auto n algo ftware p ects. eliabilit PO6 3 3	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nc ch
Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3	n solution ssionals nal developmation olved in d olved in d ftware qu uality ass andardiza pplying s oftware re PO2 3	ns for in var opment systen ligital tr lality a urance ation in oftware eliabilit PO3 3	real vious et tin con n and ransfor ssurance metric: softwa e qualit y techn PO4 3	world pengineen nputer a desig mation. the in soft are projection y and re- iques. PO5 2	problem ring fi and auto n algo ftware p ects. eliabilit PO6 3	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nc ch
Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3 2 2 2	n solution ssionals nal developmation plved in d ftware qu uality ass andardiza pplying s oftware rec PPO2 3 2	ns for in var opment systen ligital tr ality a urance ation in oftware cliabilit PO3 3 2	real violations of the second	world pengineen nputer a desig mation. ee in soft s in soft are proje y and re iques. PO5 2 2	problem ring fit and auto n algo ftware p ects. eliabilit PO6 3 3	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nc ch
Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3 2 2 3 3 4 2	n solution ssionals nal developmation plved in d ftware qu uality ass andardiza pplying s oftware re PO2 3 2 1 2	ns for in var opment systen ligital t urance ation in oftware cliabilit PO3 3 2 1 2	real violations of the second	world pengineer nputer a desig mation. ee in soft s in soft re proje y and re iques. PO5 2 2 1 2	problem ring fi and auto n algo ftware p ects. eliabilit PO6 3 3 3 1	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nd ch
Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3 2 2 3 3	n solution ssionals nal developmation plved in d ftware qu uality ass andardiza pplying s oftware rec PO2 3 2 1	ns for in var opment systen ligital tr aality a urance ation in oftware cliabilit PO3 3 2 1	real violations of the second	world pengineen nputer a desig mation.	problem ring fi and auto n algo ftware p ects. eliabilit PO6 3 3 3	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nc ch
Course The stud CO1 CO2 CO3 CO4 CO5	effectively working v orientation for a lifelon Model a computer b understanding of the tra Outcomes (COs) dents will be able to Understand the signific Understand and apply Understand and apply Identify contemporary Develop and apply the ation Matrix	vith profes g professio based auto adeoffs invo cance of so software q software st issues in a practice so D. No. PO1 1 3 2 2 3 3 4 2	n solution ssionals nal developmation plved in d ftware qu uality ass andardiza pplying s oftware re PO2 3 2 1 2	ns for in var opment systen ligital t urance ation in oftware cliabilit PO3 3 2 1 2	real violations of the second	world pengineer nputer a desig mation. ee in soft s in soft re proje y and re iques. PO5 2 2 1 2	problem ring fi and auto n algo ftware p ects. eliabilit PO6 3 3 3 1	ns by (elds an omation orithms projects. rojects.	Commu ad purs arenas. that	inica sue	ting a resear	nc ch

Unit I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9 Hours

The Role of SQA - Software Quality Assurance Plan - Software Quality Assurance considerations - Need of Software Quality Assurance - SQA People.

Unit II MANAGING SOFTWARE QUALITY

Quality Management-Software Configuration Management-Managing Software organizations- Managing Software quality –Defect Prevention.

Unit III SQA METRICS

Software Quality-Total Quality Management (TQM)-Quality Metrics-Software Quality metric Analysis.

Unit IV SOFTWARE QUALITY PROGRAM AND SQA STANDARDIZATION 9 Hours

Software quality program Concepts-Establishment of a software quality program-Software Quality Assurance planning-purpose and scope of Software Quality Program- Software standards-ISO 9000 Quality system standards-Capability Maturity model and the Role of SQA in software development maturity- Six Sigma Concepts.

UNIT V RELIABILITY ENGINEERING PROCESS

Reliability Definition-Quality and Reliability-Reliability Functions-Reliability Mathematics - Measures of Reliability - Defining the product-Testing the acquired software-Learning reliability concepts-s/w and h/w reliability.

	Total	45 Hours	
References			

- 1. Mordechai Ben-Menachem / Garry S Marliss, —Software Quality, Vikas Publishing House, Pvt, Ltd., New Delhi, 2021.
- 2. Meir Liraz, Quality Assurance: How to set up and manage a Quality Control System, Kindle Edition, 2013.
- 3. SolisTech, Quality Assurance: Software Quality Assurance made easy, KindleEdition, 2016.
- 4. Watts S Humphrey, Managing the Software Process, Pearson Education Inc, 2007.
- 5. John D Musa, —Software Reliability Engineering, 1998.
- 6. Gordon G Schulmeyer, —Handbook of Software Quality Assurance, Third Edition, Artech House Publishers, 2007.
- 7. Charles E. Ebeling, —An introduction to Reliability and Maintainability engineering, TMH, 2000.
- 8. RoyBillington and Ronald N. Allan, —Reliability Evaluation of Engineering Systems, Springer, 2007

48

9 Hours

9 Hours

9 Hours

24CS57		DI	GITAI		GE PR	OCESS	SING			L	T P	C
										3	0 0	3
	Pre-req	uisite							nent Pattern			
• I	Basic of Computer	Vision, in	ncludir	ng featu			Assessr			Wei	ghtag	e(%)
	extraction, pattern	n extra	ction,	patte					essment		40	
	ecognition.	2	0			mester	End Ex	aminat	ions		60	
	Basic knowledge		ansfor	ms a	nd							
	compression techniq	ues.										
	Objectives											
	To impart fundament and transform function	-	of digi	tal ima	ge proc	essing	based o	on imag	ge representat	ions,	operat	ions
	Fo inculcate the kno obtain the desired im			hancem	ent, res	storation	n, comp	pression	ı by appropria	te tec	hnique	es to
•]	To apply the related	to image s	egmen	tation a	and reco	gnition	technie	ques to	real world pro	oblem	s.	
	nme Outcomes (PO	-	~			~		-				
PO1	An ability to inde		carry	out re	search	/ inves	tigatior	n and c	levelopment	work	to sol	ve
PO2	practical problems. An ability to write		at a cul	stantia	ltaahni	and ran	wt/door	mont				
PO2 PO3	Students should b	<u> </u>							er the area	of C	omput	er
105	Science and Engine			onstratt		give 0	i masu	cry UV	er ute atea	or c	omput	
PO4	Efficiently design		and d	levelop	syster	m app	lication	softv	vare for dis	tribut	ed a	nd
	centralized comput											
PO5	Understand the w	-							ardware arcl	nitectu	ires,	the
	software compone	nts and	design	solutio	ons for	real v	world j	problen	ns by Comm	unica	ting a	and
	effectively workin										ch	
	orientation for a lif											
PO6	Model a comput								orithms that	expl	ore t	he
	understanding of th	e tradeoff	s invol	ved in o	ligital t	ransfor	mation.					
	Outcomes (COs)											
	ents will be able to											
CO1	Understand the in											
	Implement the ari image.		-	-	_	-			_	_		
CO3	Analyze the tech		itable	for ima	ige enh	anceme	ent and	l image	e restoration	in sp	atial ai	nd
COA	frequency domain						to		· · · ·			
CO4 CO5	Apply image com		<u> </u>						<u> </u>			
	Apply an image re	presentati		recogn		cinique	5 10 80	ive ieal	worra proble	1115.		
Arucula	uon matrix	CON	DO1	DO3	DO1	DO 4	DO.	DOC]			
		CO. No.	rui	PO2	PO3	PO4	PO5	PO6				
		1	2	2		3						
		2	2		3	3	2	3				
		2	2	2		2						
		3	3	3		2						
		4	3			2	3	3				
		5	2	2	2	2	2	3				
		-				1		-	1			

Unit I Digital Image Fundamentals	9 Hours
Nature of digital image processing - digital image representation - types of images	
processing operations - fundamental steps in image processing - image processing appli	
imaging system - physical aspects of image acquisition - sampling and quantization - re-	lationship
between pixels - image storage and file formats.	
Unit II Image Processing Operations and Transforms	9 Hours
omeni ininger rocessing operations and transforms	> 110u15
Arithmetic operations - logical operations - geometrical operations - image interpolation	ion techniques -
convolution and correlation operations - data structures and image processing applications de	-
- transforms: need for image transforms - properties of fourier transform - discrete co	
discrete sine transform - walsh transform - hadamard transform - haar transform - slant trans	
KL transforms.	
Unit III Image Enhancement and restoration	9 Hours
Need for image enhancement - Point operations - Spatial filtering concepts - Frequency	
filtering - Image restoration model: Categories of image degradations - Image restoration in	1 noise -
Image restoration techniques.	
Unit IV Image Compression and Segmentation	9 Hours
Chief () Indee Compression and Segmentation	
Compression: Model – Types of redundancy – Lossless compression and lossy compression	ession algorithms
- Segmentation: Classification – Detection of Discontinuities – Edge detection - Co	
Principles of Thresholding – Region based segmentation – Dynamic segmentation. Morpholog	
Erosion, Opening and Closing. Hit and Miss Algorithms Feature Analysis.	50
UNIT V Image Representation and Recognition	9 Hours
Boundary representation – Boundary Descriptions – Regional Descriptors – Fe	
Techniques - Recognition: Pattern and Pattern classes - Template matching - classifier algo	
Evaluation of classifier algorithms - Case study: Biometrics- clustering techniques and its evaluation	luation.
Та	tal 45 Houng
References	tal 45 Hours
 Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. 4ed, PHI/Pe 2018. 	arson Education,
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar, Digital Image Processing, Education, 2nd edition, 2020.	McGraw Hill

3. S. Sridhar, Digital Image Processing, Oxford University Press; Second edition, 2016.

24CS58	I	NFORM	ATIO	N RET	RIEVA	L TEC	CHNIQ	UES		L 3	T P	C
	Pre-requ	usita						Accore	nent Patte	-	0 0	3
• 1	Jnderstanding of		conce	ente a	nd M	ode of	Assessr				ightage	(%)
	etrieval techniques.	uatabase	conce	pis a					essment		40	(,,,,)
	Basic knowledge	of info	rmatior	n theo				aminat			60	
	oncepts.				5							
	Objectives											
ii • T	To gain the knowled ndexing and web sea To learn the retrieval To familiarize with th	irching. modellin	g and r	etrieval	evalua	tion and	d under	stand th	ne various a	applicati	ions of I	
					in, uigi						inctions	•
Program	me Outcomes (POs	5)										
PO1	An ability to ind practical problems.	ependent	ly carr	y out r	esearch	ı / inve	stigatio	on and	developme	ent work	to solv	ve 🛛
PO2	An ability to write a											
PO3	Students should b		to den	nonstrat	e a d	egree o	of mas	tery o	ver the ar	ea of	Comput	er
	Science and Engine											_
PO4 E	fficiently design,								for d	istribute	ed ar	ıd
PO5 U	centralized computi Inderstand the wor	•					-		orduura	rahitaa	turos ti	<u> </u>
105 0	software component											
	effectively workin											
	orientation for a life										100000	
PO6 N	Aodel a computer	r based	autor	nation	system	n and	desig	n algo			olore th	ne
	understanding of the	e tradeoff	s invol	ved in c	ligital t	ransfor	mation.					
Course (Dutcomes (COs)											
The stude	ents will be able to											
CO1	Classify the inform	nation ret	rieval s	ystem a	and web	search	1.					\neg
CO2	Outline the class	sic infor	mation	retrie	val m	odels a	and ev	aluate	the perfe	ormance	e of a	n
	information retriev											
CO3	Implement the con				uction	and co	ompress	sion for	r informati	ion retr	ieval and	t
<u> </u>	query processing in								in make an	1 <i></i> -		
CO4	Design an efficient Understand the f				•						nd that	
CO5	applications in var					normat		euleval	(IK) IIIC	Juers a	na thei	1
Articulat	tion Matrix	U										
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	2	2	1	2	2	2				
		1	2	2	1	3	3	2				
		2	1	1	1	3	2	1				
		3	2	1	2	3	3	3				
		4	1	2	2	1	2	3				
		5	2	2	3	3	1	3				

Unit I	INTRODUCTION	9 Hours
Inform	ation-Information versus Data Retrieval-Basic Concepts -Past, Present, Future-Retrievation Retrieval Systems-Architecture-Characterization of IR Model -Documents a mance Evaluation-Indexing-Web Searching-IR Versus Web Search-Components of a Se	and Update-
Unit I	I RETRIEVAL MODELING AND RETRIEVAL EVALUATION	9 Hours
	omy and Characterization of IR Models-Classic Information Retrieval Model- Alter etic, Algebraic, Probabilistic Model-Structured Text Retrieval Model-Models for val Evaluation-Retrieval Metrics-Retrieval Performance Evaluation-Reference Collection.	
Unit I	II SQA INDEXING AND QUERY PROCESSING	9 Hours
Search	and Dynamic Inverted Indices-Index Construction and Index Compression. Searching- Sec ing and Pattern Matching. Query Operations-Query Languages-Structural Query- Query Pr Processing-Automatic Local and Global Analysis.	
Unit I	V WEB RETRIEVAL AND WEB CRAWLING	9 Hours
Link A Crawle	Veb-Search Engine Architectures-Crawling the web-Crawling Documents and Email-Docum Analysis -Ranking-Simple Ranking Functions-Learning to Rank-Browsing - Applications of er-Evaluating Search Engines-Social Search.	f a Web
UNIT	V CROSS LINGUAL AND MULTIMEDIA INFORMATION RETRIEVAL	9 Hours
Approa – Othe Query	Lingual Information Retrieval: IR models – Language Problems in IR - Problems of CLI aches to Translation in CLIR - Using manually constructed Translation systems and resource er methods to improve CLIR - Multimedia Information retrieval (MIR): Introduction - data languages - Spatial access methods - A general multimedia indexing approach - One-dime - Two-dimensional colour images - Automatic picture extraction.	tes for CLIR modelling -
		45 11
Refere	ences	45 Hours
1.	Ricardo Baeza Yates, Berthier Ribeiro Neto, Modern Information Retrieval: The C Technology behind Search, (ACM Press Books), Second Edition, Reprint 2016.	concepts and
2.	Chrstopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Introduction to Retrieval Cambridge University Press, First South Asian Edition, 2011.	Information
3.	Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, Information Retrieval I and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts Londo 2016.	1 0
4.	Bruce Croft, Donald Metzler, Trevor Strohman, Search Engines: Information Practice, Pearson Education, 2015.	Retrieval in
5.	Jian-Yun Nie, Cross-Language Information Retrieval by Morgan & Claypool Publisher ser	ries, 2010.

24CS59		N	ATUR	AL LA	NGUA	GE PO	ORCES	SSING		L	TP	, (
						-				3	00	
		re-requisit							ssessment Pattern			(0)
	Understanding				pts,			ssessme	ent Il Assessment	Wei	ightag 40	e(%
	language mod Basic experier	-							ninations		<u> </u>	
	techniques.		a proce	ssing		Sem		nu Exai	linations		00	
	Objectives											
	To understand	the basics	of ling	uistics.	probab	ility and	l statist	ics.				
	To understand		-		-	-						
	To outline dif		••			-		Jenng.				
	To explore the	•	0	•				of sent	ences			
	To apply the r						-					
•	ro appry the r	nethous for	uiscou	ise ana	iysis, q	uestion	answei	ing, and	u chatbots.			
Progran	nme Outcom	es (POs)										
_			1 /1			1 /	. ,.	<i>.</i> .	1 1 1 /	1		1
PO1	An ability to practical pro		iently of	carry o	ut rese	arch /	investig	gation a	and development	work	to so.	lve
PO2	An ability to		present	a subst	antial to	echnica	l report	/docum	ient.			
PO3									y over the area	of C	Comput	er
	Science and											
PO4									software for dis	stribu	ted a	nd
PO5	centralized of Understand								erms. w hardware arcl	hitect	11700	tha
105									oblems by Comm			
									Fields and pursue			
									d automation arena			
PO6									algorithms that	expl	ore t	he
Course	understandin Outcomes (C	-	deons	involve		gital tra	nstorma	ation.				
	ents will be a											
CO1			of ling	istics	nrohahi	ility an	d statis	tics ass	ociated with NLP.			
CO2					<u> </u>				uage models, name	ed en	tity	
	tagging, an		-			0	0	, 0	C ,		2	
CO3			y techi	niques	for an	nalyzing	g and	represe	enting the structur	re of	natu	al
<u> </u>	language se		1.00	-4	1			-1	. 1	- 4		1.
CO4	and concep	•	amerei	nt word	a sense	es, sem	antic r	oles, al	nd relationships b	etwee	en wor	as
CO5	Develop a s		bot usir	ng dialo	gue sys	stem co	ncepts.					
Articula	tion Matrix	<u>^</u>		-			<u>^</u>					
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1		2	3	1	1		-			
							-		1			
		2	2	2	2	3		3				
		3	3		3	3		3	1			
		4	1		2	3		3	4			
		1 4	1		-	5	I	5				
		5			2	3		3				

Unit I	INTRODUCTION TO NLP	9 Hours
	e Processing – Components - Basics of Linguistics, Probability and Statistic rphology-Finite State Automata- Finite State Automata for more G	
Unit II	STATISTICAL NLP AND SEQUENCE LABELING	9 Hours
Semantics – TF-	nguage models –Smoothing -Text classification- Naïve Bayes classifier – Evaluat IDF - Word2Vec- Evaluating Vector Models –Sequence Labeling – Part of Spee Named Entities –Named Entity Tagging.	
Unit III	CONTEXTUAL EMBEDDING	9 Hours
•	ontext Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's a rs -Partial Parsing – Dependency Relations- Dependency Parsing Transition Base COMPUTATIONAL SEMANTICS	Ų
	COMPUTATIONAL SEMANTICS	9 Hours
	nd WordNet – Word Sense Disambiguation - types of word sense disam Labeling – Proposition Bank- FrameNet- Selectional Restrictions -	biguation – Information
UNIT V		9 Hours
Question Answer	plate Filling.	ce –
Discourse Coher Question Answer	DISCOURSE ANALYSIS AND SPEECH PROCESSING ence – Discourse Structure Parsing – Centering and Entity Based Coherence ring –Factoid Question Answering – Classical QA Models – Chatbots and Dialog	ce –

- 3. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009.
- 4. Nitin Indurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", Second edition, Chapman & Hall/CRC: Machine Learning & Pattern Recognition, Hardcover, 2010.
- 5. Deepti Chopra, Nisheeth Joshi, "Mastering Natural Language Processing with Python", Packt Publishing Limited, 2016.
- 6. Mohamed Zakaria Kurdi "Natural Language Processing and Computational Linguistics: Speech, Morphology and Syntax (Cognitive Science)", ISTE Ltd., 2016.
- 7. Atefeh Farzindar, Diana Inkpen, "Natural Language Processing for Social Media (Synthesis Lectures on Human Language Technologies)", Morgan and Claypool Life Sciences, 2015.

24CS60		DE	EP LE	ARNIN	NG TE	CHNIC)UES			L	TP	
										3	0 0	
	Pre-req								nent Patteri			
	Understanding of lin		ora, Ca	alculus,			Assessi			Wei	ghtage	e(%
	Probability and Statis								essment		40	
	Basic knowledge of 1				Se	mester	End Ex	aminat	ions		60	
	oncepts and Optimiz	zation tec	nniques	5.								
	Objectives											
	To introduce the fund		-		-	ning.						
• [To explore the different	ent types	of neur	al netw	orks.							
•]	To gain proficiency i	n implem	enting	and trai	ining re	inforce	ment le	arning a	algorithms.			
•]	To learn techniques f	or interpr	eting a	nd impi	roving 1	nodel p	erform	ance.				
Progran	me Outcomes (PO	s)										
PO1	An ability to inde practical problems.	pendently	carry	out re	search	/ inves	stigation	n and c	levelopment	work	to sol	ve
PO2	An ability to write a	and presen	nt a sub	stantia	l techni	cal repo	ort/docu	iment.				
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer											
	Science and Engine	<u> </u>										
PO4	Efficiently design,								vare for d	istribut	ed ar	ıd
DO 5	centralized computing environments in varying domains and platforms.Understand the working of current Industry trends, the new hardware architectures, the							.l				
PO5		•			•							
	software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research											
	orientation for a life										•11	
PO6	Model a compute										ore tl	ne
	understanding of th	e tradeoff	s invol	ved in o	digital t	ransfor	mation.	-		î		
	Dutcomes (COs)											
The stud	ents will be able to											
CO1	Apply the deep lea											
CO2	Analyze the perfe		of diffe	erent n	eural n	etwork	archite	ectures	suitable for	differe	ent	
COA	application scenar		•	1 .	.1 .	· ·	1 .	6	. 1		6	
CO3	Implement reinfor various environme		earning	algorit	thms to	train c	leep rei	nforcer	nent learning	g agent	s for	
CO4	Analyze case stu		real_w	orld ar	nlicati	ons of	model	intern	etability and	d evnl	ain	
004	ability techniques.		icui w	ond up	pricati	0115 01	model	merpi	ctuonity and	u expi	um	
CO5	Deploy, scale, and		deep 1	earning	g model	s effect	ively i	n real-v	vorld produc	tion		
	environment.		_	-			-		_			
Articula	tion Matrix											
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	2	2		3	3	3				
		2	2	2	2	3	3	2				
		3	2	2	2	3	2	3				
		4	2	2	1	3	3	3				
		5	2	2		3	2	2				
				l	l	l	l	I	l			

Unit I INTRODUCTION TO DEEP LEARNING

Overview of Deep Learning: Definition and brief history - Key concepts: neurons, layers, activation functions-Neural Networks Fundamentals: Perceptron's and the basics of artificial neural networks- Forward and backward propagation-Gradient descent and optimization algorithms-Deep Learning Frameworks: Introduction to popular frameworks: TensorFlow, PyTorch, Keras.

Unit II NEURAL NETWORKS

Convolutional Neural Networks (CNNs): Structure and working principle of CNNs- Applications in image recognition and computer vision- Implementation and training of CNNs- Recurrent Neural Networks (RNNs): Understanding sequential data processing-Structure and functioning of RNNs- Generative Adversarial Networks (GANs): Introduction to GAN architecture-Training GANs-Graph Neural Networks: Basics of graph representation learning.

Unit III DEEP REINFORCEMENT LEARNING

Introduction to Reinforcement Learning (RL): Basics of reinforcement learning: agents, environments, rewards-Markov decision processes (MDPs)-Q-Learning and Deep Q-Networks (DQNs): Understanding Q-learning algorithm-Introduction to Deep Q-Networks (DQNs) and experience replay-Policy Gradient Methods: Policy gradients and REINFORCE algorithm.

Unit IV MODEL INTERPRETABILITY AND EXPLAINABILITY

Importance of Model Interpretability: Motivation for model interpretability and explainability-Ethical considerations in AI-Interpretability Techniques: Feature importance methods-Local and global explanation methods-Interpretable Models: Decision trees and rule-based models-Linear models and logistic regression-Case Studies and Applications.

UNIT V DEPLOYMENT AND SCALABILITY

Model Deployment Strategies: Introduction to model deployment-Considerations for deploying deep learning models-Scalability and Performance Optimization: Techniques for improving model performance-Distributed training and model parallelism.

References

- 1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.
- 2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer International Publishing AG, 2018.
- 3. Rajalingappaa Shanmugamani, Deep Learning for Computer Vision, Packt Publishing, 2018.
- 4. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press, 2018.
- 5. Christoph Molnar, Interpretable Machine Learning, Lulu.com, 2020.
- 6. Emmanuel Ameisen, Building Machine Learning Powered Applications: Going from Idea to Product, O'Reilly Media, Inc., 2020.

9 Hours

9 Hours

9 Hours

9 Hours

E(1 * - 1

9 Hours

45 Hours

Total

24CS61		B	IG DA	TA M	INING	AND	ANALY	TICS		L T P C 3 0 0 3
	Pr	e-requisit	e					Δ	ssessment Pattern	
• F	Basic understa			ning		Mo	le of A	ssessm		Weightage(%)
	echniques.	nung of D	utu 1011	11115					al Assessment	40
• F	amiliarity v rocessing tech	0	data	storag	ge and	I Sem	ester E	nd Exa	minations	60
	Objectives	0								
• 1	o understand	the concept	ots and	challen	ges of	big data	mining	g and a	nalytics.	
	o explore diff	•			0	0				
	o understand		-				••			
	o apply data v			-	-	-		-	otivaly	
				-			-			
	o analyse real me Outcome		se studi	les and	practica	ai appii	cations	of big (lata analytics.	
Frogram		. ,								
PO1	An ability to practical prob		lently	carry o	out rese	arch /	investi	gation	and development	work to solve
PO2	An ability to									
PO3	Science and I	Engineerin	g.			Ŭ			y over the area	•
PO4	Efficiently d centralized co								software for d	istributed and
PO5									ew hardware are	
									oblems by Com	
									fields and pursue d automation aren	
PO6									algorithms that	
200	understandin									in empirier and
Course (Outcomes (CO	Os)								
The stude	ents will be ab	ole to								
CO1		A				Ų			terpret the data.	
CO2									from large databas	
<u>CO3</u>	v				č				streams efficiently	
CO4 CO5	÷								xtract frequent ite	
05	application of								, culminating in	the practical
Articulat	tion Matrix		19 1100	1045 10	5011010	ur wor	ia proo			
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6		
		1	1	2	1	3	1	1		
		2	2	3		2	1	2		
		3	1	1	2	1		2		
		4	2					3		
		5	1		2	1		1		

DATA MINING AND LARGE SCALE FILES Unit I 9 Hours Modelling - Summarization - Feature Extraction - Statistical Limits on Data Mining - Distributed File Systems - Map-reduce - Algorithms using Map Reduce - Efficiency of Cluster Computing Techniques. SIMILARITY DETECTION Unit II 9 Hours Nearest Neighbor search – Shingling of Documents – Similarity preserving summaries – Locality sensitive hashing for documents - Distance Measures - Theory of Locality Sensitive Functions - LSH Families – Methods for High Degree of Similarities. Unit III MINING DATA STREAMS 9 Hours Stream Data Model - Sampling Data in the Stream - Filtering Streams - Counting Distance Elements in a Stream – Estimating Moments – Counting Ones in Window – Decaying Windows. Unit IV LINK ANALYSIS AND FREQUENT ITEMSETS 9 Hours Page Rank -- Efficient Computation - Topic Sensitive Page Rank -- Link Spam -- Market Basket Model -- Apriori algorithm – Handling Larger Datasets in Main Memory – Limited Pass Algorithm – Counting Frequent Item sets. UNIT V CLUSTERING 9 Hours

Introduction to Clustering Techniques – Hierarchical Clustering –Algorithms – K-Means – CURE – Clustering in Non - Euclidean Spaces - Streams and Parallelism - Case Study: Advertising on the Web -Recommendation Systems.

Tatal	45 Hound
10ta	45 Hours
References	

- 1. Jure Leskovec, AnandRajaraman, Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, Second Edition, 2014.
- 2. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
- 3. Ian H.Witten, Eibe Frank "Data Mining Practical Machine Learning Tools and Techniques", Morgan Kaufman Publications, Third Edition, 2011.
- 4. David Hand, HeikkiMannila and Padhraic Smyth, "Principles of Data Mining", MIT PRESS, 2001.
- Saumyadipta Pyne, B.L.S. Prakasa Rao, S.B. Rao, "Big Data Analytics: Methods and 5. Applications", Springer, 2018.

24CS62		DATA	VISU	ALIZA	TION	TECH	NIQUE	ES		L	T P	
										3	0 0	3
	Pre-req					1 6			nent Pattern		1.4	(0/)
	Understanding of var visualizations.	rious type	s of da	ta			Assessi		essment	wei	ghtag 40	e(%)
	Familiarity with prin	ciples of	and a	lata			End Ex				60	
	visualization.	cipies of	good t	iata	50	mester		ammai	10113		00	
	Objectives											
•]	To understand the co	ncepts an	d chall	enges o	f big da	ata mini	ng and	analyti	cs.			
•]	To explore different	data mini	ng algo	rithms	and the	ir appli	cations.	•				
	To understand the va		0 0			••						
	To apply data visuali		0		• •		0		V.			
	To analyse real-world		-				-		-			
	to unaryse rear work	a cuse sta	ares un	a practi	iour upp	neution	15 01 012	5 aara a	naryties.			
Program	nme Outcomes (PO	s)										
PO1	An ability to inde	pendently	carry	out re	search	/ inves	tigation	and d	levelopment v	vork	to sol	ve
_	practical problems.		•				C		, i i i i i i i i i i i i i i i i i i i			
PO2	An ability to write a	1				1						
PO3	Students should b		o dem	onstrate	e a de	gree o	f mast	ery ov	er the area	of C	comput	er
PO4	Science and Engineering. Efficiently design, build and develop system application software for distributed and											
	centralized computing environments in varying domains and platforms.											
PO5	Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and											
												ind
	effectively working orientation for a life										cn	
PO6	Model a compute										ore t	he
	understanding of th											
	Dutcomes (COs)											
	ents will be able to											
CO1	Understand the ke	· ·		•					(1)1 (1.1		1 1 .	
CO2	Analyze and use tree and network e		ely the	vario	us vist	alizatio	on stru	ctures	(like tables,	spati	al dat	a,
CO3	Evaluate informat	,	lizatio	n svste	ms and	1 other	forms	of vis	sual presentat	ion 1	for the	eir
	effectiveness.			2					I	-		
CO4	Design and build of			-								
CO5	Analyse streaming application of clus							ns, cul	lminating in	the	practic	al
Articula	tion Matrix	tering inc	tilous t	0 30170	icai-we	nu pro	orenis.					
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	3	1	2	2	1	2				
		2	2	1	2	3	2	2				
		3	1		2	2	1	1				
		4	3	1	3	3	2	2				
				-			-	-				
		5	2	1	3	2	1	1				

Unit I	FUNDAMENTALS OF VISUALIZATION	9 Hours
	isualization: Purpose of Visualization, External Representation and Significance	
U U	Abstraction in Visualization: Datasets Types & Characteristics, Attribute Types	and
Semantic Represe	entations.	
Unit II	PRINCIPLES OF REPRESENTATION	9 Hours
Marks and Ch	annels: Exploring Different Marks and Uses, Understanding Channel	ls in Data
Visualization, T	able and Spatial Data Organization: Rules for Arranging Tables, S	patial Data
Representation: C	eometry, Scalar Fields, Vector Fields, Tensor Fields.	
Unit III	ADVANCED DATA VISUALIZATION TECHNIQUES	9 Hours
Networks and T	rees Visualization: Strategies for Arranging Networks and Trees, Matrix	Views for
Representing Cor	nections. Mapping Color in Visualization: Color Theory and Its Application,	Effective
Use of Color Map	os and Other Channels.	
Unit IV	INTERACTIVE VISUALIZATION AND MANIPULATION	9 Hours
Manipulating Vi	ews: Dynamic View Changes over Time, Selective Element Display &	Interaction,
Changing Viewp	oints & Reducing Attributes. Faceting & Focus/Context: Juxtaposing &	Coordinating
Multiple Views, S	Static & Dynamic Layers in Visualization, Filtering and Aggregation.	-
8		
UNIT V	VALIDATION AND CASE STUDIES	9 Hours
Validation in Vi	sualization: Levels of Validation, Validation Approaches. Focus & conten	xt: Elide –
	istort – Case studies: Real World Applications.	
	Total	45 Hours
References		

- Tamara Munzner, Visualization Analysis and Design, A K Peters Visualization Series, CRC 1. Press, 2014.
- Scott Murray, Interactive Data Visualization for the Web, O'Reilly, 2013. 2.

- 3. Alberto Cairo, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders, 2012.
- 4. Nathan Yau, Visualize This: The Flowing Data Guide to Design, Visualization and Statistics, John Wiley & Sons, 2011.

24CS63	3		BLO	СКСН	AIN TI	ECHN	DLOG	IES		L		T P	C
										3		0 0	3
	Р	re-requisit	e					As	sessment Patter	n			
٠	Basic understa	anding of ci	yptogr	aphic		Mod	e of As	sessme	nt	W	eigl	htage	(%)
	principles.	-		_					l Assessment			40	
•	Fundamentals	of networ	king co	oncepts	and	Sem	ester Ei	nd Exar	ninations			60	
Course	security. Objectives												
•	To understand	the fundar	nentals	of Blog	kchain	techno	Ιοσν						
•	To study the a						1059.						
•	To understand												
•	To understand		•		•								
•	To design diff	• -	-										
Progra	mme Outcom			Juseu uj	pricuti	01101							
0													
PO1	An ability to practical pro	-	lently of	carry o	ut rese	arch /	investig	gation a	and development	twor	k to	o solv	/e
PO2	An ability to		oresent	a subst	antial te	chnica	report	/docum	ent				
PO3									v over the area	ı of	Coi	mpute	r
100	Science and									• • •	001		-
PO4				develop	systen	n applie	cation s	oftware	e for distributed	l and			
	centralized c												
PO5									w hardware ar				
									blems by Com				nd
									ields and pursue		arcl	h	
PO6									l automation arer algorithms tha			e th	0
100	understandin								argoritims una	ι ελ	pioi	e ui	C
Ourse	Outcomes (C	-	deoms		u ili uig	situr tru	15101116	uion.					
	dents will be a	· ·											
CO1	Understand	l the cryptog	graphic	basics	of bloc	k chain	techno	logy.					
CO2	Understand												
CO3							1		tract on Ethereur	n.			
CO4	-								applied on it.				
CO5	Design of c	ifferent blo	ck chai	n basec	1 applic	ations f	or incre	eased se	curity.				
Articul	ation Matrix												
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6					
		1	2	1	3	2	2	3					
		1	<u> </u>	1	5		4	5					
		2	2	1	2	3	2	2					
		3	2	1	3	1	2	1					

2	2	1	2	3	2	2
3	2	1	3	1	2	1
4	2	1	2	3	2	2
5				1	1	1

	to Distributed Ledgers, Block chain Basics, Growth of block chain	
	ems, History of block chain and Bitcoin, Types of block chain, I	
	Routes of decentralization, Block chain and full ecosystem decentralization,	Smart
contracts, Decent	ralized organizations, Platforms for decentralization.	
Unit II	BLOCK CHAIN AND BITCOINS	9 Hours
	hitecture, Versions, Variants, Use cases of block chain, Block chain vs share	
	cryptocurrencies, Types, Applications. Bitcoins: Introduction, Bitcoin digita	•
	ctions, Block chain mining, Alternative Coins, Limitations of Bitcoin, Application	ons of
Bitcoin Scripts, E	itcoin Blocks.	
Unit III	ETHEREUM	9 Hours
		<i>7</i> Hours
Introduction: Eth	nereum, The Ethereum ecosystem, IOTA, EOS, Multichain, Bigchain, Adv	antages and
	thereum vs Bitcoin, Design of new blockchain, Potential for disruption, Design of	
	ving Information about blocks in Blockchain, Blockchain applications, Devel	
contract on privat		oping sinur
•onduce on priva		
Unit IV	HYPERLEDGER	9 Hours
Introduction to H	lyper ledger fabric, components of Hyper Ledger Fabric Technology, Develop H	lyper Ledger
Block Chain App	lications using Composer Framework, Model the Block Chain Applications usin	ng Composer
	age, Alternative Decentralized Solutions, Hyper ledger Fabric II: Beyond Chai	n code,
fabric SDK and F	Front End-Hyper ledger composer tool.	
T TN TT/TN X 7		
UNIT V	APPLICATIONS	9 Hours
D1 1 1 ' ' T		
	inancial Software and Systems (FSS): Settlements, KYC, Capital markets-Insu	
1	pply chain, Block chain for Government: Digital identity, land records and other l	ands
of record keeping	between government entities, public distribution system / social welfare system.	

HISTORY OF BLOCK CHAIN

References
Nelei ences

Unit I

- 1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018.
- 2. Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016.
- 3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
- 4. Bahga, Vijay Madisetti, "Block chain Applications: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti publishers 2016.

62

9 Hours

45 Hours

Total

4CS64	FULL STACK WEB APPLI	CATION DEVELOPMENT	L	T P	(
			3	0 0	3							
	Pre-requisite	Assessment Patter	n									
• 1	Understanding of web protocols and web	Mode of Assessment	Wei	ghtage	e(%							
5	standards.	Continuous Internal Assessment		40								
•]	Basics of Database connectivity	Semester End Examinations		60								
ourse	Objectives											
• ′	To understand the basics and components of f	rontend web development.										
• ′	To understand back end web development bas	sics and tools.										
• ′	To understand the PHP components and frame	ework for web development.										
• ′	To explore the features of SQL and MySQL for	or databases.										
	To explore integration of PHP and advanced v											
	nme Outcomes (POs)	T										
0	· · · · · · · · · · · · · · · · · · ·		1	4 1								
PO1	An ability to independently carry out reso practical problems.	earch / investigation and development	work	to sol	ve							
PO2		tachnical raport/document										
PO3												
105	Science and Engineering.											
PO4	Efficiently design, build and develop	system application software for d	listribut	ted an	d							
	centralized computing environments in vary											
PO5	Understand the working of current Industry trends, the new hardware architectures, the											
	software components and design solutions for real world problems by Communicating and											
	effectively working with professionals in	various engineering fields and pursue	e resear	rch								
	orientation for a lifelong professional develo	ppment in computer and automation aren	nas.									
PO6	Model a computer based automation		t expl	ore th	ne							
	understanding of the tradeoffs involved in di	gital transformation.										
	Outcomes (COs)											
he stud	ents will be able to											
CO1	Understand the basics of JavaScript, CSS a	nd other web development features.										
CO2	Understand various back end web developm	nent tools and frameworks.										
CO3	Understand and apply techniques for ana	lyzing and representing the structure of	of natu	ral								
	language sentences.											
CO4	Explore the necessity of SQL and MySQL	features for databases.										
	To develop a simple Web Applica		advanc	ed w	eb							
CO5	development features.	and by integrating simple and	auvanc	cu w	υU							

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1			2	3	3	3
2			2	3	3	3
3	2		1		3	3
4	2		2		3	3
5	3	3			3	3

Unit IINTRODUCTION TO WEB DEVELOPMENT9 Hours

Introducing Flexbox– JavaScript for Front-end- Syntax & Creating Concepts with JavaScriptDesign Patterns & Object Modelling- HTTP Requests & Routes- Introducing CSS- CSS Grid & Creating Responsive Layouts– jQuery & jQuery-mobile- Bootstrap & Angular JS-Node & Express Backend integration- Basics of Web pack & Sass and Web pack.

Unit II BACK END WEB DEVELOPMENT

OOPS-JSON-AJAX- Node.js-Development Environment & Tools- Express Framework, Building scalable web applications, Design Patterns & Object Modelling– Database & MongoDB- HTTP & Web sockets for Node.js

Unit IIIHYPERTEXT PREPROCESSOR9 Hours

Introduction, PHP Document, Language Fundamentals, Decision Making Statement, Loops, Statements, Operators, PHP functions, Arrays & Functions, String Functions, Server-Side Processing, Processing Forms via GET/POST, State and Persistence, Web Application Development, Introduction to PHP Frameworks & Basic OOP

Unit IV NO SQL

ntroduction to NoSQL, History of NoSQL Exploring NoSQL, Interfacing and Interacting with NoSQL, NoSQL Storage Architecture, , Querying, Modifying and Managing. Data Storage in NoSQL, Working with NoSQL, Surveying Database Internals, Migrating from RDBMS to NoSQL, Web Frameworks and NoSQL, using MySQL as a NoSQL, case study: implement Advanced columnar data model functions for the real time applications.

UNIT V DATABASE FOR THE MODERN WEB

Introduction to Node.js- Installing Node.js - Using Events, Listeners, Timers, and Callbacks in Node.js – Introduction to MongoDB- Accessing MongoDB from Node.js. Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document- Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language. Developing Web Application with NOSQL and NOSQL Administration Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP.

	Total	45 Hours
References		

- 1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", First Edition 2018.
- 2. Frank Zammetti, Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Second Edition 2022.
- 3. Riyaz Ahmed, "Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5", CSS3, Bootstrap, JavaScript, MySQL, and PHP", Amazon Digital Services LLC Kdp, 16 Apr 2021.
- 4. Jack Chan, Ray Chung, Jack Huang, "Python API Development Fundamentals: Develop a fullstack web application with Python and Flask", 2019.
- 5. Edwin Ross, "Torres Full Stack Web Development: Round One Begin!" 2021. 6. Brad Dayley, Brendan Dayley, and Caleb Dayley, Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications, 2nd Edition, Pearson Education, 2021.

9 Hours

9 Hours

9 Hours

24CS65	S65 CYBER PHYSICAL SYSTEMS			T P	C					
	Due en univita	3	00	3						
	Pre-requisite	Assessment Patter Mode of Assessment		ahtaa	(0/)					
	Understanding basics of physical systems and	Continuous Internal Assessment	wei	Weightage(%)						
	networking concepts. Familiarity with sensor technologies.	Semester End Examinations		60						
	Objectives	Semester End Examinations		00						
	•	1								
	To learn about the principles of cyber-physical s	systems, basic requirements of CPS.								
• ′	To know about CPS models, CPS foundations.									
• ′	To make the students explore the applications a	nd platforms.								
• ′	To provide introduction to practical aspects of c	yber physical systems.								
	To equip students with essential tools to implem									
	nme Outcomes (POs)									
8										
PO1	An ability to independently carry out research / investigation and development work to solve practical problems.									
PO2	An ability to write and present a substantial technical report/document.									
PO3	Students should be able to demonstrate a degree of mastery over the area of Computer Science and Engineering.									
PO4	Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.									
PO5	Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.									
PO6	Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.									
	Outcomes (COs)									
	ents will be able to									
CO1	Explain the core principles behind CPS									
CO2	Discuss the requirements of CPS									
CO3	Explain the various models of CPS									
	Describe the foundations of CPS.									
CO4 CO5	Use the various platforms to implement the C									

Articulation Matrix

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
1	3	3	3		1	
2	2	2	2		1	
3			3	1		1
4			3	1		1
5	2		2	3	3	3

	Regulations	2024
Unit I	INTRODUCTION TO CYBER-PHYSICAL SYSTEMS	9 Hours
Driver	Physical Systems (CPS)-Emergence of CPS, Key Features of Cyber-Physical Systems-Synchronous Model: Reactive Components, Properties of Components, Composing Com s- Asynchronous Model of CPS: Processes, Design Primitives, Coordination Protocols.	ponents,
Unit I	CPS - REQUIREMENTS	9 Hours
Safety Livene	Specifications: Specifications, Verifying Invariants, Enumerative Search, Symb ss Requirements: Temporal Logic, Model Checking, Proving Liveness	olic Search
Unit I	II CPS MODELS	9 Hours
	nical Systems: Continuous, Linear Systems-Time Models, Linear Systems, Designing is Techniques-Timed Model: Processes, Protocols, Automata-Hybrid Dynamical Models.	Controllers,
Unit I	V CPS FOUNDATIONS	9 Hours
Symbo	lic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Schedulin	g for CPS
UNIT	V APPLICATIONS AND PLATFORMS	9 Hours
	al CPS- CPS Built on Wireless Sensor Networks- CyberSim User Interface- iClebo Create- myRIO- Cybersim- Matlab toolboxes - Simulink.	o Kobuki -
	Total	45 Hours
Refere	nces	
1.	Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-W Professional, 2016	/esley
2.	Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015.	
3.	Lee, Edward Ashford, and Sanjit Arunkumar Seshia. Introduction to embedded system physical systems approach. 2nd Edition, 2017.	s: A cyber
4.	André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex Dyn Springer, 2010. ISBN 978-3-642-14508-7.	namics,
5.	Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use M The publisher, Paul Temme, 2011.	odules in C,

6. Jensen, Jeff, Lee, Edward, A Seshia, Sanjit, An Introductory Lab in Embedded and Cyber Physical Systems, http://leeseshia.org/lab, 2014.

24CS66				N	IIXED	REAL	ITY			L	T P	C
		D							A	3	0 0	3
	7	Pre-requi			h	iaa M	lode of		Assessment Pattern		ightage	(0/_)
	Familiarity Fundamenta		comp	outer	graphi				rnal Assessment	** CI	40	(70)
		ling of 3D 1	nodelli	no and	renderi				xaminations		60	
	echniques.	-	nouem	ing und	renderr		linester	End E	Aummutons		00	
	Objectives											
• [Fo study at	out Fundar	nental	Concep	t and C	ompone	ents of	Virtual	Reality.			
	•	out Interac		-		•			,			
	•	out Visual		-			•					
	•	out Augme	-				•	licatior	18			
		out I/O Int					ns ripp	neution	15.			
		omes (POs)		and its	Tunetio	115.						
1 rogram		, ines (1 05)										
PO1									l computer science	theory	y in th	e
DO1		g and design		-			-	-			Coier	-
PO2		formulate, neering, cor						iems 1	n the field of Com	puter	Scienc	e
PO3	ę	Ū.		0				esired	needs within realist	ic co	nstraint	S
	such as e	conomic, se	ocial an	d ethic	al in the	e field c	of Comp	outer So	cience and Engineerir	ıg.		
PO4									nputing practice and			e
PO5							-		ence and Engineering ional development an		-	
105		y on teams						protess	ional development an	a run	ction	
PO6		•		-				ecializa	ation and develop ir	nova	tive an	d
		oriented me	ethodol	ogies to	o tackle	gaps ic	lentified	1.				
	Outcomes	· · ·										
The stud	ents will be	e able to										
CO1	Apply	principles	of inte	raction	design	n to c	reate i	ntuitive	and immersive us	er in	teractio	ns
		nixed reality										
CO2 A						•		•	ons for mixed real	•		gy
			omains	, inclu	ıding	gaming	g, edu	cation,	healthcare, manuf	actur	ing, a	nd
	entertain		in das	ioning	usori	ntarfaa	ac and	ovnor	riences tailored for	mixo	d rooli	tx7
	environn	•	in des	igning	user r	merrac	es and	exper	lences tanoieu ioi	mixe	u lean	ty
CO4			modeli	ng, ani	mation,	and as	set crea	tion for	r mixed reality conten	t		
CO5 I	Demonstrat	e an unde	erstandi	ng of	the fu	ndame	ntal co	ncepts	and principles of	mixe	d reali	ty
	technolo	gy, includii	ng virtu	al reali	ty (VR)	, augm	ented re	eality (A	AR), and their integra	tion.		
Articula	tion Matri	v										
Alucula		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6]			
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Unit IINTRODUCTION TO VIRTUAL REALITY9 Hours

Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.

Unit II INTERACTIVE TECHNIQUES IN VIRTUAL REALITY

Safety Specifications: Specifications, Verifying Invariants, Enumerative Search, Symbolic Search Liveness Requirements: Temporal Logic, Model Checking, Proving Liveness .

Unit III VISUAL COMPUTATION IN VIRTUAL REALITY

Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

Unit IV AUGMENTED AND MIXED REALITY

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

UNIT V I/O INTERFACE IN VR & APPLICATION OF VR

Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digital globe, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices. VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

References

- 1. Burden, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.
- 2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, First Edition 2013.
- 3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
- 4. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.
- 5. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
- 6. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
- 7. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.

9 Hours

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45 Hours

Total

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•]	To gain kno	wledge of	n Devo	ps platf	orm								
•]	To understar	nd buildir	ng and o	leployr	nent of	code.							
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	me Outcor												
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CO5	Correlate							~					
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		CO. 110.	101	104	105	107	105	1 00					

CO. No.	PO1	PO2	PO3	PO4	PO5	PO6
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4	3	2	1	2	3	
5	3	2	2	1	2	3

	Regulations	2024
Unit I	INTRODUCTION	9 Hours
	ngineering - traditional and Agile process models - DevOps -Definition - cycle process - need for DevOps –Barriers.	Practices -
Unit II	DEVOPS PLATFORM AND SERVICES	9 Hours
Centers - Op	platform - IaaS, PaaS, SaaS - Virtualization - Containers –Supporting Multiple eration Services - Hardware provisioning- software Provisioning - IT services - SL ning - security - Service Transition - Service Operation Concepts.	
Unit III	BUILDING, TESTING AND DEPLOYMENT	9 Hours
Developmen	s architecture - coordination model - building and testing - Deployment pipeline - t and Pre-commit Testing -Build and Integration Testing - continuous integration - security - Resources to Be Protected - Identity Management.	
Unit IV	DEVOPS AUTOMATION TOOLS	9 Hours
	e Automation- Configuration Management - Deployment Automation - - Log Management -Monitoring.	Performance
UNIT V	MLOPS	9 Hours
MLOps - D Real world e	efinition - Challenges -Developing Models - Deploying to production - Model G xamples.	overnance -
	Total	45 Hours
References		
	Bass, Ingo Weber and Liming Zhu, —"DevOps: A Software Architect's Perspectivation, 2016.	ve", Pearson
2. Joak	im Verona - "Practical DevOps" - Packet Publishing , 2016.	
3. Vikte	or Farcic -"The DevOps 2.1 Toolkit: Docker Swarm" - Packet Publishing, 2017.	
4. Marl		

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	Understandin				nd	Se	mester	End Ex	aminatio	ns				60	
	capabilities.														
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• '	To understand	the conc	epts of	emerging	g mobi	ile tech	nology								
	To understand		-				0.								
• '	To be aware o	of pervasiv	ve com	nuting pra	actices	\$									
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Unit I	INTRODUCTION	9 Hours
Mobile	e Computing – Networks – Middleware and Gateways – Developing Mobile	Computing
	cations – Mobile Computing Architecture: Architecture for Mobile Computing – Three-Tie	
Archite	ecture – Design Considerations for Mobile Computing.	
Unit I	I TELECOMMUNICATION SYSTEMS	9 Hours
Unit	I IELECOMMUNICATION STSTEMS	9 Hours
GSM Auther	l System for Mobile Communications – GSM Architecture – GSM Entities - Call – GSM Addresses and Identifiers – Network Aspects in GSM – GSM Frequency – ntication and Security -Mobile Computing through Internet –Mobile Computing throug none – Emerging Technologies: - Bluetooth – RFID -Wireless Broadband (WiMax) - Mobile	Allocation –
Unit I	II WIRELESS NETWORKS	9 Hours
Netwo	ess Standards Wireless LAN – IEEE 802.11 – Infrared vs Radio Transmission, Infrastru orks, Ad-hoc Networks, HIPERLAN, Wi-Fi, Emerging Technologies: - Bluetooth – RFID - ess Broadband (WiMax) - Mobile IP.	icture
where		
Unit I Short M – GPF	V MOBILE DATA TECHNOLOGIES Message Service (SMS)- Value Added Services through SMS – GPRS- GPRS and Packet D RS Network Architecture – GPRS Network Operations –Data Services in GPRS- App – Limitations of GPRS – CDMA and 3G- Spread Spectrum Technology- CDMA Versus G	lications for
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PO6	Model a computer			•			0	algorith	ms that	at exp	plore	th	e
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CO2	Implement the basic							onstrain	ed and	linco	onstr	aine	d
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CO3	Apply the modern me		optimiz	ation te	chniaue	es to so	lve eng	neering	probler	ns usii	ng M	atla	b
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Unit IINTRODUCTION TO OPTIMIZATION9 Hours

Engineering application of optimization - Statement of an optimization problem - Optimal problem formulation - Classification of optimization problem. Optimum design concepts: Definition of global and local optima - Optimality criteria - Review of basic calculus concepts - Global optimality

Unit II OPTIMIZATION ALGORITHMS

Optimization algorithms for solving unconstrained optimization problems - Gradient based method: Cauchy's steepest descent method, Newtons method, Conjugate gradient method. Optimization algorithms for solving constrained optimization problems : Direct methods - Penalty function methods – Steepest descent method.

Unit IIIMODERN METHODS OF OPTIMIZATION9 Hours

Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search - Neural-Network based Optimization -Fuzzy optimization techniques -Particle Swarm Optimization- Applications. Use of Matlab to solve optimization problems.

Unit IV ESTABLISHED AND PROPOSED VARIANTS OF PSO

9 Hours

9 Hours

Unified Particle Swarm Optimization - Memetic Particle Swarm Optimization - Vector Evaluated Particle Swarm Optimization - Composite Particle Swarm Optimization A Meta-Strategy Approach – Guaranteed Convergence Particle Swarm Optimization - Cooperative Particle Swarm Optimization - Niching Particle Swarm Optimization - Tribes - Quantum Particle Swarm Optimization.

UNIT V PERFORMANCE ENHANCING TECHNIQUES 9 H

9 Hours

Introduction-The stretching technique for Alleviating Local Minimisers-The Deflection Technique for Detecting Several Minimisers-The Repulsion Technique-Rounding technique for Integer Optimization Applications of Particle Swarm Optimization.

	Total	45 Hours
References		

References

1.DEB. K, Optimization for Engineering Design: Algorithms and Examples, India: PHI Learning, 2012 2.Yang. X, Optimization Techniques and Applications with Examples, United States: Wiley, 2018

3.Nayak. S, Fundamentals of Optimization Techniques with Algorithms, United Kingdom: ElsevierScience, 2020

4.Konstantinos. E, Parsopoulos and Michael N. Vrahatis, Particle Swarm Optimization and Intelligence Advances and Applications, Information Science Reference, IGI Global, New York, 2010.

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Unit III											6 H	ours
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Review of	the Literatu	ure, Metho	ods, Re	sults, E	Discussi	on, Cor	clusior	is, The	Final Check.			
Unit IV											9 H	ours
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key skills		ded whe	en wr	iting	an In	troducti	on, sl	kills n	eeded when writing	ng a	i Re	view
of the Liter	ature.											

UNIT	V	6 Hours
	are needed when writing the Methods, skills needed when writing the Results, skills are n the Discussion, skills are needed when writing the Conclusions.	eeded when
	Total	30 Hours
Refere	nces	
1.	Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books))
2.	Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press	
3.	Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.	
4.	Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht London, 2011.	t Heidelberg

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Unit IIICost Behaviour and Profit Planning Marginal Costing9 Hours

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning.

Unit IV	Total Quality Management and Theory of Constraints	9 Hours
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Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

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Relevant provision of factories Act and rules and other statues applicable to textile industry effluent treatment and waste disposal in textile industry

Total 30 Hours

References

- 1. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.
- 2. Charles T. Horngren and George Foster, Advanced Management Accounting
- 3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
- 4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

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Unit II												10 110	ui 5
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santosh,						iiiiba, b	alya, a	sine ya,	orunna	aenarya ana aparigra	ina, 11)	Shadel	ia,
,	1 ,	<u> </u>	,	1									
Unit III												10 Ho	urs
							benefi	ts for n	nind &	body ii)Regularizat	ion of	breathi	ng
technique	es and its	s effe	ects-Type	s of pra	nayam.								
										781	-1	20.11	
Reference	000									Tot		30 Ho	urs
			s for Gro f Enginee							hyasi Mandal, Nagp [47].	ur. M	odel	
			conquerii Kolkata.	ng the	Internal	l Natur	e by Sv	wami V	/ivekan	anda, AdvaitaAshra	ma (F	Publicati	on
	-												

24XE04]	DISAS	TER M	IANA(EMEN	T		L 2	T P	
	 P	re-requis	site						Assessment Patter		0 0	0
• Γ	Disaster risk r	_	iii c			M	ode of	Assessi			ightage	e(%
	The strengths		inesses	of disa	ster				nal Assessment		100	-(
	nanagement a	approache	es.			Se	mester	End Ex	aminations			
Course (Objectives											
	earn to dem. umanitarian		a critic	al unde	rstandi	ng of k	ey con	cepts ir	n disaster risk redu	ction a	nd	
	Critically evaluerspectives.	uate disa	ster ris	k reduc	tion and	d huma	nitarian	respon	se policy and pract	ice fro	m mult	iple
	Develop an u ypes of disast					humani	tarian r	esponse	e and practical rele	vance	in spec	rific
									nagement approach y or the countries th			and
Program	me Outcom	es (POs)										
PO1	An ability t	o indepe	ndently	carry	out re	search	/ inves	tigatior	and development	work	to sol	ve
	practical pro			•				C	•			
PO2	An ability to	write and	d prese	nt a sub	ostantia	l techni	cal repo	ort/docu	iment.			
Course (Outcomes (C											
	ents will be a											
CO1	Illustrate th	e kev cor	icents i	n disast	er risk	reductio	on and 1	humani	tarian response.			
CO2		e strengt	-						nt approaches, plai	nning a	and	
Articulat	tion Matrix											
		CO. No.	PO1	PO2	PO3	PO4	PO5	PO6				
		1	1	1								
		2	2									
Unit I	Int	roductio	n								5 Ho	hire
	1110	Touucio	<u></u>								5 110	Juis
	Definition, e Disasters: I							veen H	azard And Disaste	er; Na	tural A	nd
Unit II	Re	percussio	ons of I	Disaster	rs and	Hazard	s				5Ho	ours
Earthqual Avalanch	kes, Volcani	sms and le disaste	Cyclo r Nucl	ones, T ear Rea	'sunami actor M	is and Ieltdow	Floods	, Drou	of Ecosystem. N ghts and Famines. Accidents and Oil	, Land	slides	and

Unit III	Disaster Prone Areas in India	5 Hours
	eismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areand Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And E	
Unit IV	Disaster Preparedness and Management	5 Hours
Of Remote	ss: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Sensing, Data From Meteorological And Other Agencies, Media Reports: Goverr Preparedness.	. .
TT:4 X7	Disaster Mitigation	0.11.0.000
Unit V	Disaster mitugation	9 Hours
Disaster m Structural 1	itigation meaning, concept and strategies of disaster mitigation, emerging trends in nitigation and non-structural mitigation, programs of disaster mitigation in India. Total	n mitigation.
Disaster m	itigation meaning, concept and strategies of disaster mitigation, emerging trends in nitigation and non-structural mitigation, programs of disaster mitigation in India. Total	
Disaster m Structural 1 References 1. R.	itigation meaning, concept and strategies of disaster mitigation, emerging trends in nitigation and non-structural mitigation, programs of disaster mitigation in India. Total	n mitigation. 30 Hours
Disaster m Structural 1 References 1. R. Ro 2. Sal	itigation meaning, concept and strategies of disaster mitigation, emerging trends in nitigation and non-structural mitigation, programs of disaster mitigation in India. Total Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strateg	n mitigation. 30 Hours gies " , New

24XE05 VALUE EDUCATION	L T P C 2 0 0 0
Pre-requisite Assessment Pattern	
Awareness about ethics and human value Mode of Assessment	Weightage(%)
Continuous Internal Assessment	100
Semester End Examinations	
Course Objectives	-
Interpret value of education and self- development.	
Imbibe good values in students.	
• Let the should know about the importance of character.	
Programme Outcomes (POs)	
PO1 An ability to independently carry out research / investigation and development v	work to solve
practical problems.	
PO2 An ability to write and present a substantial technical report/document.	
Course Outcomes (COs)	
The students will be able to	
CO1 Knowledge of self-development.	
CO2 Learn the importance of Human values.	
CO3 Developing the overall personality.	
Articulation Matrix	
CO. No. PO1 PO2 PO3 PO4 PO5 PO6	
Unit I	8 Hours
	o nours
Values and self-development- Social values and individual attitudes-Work ethics- Indian vision	n of humanism-
Moral and non- moral valuation-Standards and principles-Value judgements.	i oi numamism-
Unit II	7 Hours
	_
Importance of cultivation of values- Sense of duty Devotion- Self-reliance- Confidence-Concen	tration-
Truthfulness- Cleanliness-Honesty- Humanity- Power of faith- National Unity- Patriotism- L	ove for nature-
righteness creatiness rolesty- futurality- i ower of fatur- futurational Onity- i autousin- L	
Discipline.	
Discipline.	
· · ·	8 Hours
Unit III	-
Discipline. Unit III Personality and Behavior Development - Soul and Scientific attitude- Positive Thinking- Integration	rity and
Discipline. Unit III Personality and Behavior Development - Soul and Scientific attitude- Positive Thinking- Integ discipline-Punctuality- Love and Kindness- Avoid fault Thinking- Free from anger- Dignity of	rity and labour-
Discipline. Unit III Personality and Behavior Development - Soul and Scientific attitude- Positive Thinking- Integration	rity and labour-

Unit IV		7 Hours
Character and Co	ompetence -Holy books vs Blind faith, Self-management and Good health.	Science of
reincarnation, Equ	uality, Nonviolence ,Humility, Role of Women. All religions and same message	e, Mind your
Mind, Self-contro	1. Honesty, Studying effectively.	
	Total	30 Hours
References		
1. Chakrobor Press, Ne	ty, S.K. "Values and Ethics for organizations Theory and practice", Oxford	University

24XE06				PED	DAGO	GY STU	UDIES			L 2	T P 0 0	C 0
	р	re-requis	site						Assessment Pattern	4	UU	U
• • • •	areness ab			ng toohr	iquas	м	ode of	Assessi		Wei	ghtage((%)
• Aw	areness au	out basic	teacim	ig teem	nques				nal Assessment	VV CI	100	. / 0 /
									aminations		100	
Course Ob	iectives					50	mester	Liid LA				
	•						·			1	1	
unc	lertaken by	the DfID	, other	agenci	es and i	researcl	ners	progra	mmer design and po	ncy n	laking	
• Ide	ntify critica	al evidenc	e gaps	to guid	le the d	evelopr	nent.					
Programm	e Outcom	es (POs)										
	n ability t ractical pro		ndently	/ carry	out re	search	/ inves	stigation	and development	work	to solv	e
Course Ou	tcomes (C	Os)										
The studen		,										
	What peda leveloping			es are b	being u	sed by	teache	rs in fo	ormal and informal	classr	ooms i	n
CO2	<u> </u>	e evidence	e on th		tiveness	s of the	se peda	igogical	l practices, in what c	conditi	ons, and	d
					culum a	and pra	cticum)) and th	ne school curriculum	and	guidanc	e
	naterials be										2	
L					0 01							
Articulatio	on Matrix											
				•	•	•	•	•	-			
		CO. No.		PO2	PO3	PO4	PO5	PO6				
		1	1									
		2	1									
		3	1									
Unit I	Int			Mathad	lology						8 Hot	
Unit I		roductio		vietnot	lology						0 1101	115
		-	-		-				ninology-Theories of ions-Overview of m		-	ind
Unit II	Th	ematic O	vervie	W							7 Hou	urs
Pedagogica Curriculum				by teac	hers in	formal	and in	formal	classrooms in devel	oping	countrie	es,
Unit III	Evi	idence on	the E	ffective	eness of	f Pedag	ogical	Practic	es		8 Hou	urs
	·									·		
(curriculum pedagogy.	and pract Theory of c	icum) and change, S	d the s trength	chool, and na	curricul ature of	lum and the bo	d guida dy of ev	nce ma vidence	tudies. How can tea terials best support for effective pedago iefs and Pedagogic st	effecti gical,	ve practice	

Unit I	V Professional Development	7 Hours
	nent with classroom practices and follow up, Support Peer support, Support from the head nmunity, Curriculum and assessment, Barriers to learning: limited resources and large class	
	Total	30 Hours
Refere	nces	
1.	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare 261.	, 31 (2): 245-
2.	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal o Studies, 36 (3): 361-379	f Curriculum
3.	Akyeampong K (2003) Teacher training in Ghana - does it count. Multi-site teacher educa project (MUSTER) country report 1. London: DFID	tion research
4.	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learn maths and reading in Africa: Does teacher preparation count? International Journal Development, 33 (3): 272-282	•
5.	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary educa and Boston: Blackwell.	ation. Oxford

6. Chavan M (2003) Read India: A mass scale, rapid, "learning to read" campaign.

24XE07		В	USINESS	ANAL	YTICS				L 2	T P 0 0	0
	Pre-requi	sito					Assessment P	ottorn	2	UU	0
• P	Business analytics with		nization	M	ode of A				Woi	ghtage	(%)
• B	Susmess analytics with	ini an orga	Inzation.				nal Assessme		WCI3	100	(/0
							aminations	int –		100	
Course C	Objectives			50	mester		ummutons				
	lustrate the role of bu	siness anal	vtics within	1 an oro	anizatio	n					
• A	analyze data using sta	atistical and	d data min	ing tecl			nderstand rela	ationship	s be	tween	the
	nderlying business pro		e			1 4	f	- 4	1	1	
	o gain an understand roblems and to support					analyt	ics to formul	ate and	solve	e busin	ess
• T	'o become familiar wi	th processe	es needed to	o develo	p, repo	rt, and	Analyze busin	ness data	•		
	Jse decision-making t nalytical and manager		tions resea	arch tec	hniques	s and M	lanage busin	ess proce	ess u	sing	
Program	me Outcomes (POs)										
PO1	An ability to indepe	endently ca	rry out re	search	/ inves	tigatior	and develo	pment w	vork	to sol	ve
	practical problems.					_					
	fficiently design, by centralized computin							distri	buted	d a	nd
PO6 M	software component effectively working orientation for a lifeld Iodel a computer understanding of the	with pro ong profess based au	fessionals sional devel utomation	in var lopmen systen	ious e t in com	ngineer puter a desig	ing fields a nd automatio n algorithm	and pur n arenas.	sue	resear	ch
	Dutcomes (COs)										
The stude	ents will be able to										
CO1	Implement the know	vledge of d	ata analytic	·s							
CO1 CO2	Implement the know Apply the ability of				isions h	based o	n data and dee	ep analyt	ics.		
CO2	Apply the ability of	think critic	ally in mak	ting dec						SUDDO	ort
		think critic to use tec	ally in mak	ting dec						suppo	ort
CO2	Apply the ability of Analyze the ability	think critic to use tec aking.	ally in mak hnical skil	ting dec ls in pr	edicati	ve and	prescriptive			suppo	ort
CO2 CO3	Apply the ability of Analyze the ability business decision-m	think critic to use tec aking. y to transla	ally in mak hnical skil te data into	ting dec ls in pr clear, a	redicati	ve and	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit	think critic to use tec aking. y to transla	ally in mak hnical skil te data into	ting dec ls in pr clear, a	redicati	ve and	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision	think critic to use tec aking. y to transla	ally in mak hnical skil te data into	ting dec ls in pr clear, a	redicati	ve and	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision	think critic to use tec aking. y to transla n problems	ally in mak hnical skil te data into	ting dec ls in pr clear, a	redicati	ve and	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision tion Matrix	think critic to use tec aking. y to transla n problems	ally in mak hnical skil te data into in busines	ting dec ls in pr clear, a s analyt	redicati actional ics.	ve and ple insig	prescriptive			suppo	prt
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision tion Matrix CO. No. 1	think critic to use tec aking. y to transla n problems PO1 P0 2	ally in mak hnical skil te data into in busines	ting dec ls in pr o clear, a s analyt PO4 2	redicati actionat ics. PO5 1	ve and ole insig PO6 1	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision tion Matrix CO. No. 1 2	think critic to use tec aking. y to transla n problems PO1 P0 2 2	ally in mak hnical skil te data into in busines	ring dec ls in pro- o clear, a s analyt PO4 2 2 2	redicati actional ics. PO5	ve and ole insig PO6	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the ability Analyze the decision tion Matrix CO. No. 1 2 3	think critic to use tec aking. y to transla n problems PO1 P0 2 2 1	ally in mak hnical skil te data into in busines	ting dec ls in pr o clear, a s analyt PO4 2	redicati actionat ics. PO5 1	ve and ole insig PO6 1	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the abilit Analyze the decision tion Matrix CO. No. 1 2 3 4	think critic to use tec aking. y to transla n problems PO1 P0 2 2	ally in mak hnical skil te data into in busines	ring dec ls in pro- o clear, a s analyt PO4 2 2 2	redicati actionat ics. PO5 1	ve and ole insig PO6 1	prescriptive			suppo	ort
CO2 CO3 CO4 CO5	Apply the ability of Analyze the ability business decision-m Determine the ability Analyze the decision tion Matrix CO. No. 1 2 3	think critic to use tec aking. y to transla n problems PO1 P0 2 2 1	ally in mak hnical skil te data into in busines	ring dec ls in pro- o clear, a s analyt PO4 2 2 2	redicati actionat ics. PO5 1	ve and ole insig PO6 1	prescriptive			suppo	prt

	Business Analytics and Statistical Tools	6 Hours
Business Anal Statistical Not	Business analytics, Scope of Business analytics, Business Analytics Process, Rela ytics Process and organisation, competitive advantages of Business Analytics-Statis ation, Descriptive Statistical methods, Review of probability distribution and data estimation methods overview.	stical Tools:
Unit II	Trendiness and Regression Analysis	6 Hours
Analytics Pers	ationships and Trends in Data, simple Linear Regression. Important Resources sonnel, Data and models for Business analytics, problem solving, Visualizing and s Analytics Technology.	
Unit III	Organization Structures of Business Analytics	6 Hours
Unit IV	ts step in the business analytics Process, Prescriptive Modelling, nonlinear Optimizati Forecasting Techniques	6 Hours
Time Series, F	d Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series w	: Stationary
	egression Forecasting with Casual Variables, Selecting Appropriate Forecasting Mode	
Unit V		els.
Formulating D	egression Forecasting with Casual Variables, Selecting Appropriate Forecasting Mod	els. 6 Hours
	egression Forecasting with Casual Variables, Selecting Appropriate Forecasting Mode Decision Analysis Decision Problems, Decision Strategies with the without Outcome Probabilities, Deci	els. 6 Hours