## Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)



## **Course Contents (Syllabus) for**

## **First Year M. Tech.** (Computer Science and Information Technology)

Sem – I to II

AY 2020-21

Odd Semester//Sem-I Professional Core (Theory)

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Pre-Re	equisite	e Courses:																
Textbo	ooks:																	
		1. Kothari	C. R, "I	Research	n Metho	dology	', New A	Age into	ernationa	al, 2 <sup>nd</sup> E	dition	, 1990						
		2. Chopra	Deepak	and Sor	ndhi Neo	ena, "Re	esearch	Method	lology :	Concept	ts and	cases'	", ,					
		Vikas P	ublishin	g House	e, New I	Delhi,2 <sup>n</sup>	<sup>d</sup> Editio	n, 2015										
Refere	ences:																	
		1. Melville											r					
									. Ltd., 1 <sup>s</sup>									
~		2. G. Rama	amurthy	, "Resea	rch Me	thodolo	gy", Dr	eam Te	ch Press	, New D	elhi,	$2^{nu}$ Ed	itior					
Course	e Obje	ctives :	.1 .	1 1 0	C 1	,.	•		1	1 (1								
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		2. Make al																
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Module3: Data Collection Techniques	Hrs
Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Schedules, Other Methods of Data Collection	5
Module4: Processing and Analysis of Data	Hrs
Processing Operations, Types of Analysis, Statistics in Research, Measures of Asymmetry, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association of Attributes	4
Module5: Computers and Research	Hrs
Role of computer in research process, Data Analysis and Visualization Techniques, Data Storage, Scientific Simulations, Plagiarism Checker	4
Module 6: Technical writing methods.	Hrs
Paper Writing, Technical report, Types of Technical report, dissertation/thesis writing. Presentation techniques, Patents and other IPRs, Tools for report writing.	4
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Realize the process of research.	
Module 2: Formulate of a research problem in respective study domains	
Module 3: Learn the important steps in conducting research	
1 I U	
Module 4: Apply data analytics for research validation.	

Title of the Course: Ad	lvanced A	lgorith	ms 3I	F <b>501</b>		Ι		Т	Р	Cr
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Pre-Requisites: Fundar	nental kno	wledge	e in Coi	nputer	Algorit	hms				
<b>Fextbooks:</b>										
	H. Corman	et al, "	Introdu	iction to	o Algor	ithms",	PHI L	earning	pvt. Ltd, 7	hird
Edition										
References: 1. E. Horow	vita Sortoi	Sahani	ot ol "	Fundar	nontola	ofCon	mutor	Algorith	nms", Univ	orsitios
	cond Edition		et al,	runuai	nemais		iputer	Aigoriu	iiiis, Uiiiv	ersities
Course Objectives :		011								
1. To introd	uce concep	L .	-	•						
2. To impart										
3. To explai	_	rithms t	based of	n comp	lexities					
Course Learning OutcoCOAfter the comp		he cou	rse the	studer	nt shou	ld he	Blo	om's (	ognitive	
able to		ne cou	ise the	stuuti	it silvu				e e	
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CO2 Calculate the sh									Applying	
CO3 Verify the giver	-	1 belong	gs to N	P-C cat	egory a	nd find	V	E	valuating	
its approximate	solution									
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	CO2	2		3		0				
	CO3			-	3	1				
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Single Source Shortest Path Algorithms	(
Bellman-Ford Algorithm, SSSP in Directed Acyclic Graphs, Dijkstra's Algorithm,	6
Difference Constraints and Shortest Paths, Proofs of Shortest-paths Properties	
Module 3	Hrs.
APSP and Maximum Flow	
Shortest Paths and Matrix Multiplication, Floyd-Warshall Algorithm, Johnson's Algorithm	-
for Sparse Graphs	6
Flow Networks, Ford-Fulkerson Method, Maximum Bipartite Matching, Push-relable	
algorithms	
Module 4	Hrs.
Multithreaded Algorithms and Matrix Operations	
Dynamic Multithreading fundamentals, Multithreaded Matrix Multiplication,	
Multithreaded merge sort	7
Solving systems of linear equations, Inverting matrices, Symmetric positive-definite	
matrices and least-squares approximation	
Module 5	Hrs.
Computational Geometry and NP-Completeness	
Line-segment properties, Determining whether any pair of segments intersects, Finding the	
convex hull, Finding the closest pair of points	7
Polynomial time, Polynomial-time verification, NP-completeness and reducibility, NP-	
completeness proofs, NP-complete problems	
Module 6	Hrs.
Approximation Algorithms	
The vertex-cover problem, The traveling-salesman problem, The set-covering problem,	7
Randomization and linear programming, The subset-sum problem	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Explain basic concepts of Graph Algorithms	
Module 2: Compare and contrast different SSSP algorithms	
Module 3: Apply Shortest path algorithm to real word problems	
Module 4: Apply multithreading techniques to solve different problems	
Module 5: Classify algorithms into different categories	
Module 6: Design approximate methods for solving hard problems	

Title	of the	Course: Crypto	ology 3I	T503					L		Т	Р	Cr
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Pre-l	Requis	ite Courses: C	omputer	Netwo	rks								•
Fext	books:												
		1. Stallings Wi		•• •	raphy a	nd Netv	vork sec	urity: I	Principle	s an	d Prac	tices",	Pearson
		Publication,	7 <sup>th</sup> Ed,	2016									
Refe	rences		1 7	• 1 11 1	. 1 1	// <b>T</b> 1		27.1	G		1		
	I	. Katz Jonathan 2 <sup>nd</sup> Ed, 2018		indell Y	ehuda,	"Introd	uction to	o Mode	rn Crypt	togra	aphy'',	CRC F	ress,
	2	2. Schneier Bru		olied Cr	vptogra	phy: Pro	otocols	& Algo	rithms a	nd S	ource	Code i	n C".
		Wiley Publica	ation, $2^{n}$	<sup>d</sup> Ed, 2	015	E J -		0					- )
Cour	rse Obj	ectives :											
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		2. To impart var		21				-					
		To make und		security	attack 1	model a	nalysis	against	crypt_c	omp	lexity.		
Cour T		rning Outcome		6.41		4 1	4 1	11	D1	2- 0			
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	CO1	Discuss vulnera							II		dersta	U U	
	CO2	Practice and an	alyse cr	yptogra	phic alg	orithms	5.		III,	Applying,			
									IV	Analyzing Evaluating, Creating			
	CO3	Classify and			ifidentia	lity, I	ntegrity	and	V,	Ev	aluatir	ig, Cre	ating
		Authentication	services	5.					VI				
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Attack Categories: Physical, Side Channel, Software, Environmental, Network Attacks	
Cryptography and Cryptanalysis, Classical Encryption Techniques	
Module 2: Number Theory	Hrs
Modular Arithmetic, Euclidean Algorithm, Prime and Relatively Prime Numbers,	
Primitive Roots, Fermat's Little Theorem, Euler Totient Function, Chinese Remainder Theorem,	07
Discrete Logarithms, Index Calculus Algorithm, Pseudo Randomness	
Module 3: Modern Cryptographic Techniques	Hrs
Modes of Data Operation, Key Length and Perfect Secrecy and Confidentiality,	
Symmetric & Asymmetric Cryptography,	
Data Encryption Standard (DES/2DES/3DES), Cracking DES and MIM attack, Advanced	07
Encryption Standard (AES), Design and Analysis of RSA Cryptosystem	
Module 4: Authentication and Integrity Check	Hrs
Session Keys and Management, Key Exchange and Diffie Hellman algorithm, Digital Signature	
Algorithm, Kerberos Systems, X.509 Digital Certificates,	07
Hash algorithms, Message Authentication Codes	
Module 5: Web and IPSec	Hrs
Secure Socket Layer (SSL), Transport Layer Security (TLS)	
Secure Electronic Transaction (SET), E-Commerce	06
IP security Architecture, Virtual Private Network (VPN)	
Module 6: Perimeter Security	Hrs
Firewall Types and Configuration, Trusted Systems,	
Intrusion Detection and Prevention Systems (IDPS), Honeypots	06
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Associate core concepts of conventional security architecture.	
Module 2: Apply mathematical model for construction of trap door functions.	
Module 3: Compare and implement various cryptographic algorithms.	
Module 4: Identify authentication and integrity check support systems.	
Module 5: Recommend transport layer security (TLS) for web services.	
Module 6: Devise security mechanisms across network boundaries.	

information security tools and related case studies.

Title of th	e Course: U	nix Inte	ernals $\overline{3}$	IT502				<u>L</u> 3	<u>T</u>	<u>P</u> 0	<u>C</u>
Pre-Requi	isite Courses	• Opera	ting sv	stems	Data Co	mmuni	cation &	_	-	÷	
	Programmable								iking, c	omputer	
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	vens Richard V	N "Uniz	x Netwo	rk Prog	rammin	g "Pre	entice H	all (PHI	) Seco	nd Editio	n 199
	odule 1(first					8,11			.), 2000		,,
``	s Sumitabha,	L /	/	s and A	nnlicati	ons" T	MGH	Fourth	Edition	2008	
	ch Maurice J.,										2 3)
Reference		The D	csign 0j	unia C	эрстин	18 5950	,111 , 11	<u>11. (1910c</u>			,
	j Jorgensen, "	Beei's Gi	uide to I	Jnix IPO	C". Bria	n "Beei	Jorgens	en" Hall	Versio	n 1.1.2. D	ecemb
	2010. (E-book				- ,	5	0	,	,	,	
	j Jorgensen, "		/	Netwo	rk Prog	rammin	g: Usir	ng Intern	net Sock	ets", Bria	ın "Be
	gensen" Hall, V							U		,	
4. Stev	vens Richard V	N., "UNI	X Netw	ork Pro	ogramm	ing: In	terproce	ess Com	municat	ions", Vo	olume
Pre	ntice Hall, Sec	ond Edit	tion, 199	99. (mo	dule 4)						
Course O	bjectives :										
	1. Introduce										
	2. Instruct th	e IPC for	r solving	g the re	al world	l proble	ms.				
	3. Prepare st	udents to	analyz	e and in	terpret	function	ning of	socket pi	rogramr	ning.	
Course Le	earning Outc	omes:									
CO Af	ter completio	n of the	course	student	should	l be abl	e to	Bloor	n's Cog	nitive	
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CO1 In	vestigate the d	esign pri	ncipal a	ind phil	osophy	ofthe		IV	A	Analyzing	
	nix/Linux OS	0 1	1	1	1 5					, ,	
CO2 Ar	opraise the arc	hitecture	of Unix	k/Linux	OS.			IV	A	Analyzing	
	assify the varie					ng.		V		Evaluating	
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			<b>PO1</b>	PO2	PO3	PO4	PO5	PO6			
		CO1			1	3					
		CO2	2					1			
		CO3			3	1					
Assessme	nts :										
Teacher A	ssessment:										
Two comp	oonents of In	Semeste	er Eval	uation	(ISE), (	Dne Mi	d Seme	ester Exa	aminati	ion (MSE	E) and
one End S	emester Exar	ninatior	n (ESE)	having	g 20%, 3	30% an	d 50%	weights	respec	tively.	
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	IS	SE 2						10	)		
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ISE 1 and	ISE 2 are base	d on assi	ignmen	t/decla	red test	/quiz/s	seminar	etc.			
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to system concepts, Kernel Data Structure, System Administration.	
Module 2: The Unix Model	Hrs.
Introduction, Basic Definitions, Input and Output, Signals, Process Control, Daemon Processes, Listing internet daemons and their service capabilities	6
Module 3: Internal Representation of Files	Hrs.
Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types, The Buffer Cache concept.	6
Module 4: Structure of Process and Process Control	Hrs.
Process stages and transitions, layout of system memory, the context of a Process, saving context of a process, manipulation of the process address space.	8
Module 5: Process Creation	Hrs.
Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process.	6
Module 6: Interprocess Communication (IPC)	Hrs.
Introduction, File and Record Locking, A Simple Client-Server Example, Pipes, FIFOs (First in first out), Streams and Messages, Name Spaces, System-V IPC, Message Queues, Semaphores, Shared Memory, TCP/UDP Sockets, Threads, MPI (Message passing interface), OpenMP, Cuda, Difference between Unix & Windows IPC mechanisms.	8
Module wise Measurable Students Learning Outcomes :	
Module 1: Examine the signaling system, process control.	
Module 2: Assess the kernel data structures for process and file.	
Module 3: Verify the operations on processes	
Module 4: Comprehend the various IPC's.	
Module 5: Create process for applications	
Module 6: Perform IPC for Chatting application	

**Professional Elective (Theory)** 

	the Cou	urse: Prof	fessional l	Electiv	e 1 - A	rtificial	Intelli	gence		L	Т	Р	Cr
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		anakiramar ndia Ltd.,20		oundat	ions of	Artifici	armer	ngence	and f	experi	. Systen	ns, Ma	acminan
		Russell and		Artifici	al Intel	lligence	_ A M	odern A	nnro	ach"	Prentic	a_Hall	2010
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Referen	``````````````````````````````````````		).										
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		Townsend, '					Sybex ]	Inc.198	7.				
Course							- )	- )	-				
	•	o introduce	e theory d	evelope	ed in A	rtificial	Intellig	gence.					
	2. T	To impart te	chniques	used in	major	applica	tion are	as of A	rtifici	al Int	elligenc	ce.	
	3. Т	o describe	about the	e state c	of the a	rt in Art	ificial l	Intellige	nce		_		
Course	Learnii	ng Outcom	les:										
	CO	After the	completi	on of t	he cou	rse the s	student	t should	l Bl	oom'	s Cogni	tive	
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	CO1	Apply sch			lge rep	resentat	ion.			III	apply	-	
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			<u>CO1</u>	PO1	PO2	PO3	PO4	PO5	PO6	_			
			CO1	3						_			
			CO2		2				2				
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Course C	Contents:
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Module 1: Introduction and searching in AI	6 Hrs.
Problem, Problem Spaces and Search, Application, Characteristics of AI, Heuristic, A*, AO*.	
Module 2: Knowledge Representation & Logic	7
	Hrs.
Predicate calculus, Predicates and arguments, ISA hierarchy, Frames, Unification	
Module 3: Logic Programming	6
	Hrs.
Logic programming in Prolog, writing a Prolog program, Structure of Prolog program, Searching and backtracking in prolog, Lists	
Module 4: Planning	7
	Hrs.
Introduction, Planning as problem solving, STRIPS, Forward and Backward planning, Non linear	
planning	
Module 5: Neural Networks	6 Hrs.
History and Introduction to Neural network, Working of neurons, Basic components of	
ANN, ANN Arhitecture, Feedforward network, Applications of Neural Network.	
Module 6: Expert systems & Natural Language Processing	7 Hrs.
Introduction, Functionality /components of Expert systems, Architecture of ES, Bulding an Expert system, NLP and Understanding.	
Module wise Measurable Students Learning Outcomes :	
Module 1: Survey the nature of the difficult problems that AI seeks to solve.	
Module 2: Invest variety of methods for encoding knowledge in computer systems.	
Module 3: use the logic programming for problem solution	
Module 4: Provide intelligent problem solution.	
Module 5: Provide solution using constraint satisfaction.	
Module 6: Design the expert system.	1

	ou	rse: Profess	ional <mark>E</mark>	lective	1 - Dist	tribute	d Opera	ating Syster		<u>T</u>	<u>P</u>	<u>Cr</u>
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Pre-Requisite	e C	ourses: Oper	rating S	ystems	, Distrib	outed No	etwork					
<b>fextbooks:</b>												
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2.		oulouris Geo		llimore	Jean, K	indberg	g Tim "	Distributed	System	s: Conce	pts and	
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Semester Examination (ESE) having 2070, 5070 and 50	70 weights respectively.
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MSE	30
ISE 2	10
ESE	50
ISE 1 and ISE 2 are based on assignment/declared t	est/quiz/seminar etc.
MSE: Assessment is based on 50% of course conten	nt (Normally first three modules)
ESE: Assessment is based on 100% course content	with60-70% weightage for course content
(normally last three modules) covered after MSE.	
Course Contents:	

Module 1: Introduction to distributed Systems	Hrs.
Definition and goals, Hardware and Software concepts, Design issues	6
Module 2: Communication & Synchronization in distributed systems	Hrs.
Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC Remote procedure call Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems	6
Module 3: Processes and processors & Distributed File Systems:	Hrs.
Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues, Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study	7
Module 4: Distributed Shared Memory	Hrs.
Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing	5
Module 5: Naming & Distributed Web-based Systems	Hrs.
Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications	7
Module 6: Security & Case Study	Hrs.
Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management ,Java RMI, Sun Network File System, Google case study	6
Module wise Measurable Students Learning Outcomes : After the completion of the course the	students
<ul> <li>should be able to</li> <li>Module 1: Explain the fundamentals of Distributed systems</li> <li>Module 2: Describe the communication and synchronization</li> <li>Module 3: Use the Distributed file systems</li> <li>Module 4: Express the issues of Distributed Shared Memory</li> <li>Module 5: Analyze distributed web based systems</li> <li>Module 6: Study the security of Distributed operating system</li> </ul>	

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Module 5: Reinforcement Learning         Introduction, The Learning Task, Q Learning, Nondeterministic Rewards and Action,         Temporal Difference Learning, Generalizing from examples. Relationship to Dynamic         Programming         Module 6: Case Studies in Machine Learning         Recommender systems as regression problem, Spam email Classification, MNIST digit	o to Dynamic 6 Hrs. MNIST digit	Clustering K means, EM, Principal Component Analysis, Outliers Detection.	6
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Module 6: Case Studies in Machine Learning	, MNIST digit	Temporal Difference Learning, Generalizing from examples. Relationship to Dynamic	6
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tudents should be able to Module 1: Explain the concepts of Machine Learning and Regression. Module 2: Apply Neural Networks technique for solving Machine Learning problem statemen	g problem statements.		
<ul> <li>Module wise Measurable Students Learning Outcomes: After the completion of the course students should be able to</li> <li>Module 1: Explain the concepts of Machine Learning and Regression.</li> <li>Module 2: Apply Neural Networks technique for solving Machine Learning problem statemen</li> <li>Module 3: Analyze the Machine Learning algorithms for optimization.</li> <li>Module 4: Understand Unsupervised learning techniques.</li> </ul>	ig problem statements.		

Module 5: Explain and apply Reinforcement Learning.Module 6: Apply the theory Learned in the course to concrete case studies.

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	1.	Bonczek Ro	bert H, F	Iolsapple	e Clyde '	W, Whii	nston An	drew B,	"Founda	ation	ns of Deci	sion Su	pport
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Options for models, Problems of models, Data mining, Model-based management systems	
Module 3: Intelligence and Decision Support Systems	Hrs.
Programming reasoning, Uncertainty, User interface, Goals of the user interface, Mechanisms of user interfaces, User interface components, Representations.	6
Module 4: Issues of DSS Design	Hrs.
International decision support systems, Information availability standards, Cross-cultural modeling, Effects of culture on decision support system, Designing a decision support system, Planning for decision support systems, DSS design and reengineering	7
Module 5: Object-Oriented Technologies and DSS Design	Hrs.
Kinds of development tools, Benefits of object-oriented technologies for DSS, Implementation and evaluation, Implementation strategy, Implementation and system evaluation	6
Module 6: Extensions of Decision Support Systems	Hrs.
Executive information and dashboards, KPIs and balanced scoreboards, KPIs and balanced scoreboards, Dashboards, Dashboard as driver to EIS, Group Decision Support Systems (GDSS), Groupware, Features of Support	7
Module wise Measurable Students Learning Outcomes : After the completion of the course the	e student
should be able to,	
Module 1: Realize basic concepts of DSS.	
Module 2: Recognize DSS components.	
Module 3: Design and apply intelligence in DSS.	
Module 4: Resolve the design issues in DSS.	
Module 5: Analyze the benefits of DSS using object oriented approach.	
Module 6: Design dashboards and KPI's.	

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		1999.				-	-	-			w Hill, 2 <sup>nd</sup> Edit
		2. Lyu, "Sof 1996.	tware F	Reliabili	ty Eng	ineering	,", IEEI	E Com	puter S	ociet	y Press, 1 <sup>st</sup> Edit
Re	ferenc				. 1		1 . 0	0	<b>г</b> .		ז א נו
		1. Jalote	Pankaj, ation, 3r		-		ich to So	onware	Engine	ering	, Narosa
					· ·		" Pears	on Edua	ration I	ndia	New Delhi,2 <sup>nd</sup>
			n, 2006.	Soltwa	ie Engl	neering	, 1 cars		20110111	nuna,	New Denn,2
Co	urse O	bjectives :	-,								
		1. To provide	e fundar	nental k	nowled	ge of So	oftware	Reliabi	lity.		
		2. To make a			-	•		-			
		3. To apprais		ult dete	ction of	softwar	e syster	ns.			
Co		earning Outco									. ~
	CO	After the completion of the course the student should be									's Cognitive
_	~~.	able to	•		2				L	evel	Descriptor
	CO1	Grasp scientif Reliability	ic conce	pts of S	oftware	•				II	Understanding
Ī	CO2	Apply Softwar	re Relial	bility G	rowth N	Iodels i	n Softw	are		III	Applying
		Development									
	CO3	Resolve the Se	oftware	system	fault tol	erance				IV	Analyzing
C	D-PO N	/Iapping :	r	-	1	1	1	1	T	-	
			0.01	PO1	PO2	PO3	PO4	PO5	PO6	_	
			CO1	3	2			1		_	
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			CO3	1			2		1		
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		IS	SE 2						1	10	
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	ormall	y last three mod	dules) co	overed a	fter MS	SE.					
(1	~										
(r Co		ontents: l: Basic Netwo				J					Hrs.

Need and Concepts of Software Reliability, Failure and Faults – Prevention, Removal, Tolerance, Forecast, Dependability Concept – Failure Behavior, Characteristics, Maintenance Policy, Reliability and Availability Modeling, Reliability Evaluation	7
Module2: Software Reliability Models	Hrs.
Exponential Failure Models – Jelinski-moranda model, Poisson, Musa, Exponential models, Weibull Model, Musa-okumoto Model, Bayseian Model –Littlewood verral Model, Phase Based Model	7
Module3: Prediction Analysis	Hrs.
Model Disagreement and Inaccuracy – Short & Long Term Prediction, Model Accuracy, Analyzing Predictive Accuracy – Outcomes, PLR, U & Y Plot, Errors and Inaccuracy, Recalibration – Detecting Bias, Techniques, Power of Recalibration, Limitations in Present Techniques, Improvements.	6
Module4: The Operational Profile and testing	Hrs.
Concepts and Development Procedures – Customer Type, User Type, System Mode, Functional and Operational Profile, Test Selection - Selecting Operations, Testing For Reliability Measurement	6
Module5: Software Fault Detection	Hrs.
Basic terminology of Fault tolerant, Fault detection using fault tree, Fault tolerant in SRE, Techniques for Fault tolerant: Recovery blocks, N- version programming	7
Module 6: Software Fault Analysis	Hrs.
Fault tree modeling, Fault tree analysis, Analysis of fault tolerant software system, Quantitative analysis of fault tolerant system.	6
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Realize the basics of software reliability	
Module 2: Comprehend the modeling of software reliability.	
Module 3: Analyze the software reliability prediction.	
Module 4: Generate operational profile of software system.	
Module 5: Examine fault detection in system development	
Module 6: Design the fault detection tree for software reliability engineering	

Fitl	e of th	e Course: Pro	fessiona	l Electi	ve-2 W	<i>ireless</i>	Sensor		L		Т	Р	0
		3IT517							3		0	0	3
	_	isite Courses:	Wireles	s comm	unication	on tech	nologies						
Гех	tbook												
		1. Kazem, S											-
		Protocols 74300-2)	and Ap	plicatio	n", Joh	in Wile	y and S	Sons 1s	st Ed.,	2007	(ISB	SN: 978-0	)-47
		2. HolgerKei	rl Will	io And	ireas	"Protoc	ols and	1 Arcł	nitecture	es fo	r W	ireless S	lens
		Network"	· ·	•	,						1 11		•••••
		3. Cauligi F	Raghaver	ndra, S	, Sival	lingam,	Krishr	na M.,	ZantiT	Faieb,	, "W	ireless S	Sens
		Network",	Springe	r 1st Ed	. 2004 (	ISBN:	978-402	0-7883	-5)				
Ref	erence		-	• // • • •			~						
		1. B. Krishna			-				-			•	
		2. Mahalik M Platforms,	,				•	10n: Fu	ndamen	itals,	Stand	ards,	
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		2. To Make					11			and p	protoc	cols	
		3. To familia											
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	CO2	Differentiate	betwee	en rou	iting	protoco	ls for	wire	less	IV	Ana	lyzing	
-	CO3	communication Design wire		nsor n	otwork	sconar	io for	raal	lifa	VI	Cro	ating	
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Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology	
Module 2: Basic Wireless Sensor Technology, Wireless Transmission Technology and	Hrs.
Systems	
Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment,	
WN Trends, Introduction of Wireless Transmission Technology and Systems, Radio	6
Technology Primer, Available Wireless Technologies,	
Module 3: Medium Access Control Protocols for Wireless Sensor Networks	Hrs.
Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs,	6
Sensor-MAC Case Study, IEEE 802.15.4 LR-WPANs Standard Case Study	6
Module 4: Routing Protocols for Wireless Sensor Networks, Transport Control	Hrs.
Protocols for Wireless Sensor Networks	
Introduction, Background, Data Dissemination and Gathering, Routing Challenges and	
Design Issues in Wireless Sensor Networks, Routing Strategies in Wireless Sensor	
Networks, Traditional Transport Control Protocols, Transport Protocol Design Issues,	7
Examples of Existing Transport Control Protocols, Performance of Transport Control	
Protocols.	
Module 5: Topology control, Operating Systems for Wireless Sensor Networks	Hrs.
Motivation and basic ideas, Controlling topology in flat networks - Power control,	
Hierarchical networks by dominating sets, Hierarchical networks by clustering, Combining	
hierarchical topologies and power control, Adaptive node activity, Introduction of	7
operating system for WSN, Operating System Design Issues, Examples of Operating	
Systems	
Module 6: Network Management for Wireless Sensor Networks, Performance and	Hrs.
Traffic Management	
Introduction, Network Management Requirements, Traditional Network Management	
Models, Network Management Design Issues, Example of Management Architecture:	6
MANNA, Other Issues Related to Network Management, Introduction of performance and	0
traffic management, Background, WSN Design Issues, Performance Modeling of WSNs, Case Study: Simple Computation of the System Life Span	
Module 1: Explain wireless Sensor Networks architecture	
Module 1:Explain wireless Sensor Networks architectureModule 2:Study the wireless Sensor Networks protocols and working	
Module 1:Explain wireless Sensor Networks architectureModule 2:Study the wireless Sensor Networks protocols and workingModule 3:Describe & Implementing different MAC protocols	
Module 2: Study the wireless Sensor Networks protocols and working	

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		1. AWS											
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						pt of virt vironme		11					
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	CO1	Explain cl	oud com	puting e	nvironm	ent for pa	arallelisn	1	II	Und	lerstanding	g	
	CO2	Employ di application		virtualiza	tion tech	iniques to	o cloud b	ased	III	App	olying		
_	<b>CO3</b>	Use cloud		ing nlatfe	orms for	developr	nent of r	esilience	e III	Δnr	olying		
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		n: Amazon 2: Virtuali		vices (A	risj jun	aamenill	ıs unu fl	ee uer ll	ccount	creation		rs.	
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Virtualization structures: <i>Hosted and Bare-Meta</i> , Server Virtualization, Terminal Services, Desktop Virtualization, Application Virtualization, Storage Virtualization.	6
Hands-on: Virtual Box installation and Virtual Machine Creation.	
Module 3: Emulation	Hrs.
Basic Interpretation, Threaded Interpretation, Predecoding, Binary Translation, Code discovery and dynamic translation.	8
Module 4: Cloud Computing Basics	Hrs.
Virtualization and Cloud Computing, Cloud Reference Model: Infrastructure as a service ( <i>IAAS</i> ), <i>Platform</i> as a service ( <i>PAAS</i> ), <i>Software</i> as a service ( <i>SAAS</i> ), Types of Clouds, Open Challenges. <i>Hands-on: Managing and creating Amazon EC2 instances.</i>	8
Module 5: Public Cloud and VPC	Hrs.
Cloud Storage, Public Cloud Networking: Route53, Content Delivery Networks, Resilience Infrastructure. Virtual Private Cloud (VPC) fundamentals, Security Groups, Network Access Control List, Network Address Translation. <i>Hands-on: VPC implementation on AWS, AWS S3 bucket creation, static website</i> <i>hosting using cloud storage.</i>	7
Module 6: Cloud Security	Hrs.
Host Security, Challenges with Cloud data, Challenges with data security, data confidentiality and encryption, Cloud Firewall, Virtual Firewall.	5
<ul> <li>Module wise Measurable Students Learning Outcomes :</li> <li>Module 1: Explain basic concepts of distributed computing.</li> <li>Module 2 : Discuss the virtualization of CPU, Memory etc</li> <li>Module 3: Apply the different emulation processes to implement virtualization.</li> <li>Module 4: Explain the cloud architecture.</li> <li>Module 5: Apply the technical aspect of public and private cloud platform.</li> <li>Module 6: Identify the security aspects of cloud platforms in corporate world.</li> </ul>	

Title of 3IT519		ourse: Prof	essional	Electiv	re 2 - In	format	ion Ret	rieval		L 3	T 0	P 0	Cr 3
Pre-Re	auisite	Courses:											
Textbo	-	courses											
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		Frakes Will	iam B., I	Baeza-Y	ates Ri	cardo, "	Inform	ation Re	trieval	– Da	ata struct	ures a	nd
		Algorithms'											
Course	Object	tives :											
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		make able to		and retr	ieve rea	l time d	lata stor	age					
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		be able to							level	Γ	Descriptor	r	
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		retrieval fo		,		0					rr-J8		
	CO3	Evaluate p					nation r	etrieval	V	E	valuating	g	
		system		11								-	
CO-PO	Марр	ing :											
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			CO2		2								
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		ction, Phor									1		
Modu	le 2: Ir	ndex constr	uction a	nd tern	n score								Hrs.
Hardw	are bas	sics, Blocke	d sort-b	ased in	dexing,	Single	pass in	-memor	y index	xing	, Distrib	uted	7

indexing Dynamic indexing, Other types of indexes, Index compression, Statistical	
properties of terms in information retrieval, Dictionary compression, Postings file compression,	
References and further reading, Scoring term weighting and the vector space model,	
Parametric and zone indexes, Term frequency and weighting, The vector space model for	
scoring, Variant TF-IDF functions, Computing scores in a complete search system,	
Efficient scoring and ranking, Components of an information retrieval system, Vector space	
scoring and query operator interaction, References and further reading	
Module 3: Evaluation in information retrieval	Hrs.
Information retrieval system evaluation, Standard test collections, Evaluation of unranked	
retrieval sets, Evaluation of ranked retrieval results, Assessing relevance, A broader	
perspective: System quality and user, Utility, Results snippets, Relevance feedback and query	
expansion, Relevance feedback and pseudo relevance, feedback, Global methods for query	
reformulation, Probabilistic information retrieval, Review of basic probability theory, The	7
probability ranking principle, The binary independence model, An appraisal and some	
extensions, References and further reading, Language models for information retrieval,	
Language models, The query likelihood model, Language modeling versus other approaches in	
information retrieval, Extended language modeling approaches	
Module 4: Text classification	Hrs.
The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties	
of Naive Bayes Feature selection, Evaluation of text classification, Vector space classification	
Document representations and measures of relatedness in vector spaces, Rocchio classification,	
k nearest neighbor, Linear versus nonlinear classifiers, Classification with more than two	
classes, The bias-variance tradeoff, Support vector machines and machine learning on	7
documents, Support vector machines: The linearly separable case, Extensions to the support	
vector machine model, Issues in the classification of text documents, Machine-learning methods	
in ad hoc information retrieval	
Module 5: Clustering	Hrs.
Clustering in information retrieval, Problem statement, Evaluation of clustering, K-means,	~
Model-based clustering, Hierarchical clustering, Hierarchical agglomerative clustering,	
Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid	
clustering Optimality of hierarchical agglomerative, clustering, Divisive clustering, labeling,	6
Matrix decompositions and latent semantic indexing, Linear algebra review, Term-	Ũ
document matrices and singular value, decompositions, Low-rank approximations, Latent	
semantic indexing, References and further reading	
Module 6: Web search	Hrs.
Background and history, Web characteristics, Advertising as the economic model, The search	
user experience, Index size and estimation, Near-duplicates and shingling, References and	
further reading, Web crawling and indexes, Overview, Crawling, Distributing indexes,	6
Connectivity servers, References and further reading, Link analysis, The Web as a graph,	
PageRank, Hubs and authorities, References and further reading	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: To summarize the basic concepts of information retrieval	
Module 2: To apply index selection, term score and searching for information retrieval	
Module 3: To analyze models for information retrieval	
Module 4: To appraise text classification for information retrieval.	
Module 5: To realize the clustering and matrix for indexing and information retrieval	
Module 6: To apprehend web searching for information retrieval	

**Professional Core (Lab)** 

Title of the <b>C</b>	ourse: Uni	x Intern	als La	b 3IT55	2			L	Т	Р	Cr
								0	0	2	1
Pre-Requisite											
Hands on L		Windows	s syst	em prog	grammi	ng, An	y netw	ork pr	rogramma	ble Lar	nguage
Preferably C/C	C++, Java, p	ython, S	Scala, I	Ruby etc.							
Fextbooks:											
3. Beej Jorg Decembe	gensen, "B r 15, 2010.	•		o Unix	<i>IPC</i> ",	Brian '	"Beej J	lorgense	en" Hall,	Version	n 1.1.
4. Beej Jorg				Network	Progr	amming	: Using	z Intern	net Socket	s". Bria	n "Be
	n" Hall, Ver							,			
5. Stevens I								ss Com	municatio	ns", Vo	lume 2
	Hall, Second				<u> </u>	U	1				
References:											
	Richard W.,									dition, 1	990.
	itabha, "Un							h Editio	on, 2008.		
3. Bach Mar		he Desig	n of U	nix Oper	ating Sy	vstem",	PHI.				
Course Objec											
	istrate the u			-							
	uce the varie										
3. Impart	the IPC for	r solving	the re	al world	problen	ns.					
Course L age-	ing Autor	mage									
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De a	able to						]	level	Descript	tor	
CO1 Cor	npare the va	arious IP	C's av	ailable in	n OS.		1	IV	Analyzi		
CO2 Apr	braise the sc	ocket pro	gramn	ning func	ctioning	•	]	IV	Analyzi	-	
	ide the sy						ctive	V	Evaluati	-	
	cessing.									C	
CO-PO Map	ping:										
			<b>PO1</b>	PO2	PO3	PO4	PO5	<b>PO6</b>			
		CO1	2	1							
		CO2		2	2						
		CO3			3	1					
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Lab Assessme	ent										
There are four	-				1, LA2	, LA3 ai	nd Lab	ESE			
MP: Lab ESE		te head		-						T	-
Assessment	Based on			Conduct	ed by			and Ma	arks	Marks	
							mission				_
LA1		ctivities,		2	ourse		•		week 4	25	
	attendan	ce, jouri	nal	Fac	ulty	su		n at the	end of		
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LA2		ctivities,		-	ourse				week 8	25	
	attandan	attendance, journal			Faculty			n at the	end of		
	attendan	ice, journ	nal	Fac	ulty	su					
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LA3	Lab a	ctivities,		By C	ourse	Dur	w ing wee	k 10 to	week 14	25	_
LA3		ctivities,		By C	-	Dur	w ing wee bmissio	k 10 to n at the		25	_
LA3	Lab a	ctivities,		By C	ourse	Dur	w ing wee bmissio	k 10 to		25	
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	week 18	
	indicates starting week of the semester	
	vities shall include performing experiments, mini-project, presentations, drawing, p	programmii
	er suitable activities as per the nature of lab course.	
The exp	erimental lab shall have typically 8-10 experiments.	
Course	Contents: Sample assignment list	
Conte	nt	Hours
1.	Processing Environment:	
	a. fork, vfork, wait, wait pid(), exec (all variations exec), and exit	
	b. IPC: Interrupts and Signals: signal(any fives type of signal), alarm, kill,	8
	signal, signation, pause	0
2.	File system Internals:	
	a. Stat, fstat, ustat.	
	b. Threading concept: clone, threads of java.	6
	c. IPC: Semaphores: semaphore. h-semget, semctl, semop.	
3.	IPC: Message Queues: msgget, msgsnd, msgrcv.	6
4.	IPC: Shared memory and sockets:	
	d. IPC: Shared Memory: (shmget, shmat, shmdt.	6
	e. IPC: Sockets: socket system call in C/socket programming of Java.	

Even Semester//Sem-II Professional Core (Theory)

itle	of the C	Course: Data	Mining	Metho	as and A	Applica	tions 3	11521	L	T			Cr
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	<b>A</b>	e Courses: D	atabase	Engine	ering								
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	1.	Han Jiawei									nique	es" The Mo	orga
	2	Kaufmann S									D	and r	
	2.	Dunham M	1. H, "D	Pata Mii	ning: In	troduct	ory and	Advan	nced to	opics",	Pear	son, $2^{m}$ E	ditio
D . C.		2003											
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	1.	Chattamvell House, 2 <sup>nd</sup> I			vinning r	vietnou	s. Conc	epts a	Аррис	ations	, ma	rosa Puolis	sning
	2	Mitra Sushr			nku "De	ata Min	ing Mul	ltimedia	Soft	Compu	itina	and Riome	etric
	2.	WILEY Put	lication	$3^{rd}$ Ed	ition $20$	)03	ing wiu	linicula	i, 5011	Compu	ning		
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		To propose											
Cour		ning Outcom					Process						
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		able to					-	level	1	scriptor			
F	CO1	Summarize	the basi	c conce	pts, tec	hniques	and a	lgorithn	ns of	II		derstandin	g
		Summarize the basic concepts, techniques and algorithms of Data Mining.											0
	CO2	To apply data mining techniques and algorithms for solving								III		Applying	
		real life problems.									11 5 0		
Ē	CO3	To analyze various clustering and classification techniques in V									I	Analyzing	
		data mining.			-			-					
CO-I	PO Map	ping:											
				<b>PO1</b>	PO2	PO3	PO4	PO5	<b>PO6</b>				
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			CO3	3				2	1				
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		odules) covere	ed atter I	MSE.									
	and l'ant	onte											
Cour		ntroduction						•					[rs

Data Mining, Kinds of Data, Kinds of Patterns, Technologies, Major Issues in Data Mining.	
Getting to Know Your Data: Data Objects and Attribute Types, Basic Statistical Descriptions	6
of Data, Data Visualization, Measuring Data Similarity and Dissimilarity. Data Preprocessing:	0
Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	
Module 2: Mining Frequent Patterns	Hrs
Basic Concepts, Frequent Itemset Mining Methods, Pattern Evaluation Methods. Pattern	
Mining in Multilevel, Multidimensional Space, Constraint-Based Frequent Pattern Mining,	
Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate	6
Patterns. Advanced Pattern Mining: Pattern Mining in Multilevel, Multidimensional Space,	U
Constraint-Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal	
Patterns, Mining Compressed or Approximate Patterns.	
Module 3: Classification	
Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based	
Classification, Model Evaluation and Selection, Techniques to Improve Classification	
Accuracy	7
Classification Advanced Methods: Bayesian Belief Networks, Classification by	/
Backpropagation, Support Vector Machines, Classification Using Frequent Patterns, Lazy	
Learners, Other Classification Methods.	
Module 4: Cluster Analysis	Hrs
Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-	
Based Methods, Evaluation of Clustering. Advanced Cluster Analysis: Probabilistic Model-	7
Based Clustering, Clustering High-Dimensional Data, Clustering Graph and Network Data,	,
Clustering with Constraints.	
Module 5: Outlier Detection	Hrs
Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-	
Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining	7
Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data.	
Module 6: Data Mining Applications	Hrs
Graph Mining, Social Network Analysis, Multi-relational Data Mining, Text Mining, Web	6
Mining, Spatial Mining, Temporal Mining.	
Module wise Measurable Students Learning Outcomes: After the completion of the course the	e students
should be able to	
Module 1: Explain basic concepts of data mining and data processing techniques.	
Module 2: Realize frequent pattern mining and apply various pattern mining on different types of	data sets.
Module 3: Apprehend data classification methods and apply on different types of data sets.	
Module 4: Apply clustering methods different types of data sets. Module 5: Analyze, validate and removal of outliers within data sets.	

**Module 5:** Analyze, validate and removal of outliers within data **Module 6:** Apply data mining solution for multimedia data sets.

3IT522		8	TUCCSSIII	g And	Patter	n Rec	ognitio	on	L	Т	Р	Cr	
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Pre-Req Textboo	_	es : MATRIX C	perations	, Discr	ete Stri	ucture	5, MA	LAB	(Recom	imende	a but not n	ecessary)	
Textboo	1.	Sonka Milan, Vision", 3rd E Rafel C. Gon Education, 200	dition, CI zalez, Ric	Engir	neering	,2013		_		-	-		
Referen	ces:	Education, 200	50.										
		Gose Eark, Rie Prentice Hall of						gnition	and Im	age An	alysis", 1st	Edition,	
Course	Obje	ctives:											
	1.	To introduce	the imag	e fund	amenta	als and	d math	nematio	cal tran	sforms	necessary	for image	
		processing.											
		To explore the					ies						
		To show imag											
		To explain the	-	mpress	sion pro	ocedui	es.						
Course	Lear	ning Outcomes	:										
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	,	able to	piction of		Juise	ne stu	uciit si	nouiu	De	level	Descripto		
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CO		Implement pi							image	III	Applying	-	
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CO	)3	Design proto		an ir	nage	proce	sing	and 1	oattern	VI	Creating		
		recognition ap			U	1	U	1					
CO-PO	Map												
	-			PO1	PO2	[03	<b>PO4</b>	PO5	PO6				
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			CO2						3				
			CO3				2						
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Course	Cont	ents:											
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		color images,	-		-			-	-			7	
		y, noise image.	inetries a	ind top	0105100	*i proj		01 415	,itui iiit	4905, III	stograms,	,	
	<u> </u>	mage Enhance	ment									Hrs	
		tness transform		osition	depe	ndent	brigh	tness	correct	ion, gi	ray scale		
	-	on; geometric tr			-		-				5	6	
Modul	e 3: I	mage Preproce	essing										
		ors, zero-crossi											
•		, edges in mult	-	image	s, loca	l prep	ocessi	ng and	l adapti	ve neig	hborhood	6	
<u> </u>		ng; image restor											
		mage Segment			1.1.			1.1	1 1 1 1		1.1	Hrs	
	hical	etection method data structures; order tracing, be	edge bas	sed ima	0		1		-		•	7	

Module 5: Mathematical Morphology	Hrs
Basic morphological concepts, four morphological principles, binary dilation, erosion, Hit or miss transformation, opening and closing; thinning and skeleton algorithms; Morphological segmentation –particles segmentation and watersheds, particle segmentation	6
Module 6: Pattern Recognition Fundamentals	Hrs
Basic concepts of pattern recognition, fundamental problems in pattern recognition system, design concepts and methodologies, example of automatic pattern recognition systems, a simple automatic pattern recognition model.	7
Module wise Measurable Students Learning Outcomes: After the completion of the course the	ne students
should be able to	
Module 1: List digital image representation, properties of human visual system and various app	lications.
<b>Module 2:</b> Differentiate image processing operations for improving image quality through enl restoration and filtering etc.	nancement,
<b>Module 3:</b> Apply Affine transformation and using registration compressing data to save s channel capacity during transmission	torage and
Module 4: Apply Image segmentation techniques for partitioning into objects and background	d
Module 5: Inspect image features, quantifying shapes, patterns in images using pattern i	recognition
algorithms.	
<b>Module 6:</b> Summarize knowledge to design a prototype of image processing and pattern application.	recognition

Title of the Course: Scientific Computing 3IT523       L       T											Cr
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	i <b>site</b> Programmin	g experier	nce in (	C,C++,	Java						
Textbook:		a t		· a		1	10				
	1. Bruce Tate, "		0 0			-		20	12		
D . C	2. Dr. Mark Ga	rdenerr, "I	he Sta	tistical	Program	nming	Langu	age~,20	<i>112.</i>		
Reference		are are									
Course Ol	1. Edx.org, ours	sera.org									
	5. To introduce	the imag	oe fiin	dament	als and	mathe	matica	1 trans	forms ne	ecessar	v for imag
	processing.	, the initia	50 Iuli	aumen	uis uila	matin	matica	i trans		eeessur.	y ioi iiiug
	6. To explore th	e image e	nhance	ment t	echnique	es					
	7. To show ima										
	8. To explain th					es.					
Cour <u>se Le</u>	earning Outcome										
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									level	Descr	riptor
1.	Compare func	tional and	logica	l progr	amming	, <b>.</b>			IV	Analy	zing
2.	Use appropria							blem	III	Apply	ing
3.	Generate scrip	ots to autor	mate da	ata fori	natting a	and ana	alysis		VI	Creat	ing
CO-PO M	lapping:										
			<b>PO1</b>	PO2	PO3	<b>PO4</b>	PO5	<b>PO6</b>			
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		CO2	1								
		CO3				3					
Course Co	ntonte.										
	michts.										
Module 1	l :Using R										Hrs
	reate a scatter plo	ts, includi	ng mul	tiple co	orrelatio	n point	S.				2
b. Ci	reate line graphs										
	reate bar and pie of	chart									
Module 2: Analysis in R											Hrs
	a. Regression Analysis										•
a. R	0	IS									2
a. R <b>b.</b> C	lassification in R		0.01								2
a. R b. C Module 3	lassification in R <b>3 :AI Programm</b> i	ing PROL		• 1	<u> </u>						2 Hrs
a. R b. C Module 3 1.1 W	lassification in R <b>3 :AI Programmi</b> Vrite a program fo	ing PROL	ng fact								2 Hrs 2
a. R b. C Module 3 1.1 W 1.2 W	lassification in R <b>3 :AI Programmi</b> Vrite a program for Vrite a program for	ing PROL r calculation r solution	ng fact to the v								2
a. R b. C Module 3 1.1 W 1.2 W Module 4	lassification in R <b>3 :AI Programmi</b> Vrite a program fo Vrite a program fo <b>4: AI Programmi</b>	ing PROL r calculation r solution ing PROL	ng fact to the v OG2	water ji	ıg probl	em.					
a. R b. C Module 3 1.1 W 1.2 W Module 4 a. W	lassification in R <b>3 :AI Programmi</b> Vrite a program fo Vrite a program fo <b>4: AI Programmi</b> Vrite a program to	ing PROL r calculation r solution ing PROL solve more	ng fact to the v OG2 nkey-ba	water ju anana p	ıg probl	em.					2 Hrs
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**Professional Elective (Theory)** 

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Pre-	Requisit	te Courses: Bas	ic knowle	dge Lii	near Al	gebra.	Probal	oility T	-	It wo	•	-	
	-	nave done a cour		-		-		, j	j:				
Texí	tbooks:					0							
	1.	Ian Goodfello	w, Yoshu	a Beng	io and	Aoron	Courv	ille "D	eep Lea	arning	g", The	e MIT l	Press
		Cambridge, M	lassachuse	etts Loi	ndon, E	England	1.		-	-	-		
	2.	Aurelien Gero	on,"Hands	-on Ma	chine 1	Learnii	ng with	Scikit	-Learn	& Te	ensoFle	ow",O'	REILLY
Refe	erences:												
	1.	Prof.Mitesh N											
		Prof. Andrew	Ng, "Dee	p Learn	ning Sp	ecializ	ation",	course	e on co	ursera	a		
Cou	rse Obje						-						
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Module 3: Auto encoders and relation to PCA	
Principal Component Analysis and its interpretations, Singular Value Decomposition. Autoencoders and relation to PCA, Regularization in autoencoders, Denoising autoencoders,	7
Sparse autoencoders, Contractive autoencoders	
Module 4: Regularization	Hrs
Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout. Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization	6
Module 5: Computer Vision	Hrs
Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet Object Localization, Object Detection using Convolutional Implementation of Sliding Windows, Bounding Box Predictions, Intersection Over Union, Non-max Suppression, Anchor Boxes, YOLO Algorithm, Region Proposals.	7
Module 6: Recurrent Neural Networks	Hrs
Learning Vectorial Representations Of Words Recurrent Neural Networks, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs. Encoder Decoder Models, Attention Mechanism, Attention over images.	6
Module wise Measurable Students Learning Outcomes: After the completion of the course th	e students
should be able to	
Module 1: Understand the basics of Neural Networks.	
Module 2: Study Neural Networks/Deep Neural Networks.	
Module 3: Discuss the Auto encoders and relation to PCA.	
Module 4: Apply regularization technique in Deep Learning.	
Module 5: Analyse modern Computer Vision aspects.	
Module 6: Implement basic Recurrent Neural Networks.	

Performance Computing 3IT533       3       0       0       3         Prc-Requisite Courses: Fundamental knowledge in Computer Algorithms         Textbooks:       1. Victor Eijkhout, " Introduction to High Performance Scientific Computing", Second Edition, Lulu.com publishers         References:       1. Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press         Course Objectives :       1. To introduce concepts in numerical algebra.         3. To instruct numerical computations in parallel.       Bloom's Cognitive able to         Course Learning Outcomes:       II Understanding         CO1 Differentiate the sequential and parallel architecture       II Understanding         CO2 Study abstraction of sequential numerical algorithms       IV Analyzing         CO3       Execute the computations in parallel and estimate the UI, V Applying, performance         CO2 Study abstraction of sequential numerical algorithms       IV Analyzing         CO3       2       3         CO3       2       3         CO4 Differentiate the sequential numerical algorithms       IV Analyzing         CO3       2       3         CO3       2       4         CO4       DO1       PO2         PO3       PO4       PO5         PO6       CO3       2         CO3		the Course: Prof		Electi	ve 3- H	ligh		Ι		Т	]	Р	Cr	
Textbooks:         1. Victor Fijkhout, " Introduction to High Performance Scientific Computing", Second Edition, Lulu.com publishers         References:         1. Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press         Course Objectives :         1. To introduce concepts in numerical algebra.         3. To instruct numerical computations in parallel.         Course Learning Outcomes:         CO         After the completion of the course the student should be able to         Bloom's Cognitive able to         Objectives :         CO         Other the completion of the course the student should be able to         Import PO2         Other the computations in parallel anchitecture:         III Understanding         CO         After the computations in parallel and estimate the III, V Analyzing Evoluting         Defective:         Evolute completion of sequential numerical algorithms         V Analyzing         CO-PO Mapping :         Co-PO Mapping:         Motion PO2 PO3 PO4 PO5 PO6         Colspan="2">Colspan="2"         Assessme								-				0	3	
1. Victor Eijkhout, "Introduction to High Performance Scientific Computing", Second Edition, Lulu.com publishers         References: <ul> <li>Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press</li> </ul> Course Objectives : <ul> <li>To introduce concepts of Parallel Computing Architecture.</li> <li>To introduce concepts in numerical algebra.</li> <li>To instruct numerical computations in parallel.</li> </ul> Course Learning Outcomes:         CO         After the completion of the course the student should be able to         Bloom's Cognitive in Understanding         CO         Officientiate the sequential and parallel architecture         II Understanding         CO2         Study abstraction of sequential numerical algorithms         IV         Analyzing         Performance         CO2         POI       PO2       PO3       PO4       PO5       PO6       CO2       2       3	Pre-Re	quisite Courses: F	Fundame	ntal kn	lowledg	ge in Co	ompute	r Algor	ithms					
Edition, Lulu.com publishers         References:         1. Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press         Course Objectives :         1. To introduce concepts of Parallel Computing Architecture.         2. To introduce concepts of Parallel Computing Architecture.         3. To instruct numerical computations in parallel.         Course Learning Outcomes:         CO         After the completion of the course the student should be able to         able to       Bloom's Cognitive         clospan="2">ID Differentiate the sequential and parallel architecture       II         CO2         Study abstraction of sequential numerical algorithms         IV Analyzing         CO3         PO1         PO2         CO4         PO2         O PO4         PO5         PO6         COPO Mapping:         PO1       PO2       PO3       PO4       PO5       PO6       PO6       Seconsent:       Foconsester Examination (MSE) and one E Seconster Examination (SES), One Mid Semester Examination (MSE) and one E Seconster Examination (SES), 30% and 50% weights respectively.<	Fextbo	oks:												
Edition, Lulu.com publishers         References:         1. Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press         Course Objectives :         1. To introduce concepts of Parallel Computing Architecture.         2. To introduce concepts of Parallel Computing Architecture.         3. To instruct numerical computations in parallel.         Course Learning Outcomes:         CO         After the completion of the course the student should be able to         able to       Bloom's Cognitive         clospan="2">ID Differentiate the sequential and parallel architecture       II         CO2         Study abstraction of sequential numerical algorithms         IV Analyzing         CO3         PO1         PO2         CO4         PO2         O PO4         PO5         PO6         COPO Mapping:         PO1       PO2       PO3       PO4       PO5       PO6       PO6       Seconsent:       Foconsester Examination (MSE) and one E Seconster Examination (SES), One Mid Semester Examination (MSE) and one E Seconster Examination (SES), 30% and 50% weights respectively.<			nout, " Ir	ntroduc	tion to	High P	erform	ance Sc	eientif	ic Cor	nputing"	, Seco	ond	
1. Shameem Akhtar, Jason Roberts, "Multi-Core Programming", Intel Press         Course Objectives :         1. To introduce concepts of Parallel Computing Architecture.         2. To introduce concepts in numerical algebra.         3. To instruct numerical computations in parallel.         Course Learning Outcomes:         CO         After the completion of the course the student should be able to         Intervention of the course the student should be able to         Intervention of sequential and parallel architecture         II         Understanding         CO2         Study abstraction of sequential numerical algorithms         IV         Analyzing         performance         CO3       Execute the computations in parallel and estimate the         III, V       Applying, Evaluating         CO4       2         III       V         Assessments :       Feacher Assessment:         Feacher Assessment:       ISE 1         Foo (DSE)       Marks         Assessment :       ISE 1         Co3       10         Marks       ISE 1         ISE 1       10         MSE       30         ISE 2       10         ISE 2 <td></td> <td></td> <td></td> <td></td> <td></td> <td>C</td> <td></td> <td></td> <td></td> <td></td> <td>1 0</td> <td>-</td> <td></td>						C					1 0	-		
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performance       Evaluating         CO-PO Mapping :       PO1 PO2 PO3 PO4 PO5 PO6 CO1 3 2 3 3 4       PO5 PO6 CO2 2 3 3 4         CO2 2 3 3 4       CO2 2 3 3 4       CO2 2 3 3 4         CO3 2 3 3 4       CO3 2 3 3 4       CO3 2 3 3 4         Assessments :       Feacher Assessment:       For CO3 2 3 3 4         Fwo components of In Semester Evaluation (ISE), One Mid Semester Examination (MSE) and one E       Semester Examination (ESE) having 20%, 30% and 50% weights respectively.         Assessment       Marks         ISE 1       10         MSE       30         ISE 2       10         ESE       50         ISE 1 and ISE 2 are based on assignment, oral, seminar, test (surprise/declared/quiz), and group discussion.[One assessment tool per ISE. The assessment tool used for ISE 1 shall not be used for ISE 2]         MSE:       Assessment is based on 50% of course content (Normally first three modules)         ESE:       S0         ISE 1       100         ESE 3       50         ISE 2]       MARK         MSE:       Sesessment is based on 50% of course content (Normally first three modules)         ESE:       So         Source Contents:       Module 1: Sequential Computer Architecture         Module 1:       Sequential Computer Architecture       Hrs.			<b>–</b>			-					-	<u> </u>		
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Granularity of parallelism, Parallel programming, Topologies, Load balancing, The TOP500 List	Granu	larity of parallelis											6	

Module 3 : Computer Arithmetic	Hrs.
Integers, Representation of real numbers, Round-off error analysis, More about floating point arithmetic, Conclusions	6
Module 4: Numerical treatment of differential equations and Numerical linear	Hrs.
algebra	
Initial value problems, Boundary value problems, Initial Boundary value problem, LU factorization, Sparse matrices	7
	Hrs.
Module 5: High performance linear algebra	пrs.
Asymptotic, Parallel dense matrix-vector product, Scalability of the dense matrix-vector	
product, Scalability of LU factorization, Parallel sparse matrix-vector product,	_
Computational aspects of iterative methods, Preconditioned construction, storage, and	7
application, Parallelism and implicit operations, Block algorithms on multicore	
architectures	
Module 6: Molecular dynamics	Hrs.
Force Computation, Parallel Decompositions, Parallel Fast Fourier Transform, Integration	7
for Molecular Dynamics	/
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 7: Explain basic concepts of Sequential Computing	
Module 8: Explain basic concepts of Parallel Computing	
Module 9: Evaluate numerical representations and arithmetic	
Module 10: Analyze standard problems in Linear Algebra (LA)	
Module 11: Implement LA into its parallel counter part	
Module 12: Analyze molecular dynamics	

	the Course: Pro	ofessiona	al Electi	ve 3 - E	Big Data	a Analy	tics	L	Т	Р	C			
BIT534								3	0	0	3			
Pre-Rea	quisite Courses:	Data M	ining, D	atabase	Manag	ement S	Systems							
Textbo	oks:													
	1. Prajapati Edition, 2	-	, "Big D	ata Ana	lytics v	vith R a	nd Had	oop", Pac	kt Publisl	ning, 1 <sup>st</sup>				
	2. Minelli M Intelligent	ce and A	nalytic T											
Referen	Series, 1st	Edition,	2013.											
Keleren	1. White Tor 2. Franks Bi Streams w	ill, "Tam	ing the l	Big Dat	a Tidal	Wave: ]	Finding	Opportu	nities in H	luge Data	a			
Course	Objectives :	an Auva	incea Ai	larytics	, •• •••	y and S	AS Dus		<u>cs,15t Lu</u>	111011, 20	12			
ourse	<ol> <li>To impart</li> <li>To prepare</li> <li>To provide</li> </ol>	e student e the visu	s for ana	alyzing	the big	data usi	ing varie	ous techn		5				
CO	After completio		course	student	t should	l be abl	e to	Bloom	's Cognit	ive				
								level	De	escriptor				
CO1	Comprehend the techniques.	fundame	entals of	fvariou	s big da	ta analy	tics	II	U	Understanding				
CO2	Study the Map R analytics for bus		-		ciated	with big	, data	IV	A	nalyzing				
CO3	Design efficient volumes.				ne data i	from lar	ge	V	Cı	reating				
CO-PO	Mapping :													
			PO1	PO2	PO3	PO4	PO5	PO6						
		C01	2											
		CO2 CO3	1	1		3	3	2						
		05	1				5	2						
Two con	r Assessment: mponents of In Se er Examination (E									and one	End			
		SE 1						10						
		ASE						30						
		SE 2 ESE						<u>10</u> 50						
ISE 1 a	and ISE 2 are base		signmen	t/declar	ed test/	uiz/ser	ninar et							
MSE: A	Assessment is bas	sed on 50	)% of co	ourse co	ntent (N	Jormall	y first tl	hree modu		ntent				
(norma	ally last three mod						-							
Course	Contents:													
Modu	le 1: ta and its Importa		* * *	(D) =			D: -	. <b>.</b>	1		<u>Irs.</u> 5			

Big Data Analytics, Big Data Analytics applications.	
Module 2: Big Data Technologies	Hrs.
Hadoop's Parallel World, Data discovery, Open source technology for Big Data Analytics,	
Cloud and Big Data, Predictive Analytics, Mobile Business Intelligence and Big Data,	6
Crowd Sourcing Analytics, Inter- and Trans-Firewall Analytics.	
Module 3: Processing Big Data	Hrs.
Detecting Patterns in Complex Data with Clustering and Link Analysis, Identifying	
previously unknown groupings within a data set, Segmenting the customer market with the	
K-Means algorithm, Defining similarity with appropriate distance measures, Constructing	8
tree-like clusters with hierarchical clustering, Clustering text documents and tweets to aid	
understanding	
Module 4: Hadoop Mapreduce	Hrs.
Employing Hadoop Map Reduce, Creating the components of Hadoop MapReduce jobs,	
Distributing data processing across server farms, Executing Hadoop Map Reduce jobs,	
Monitoring the progress of job flows, Building Blocks of Hadoop Map Reduce,	8
Distinguishing Hadoop daemons -Investigating the Hadoop Distributed File System,	
Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.	
Module 5: Advanced Analytics Platform	Hrs.
Real-Time Architecture, Orchestration and Synthesis Using Analytics Engines, Discovery	
using Data at Rest, Implementation of Big Data Analytics, Big Data Convergence, and	7
Analytics Business Maturity Model.	
Module 6: Analytic Tools	Hrs.
PIG overview, SQL vs. PIG, PIG Latin, User Defined Functions, Data Processing Operators,	5
Overview of Hive, Hive QL, Tables, Querying Data.	5
Module wise Measurable Students Learning Outcomes :	
Module 1: Generalize distributed, parallel, cloud computing and SQL concepts	
Module 2: Gain conceptual understanding of data analytics	
Module 3: Knowledge of prominent algorithms used to mine the data	
Module 4: Realize of concepts of map and reduce and Hadoop File System.	
Module 5: Classify the fundamental techniques and tools used analyze large volumes of data	1.
Module 6: Summarize the data analysis with visualization techniques.	

Title of the Course: Pr	ofessiona	al Electi	ive 4 Da	atabase	Design	and	L		Т	Р	Cr
Performance Tuning 3					2 00-8-		3		0	0	3
Pre-Requisite Courses:		e Engin	eering								
Textbooks:		<u>U</u>	<u>U</u>								
1. Singh S.K 2 <sup>nd</sup> Editio	n, 2011	-		-	-	-	-				
2. Ramakris Tata McC				nannes,	"Databa	ise Man	agem	ent Sy	stems	", 2 <sup>nd</sup> Edi	tion,
References:		,									
1. Mullins C Procedure	Craig S, "I	Databas	e Admi	nistratio	on: The $2^{nd}$ F	Comple	ete Gu	ide to	Practi	ices and	
2. Shasha D	ennis and	Bonnet	t Philipp	pe, Data	abase Tu	ining, P	rincip		xperin	nents and	
Troublest	nooting T	echniqu	es, Else	evier Re	print, 3	<sup>a</sup> Editio	on, 200	)5.			
Course Objectives : 1. Preparing specificat 2. To impart 3. To discus database s	ions. t database s about th	e securit	y and a	dminist	rative a	nd perfo	orman	ce moi	nitorir	ng tasks.	
Course Learning Outco											
CO After completio		course	studen	t should	d be abl	le to	]	Bloom	n's Co	gnitive	
								level	Des	criptor	
CO1 Comprehend the	e database	e design	cycle a	ind adm	inistrati	ion		2	Unc	lerstandir	ıg
CO2 Evaluating datal guidelines	-							5		luating	
CO3 Propose optimiz transactions	zed query	plans fo	or paral	lel and o	distribut	ted		6	Cre	ating	
<b>CO-PO Mapping :</b>							•				
		<b>PO1</b>	PO2	PO3	PO4	PO5	PO6				
	CO1	2									
	CO2		1		2	4					
	CO3	3				1	2				
Assessments : Teacher Assessment: Two components of In S Semester Examination (I	ESE) havi		· ·	· ·			ctivel	у.	(MSE	E) and on	e End
	essment							arks			
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	SE 2							$\frac{30}{10}$			
	ESE							50			
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Course Contents:											
Module 1 Concepts of	Databas	e Desig	n and a	dminis	tration					I	Irs.

Introduction, Software Development cycle (SDLC), Database Development cycle (DDLC), Automated Design tools, Normalization concepts <b>Database Administration</b> DBA Tasks, Defining the Organization's DBMS Strategy, Managing User access, Database performance management	6
Module 2: Query Processing and Optimization	Hrs.
Introduction, Query processing, syntax analyzer, query decomposition, query optimization (cost estimation), pipelining and materialization, Heuristics in Query Optimization, structure of query evaluation plans.	7
Module 3: Parallel and distributed transaction processing	Hrs.
Parallel and distributed database architectures, Distributed transactions, Optimization of Distributed Queries, Multi-database Query Processing, Distributed concurrency control and recovery	6
Module 4: Database security	Hrs.
Introduction, database security issues, Access control in database systems (DAC, MAC, RAC), Inference control, multilevel database security, statistical database recovery, Intrusion tolerant database systems, SQL injection	6
Module 5: Physical Database Design and Tuning	Hrs.
Physical DB Design, Index selection, Guidelines for Index Selection, Clustering and Indexing, Overview of Database Tuning, Choices in Tuning the Conceptual Schema, Choices in Tuning Queries, DBMS Benchmarks	7
Module 6: Complex database systems	Hrs.
Introduction to Spatial Databases: Spatial Data Structures, Spatial Storage and Indexing, spatial queries, Multimedia databases, Temporal and sequential databases	7
Module wise Measurable Students Learning Outcomes :	
<ul> <li>Module 1: Describe a database by applying development cycle and automated tools.</li> <li>Module 2: Summarize the steps of query processing and optimized query evaluation plans.</li> <li>Module 3: Classify parallel and distributed transactions without deadlocks using various concurrency control techniques.</li> <li>Module 4: Propose good database security at various levels.</li> <li>Module 5: Apply various DBMS benchmarks and tuning parameters to improve performan database systems.</li> </ul>	
Module 6: Distinguish database systems like spatial database, Multimedia databases, Temp sequential databases.	oral and

	f the Course: Pro	Diessiona	al Electi	lve 4 - S	sonwar	e Defin	ed Netv	vork J	1153/	L 3	T 0	P 0	$\frac{Cr}{3}$
Pre-Re	equisite Courses:	Comput	er netwo	orks, Cl	oud Co	mputing	, Virtua	lization	1	5	0	0	
Textbo	oks.												
1.	Black Chuk, Cu	ulver Ti	mothy'	ʻSoftwa	re Def	ined Ne	etworks:	A Co	mprehe	ensive	e A	ppro	) ach'
	Wiley publicatio								1				
2.	Kurose James I	F, Ross	Keith,	"Comp	outer N	letwork	ing: A	Top-D	own A	Appro	ach	",Pe	arso
	Publication, 6 <sup>th</sup> E	dition, 20	014.										
Refere													
1.	Thomas D. Nadea								view of	Netv	vorl	K	
2	Programmability									TT'11	₄th	1.	
2.	Behrouz A. Forou 2008.	izan , "D	ata Con	nmunica	ation an	d Netw	orking	I ata M	lcGraw-	-H1II,	4	edit	10n,
Course													
Course	e <b>Objectives :</b> . 1. To pr	ovide fiu	ndament	alknov	vledoe o	of Softu	vare Def	ined Ne	etwork				
	2. To mak				•								
	3. To expl									flow			
Course	e Learning Outco		iet work	periorii		nougniv	II tuulizt	uititi ui	la open	110 W	•		
CO	After the comp		the cou	rse the	studen	t shoul	d be	Bloo	m's Co	gnitiv	ve		
00	able to							Leve		Descriptor			
CO1	Comprehend the	concept	ofabsti	acting a	and cen	tralizing	g the					tand	ling
	control plane in	-		0									0
CO2	Analyze the imp	lications	of SDN	on dat	a center	•		IV		An	alyz	ing	
CO3	Evaluate the net	work fun	ctions v	rirtualiz	ation.			V		Eva	alua	ting	
CO-PO	) Mapping :								_				
			PO1	PO2	PO3	PO4	PO5	PO6					
		CO1	3						-				
		CO2		3		1			-				
		CO3	2				3	2					
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	ments :												
	er Assessment: omponents of In Se	emester l	Evaluati	on (ISE	) One ]	Mid Ser	nester F	vamina	tion (N	(SE)	and	one	Fn
	er Examination (E				//					151)	ana	one	LIN
	· · · · · · · · · · · · · · · · · · ·	essment	<u></u>	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		<u> </u>	<u></u>	Mai	rks				
		SE 1						1(					
		ASE						30					
		SE 2						10					
		ESE						50					
ISE 1	and ISE 2 are bas		signmen	t/declar	ed test/	quiz/ser	ninar et						
	Assessment is bas		-			-			dules)				
	Assessment is bas						-			e cont	ent		
(norm	ally last three mod	dules) co	vered at	fter MS	E.								
a	e Contents:												
<u>Cou</u> rse	contents.												

Basic Packet Switching Terminology, The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Packet Forwarding IQ.	7
Module2: Introduction to SDN	Hrs.
SDN Implications: Research and Innovation, Cost, Industry, Data Center Innovation, Data	
Center Needs, Real Time Case Study of Data Center, Virtualization, Network Virtualization, Network Function Virtualization	7
Module3: Open Flow Protocol and SDN	Hrs.
OpenFlow: Flow Table structure, Flowtable Actions, Flow messages, Legacy Mechanisms	
Evolve Toward SDN, SDN Applications, and Alternate SDN Methods.	6
Module4: SDN in Data Center	Hrs.
Data Center Definition, Data Center Demands, Tunneling Technologies for the Data	
Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN	6
Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World	U
Data Center Implementations,	
Module5: SDN in Other Environments	Hrs.
Consistent Policy Configuration, Global Network View, Wide Area Networks, Service	
Provider and Carrier Networks, Campus Networks, Hospitality Networks, Mobile	7
Networks, In-Line Network Functions, Optical Networks, SDN vs. P2P/Overlay Networks,	,
Players in SDN	
Module 6: : Network Function Virtualization	Hrs.
Existing Network Virtualization Framework (VMWare and others), Mininet based	
examples, Virtualization and Data Plane I/O, Services Engineered Path, SDN open source,	6
SDN Application.	
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Recognize the origin of SDN and medium of access.	
Module 2: Grasp the control plane and data plane structure of SDN. Module 3: Analyze the SDN operation in smart network.	
Module 4: Scrutinize the SDN in Data Center and web applications.	
Module 4: Scrutilize the SDN in Data Center and web appreations. Module 5: Examine various standards of SDN in real-time environment.	
Module 5: Examine various standards of SDN in real-time environment. Module 6: Design the network function for virtualization	

Title of the Course: P Forensics 3IT538	rofessior	nal Elec	tive-4 (	Comput	ter Secu	rity and	L 3	T 0	P 0	Cr 3
Pre-Requisite Courses	: Numbe	r Theor	V							_
Textbooks:		•	, ,							
1. Godbole Nina,							ling Cyb	er Crime	s, Coi	nputer
Forensics & Leg 2. Bainbridge Dav							1 2004			
<ol> <li>Bainbridge Dav</li> <li>Stallings Willia</li> </ol>								tices and	Stand	lards"
Google books 1			ybersee	unty. F	I Oulde	Using		tices and	Stan	iarus ,
References:		1.0		D	1 0			G	<b>a</b> 1	·
1. Schneier Bruce Willy Publication			tograph	iy: Prot	ocols &	z Algori	thms and	Source	Code	ın C",
2. Nelson Bill , F	Phillips A	Amelia	, Steuar	rt Chris	stopher,	" Gui	de to Co	omputer	Forens	sics &
Investigations",	Cengage	Learnir	$1g, 6^{th}E$	Ed, 2018	8				.th	
3. Farooq Ahmad,	"Cyber I	Law in I	ndia- La	aw on I	nternet"	, New Ei	aLaw Pu	blication,	4 <sup>th</sup> Ed	, 2015
Course Objectives :	1 т	E41 ·	οτι	11 / 1		• 17	• ,	1 4 0		
1. To introduce Cy works involving						y rights a	associated	a with Co	mpute	ſ
2. To inform about		,				Typer Cr	imes and	Investiga	tion	
3. To make unders	1				,			•		
Course Learning Out		p				• • • • • • • • • • •			·	
CO After complet		e cours	e stude	nt shou	ld be a	ble to	Bloor	n's Cogn	itive	
							level	Descri	otor	
CO1 Discuss about	intention	al comp	uter atta	acks ar	d provis	sional	II	Unders	tandin	g
aspects toward										
CO2 Experiment an	nd test the	e knowle	edge bas	se for d	igital for	rensics	III, IV	Applyi Analyz	-	
CO3 Verify and pro an effective I			Security	mecha	nism to	generate	V, VI	Evalua Creatir	ting,	
CO-PO Mapping :	I Solution	1					*1	Creatin	5	
CO-I O Mapping.		PO1	PO2	PO3	PO4	PO5	PO6			
	CO1	101	2	100	101	100	1			
	CO2	1		2						
	CO3				3	1				
Assessment:										
Two components of In	Semester	r Evalua	tion (IS	SE), One	e Mid Se	emester ]	Examinat	ion (MSE	E) and	one
End Semester Examinat	tion (ESE	E) having	g 20%,	30% an	d 50% v	weightag	e respect	ively.		
	sessment						Ma			
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	ESE	aianma	nt/doolo	and too		minor of	5			
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	ESE used on as ased on 5	50% of <b>c</b>	course c	content (	Normal	ly first t	5 c. hree mod	0 ules)	ontent	(norm

Course Contents: Module 1: Malicious Software	Hrs
Advanced Persistent Threat, Infected Content Viruses, Vulnerability Exploit Worms,	7
SPAM E-Mail, Trojans, Attack Agent Zombie, Bots, Keyloggers, Phishing, Spyware,	
Backdoors, Rootkits	
Module 2: Cyber Crime & Computer Forensics	Hrs
Cyber Crimes, , ITA 2000, Digital Evidence and Storages, Digital Forensics Life Cycle,	7
Tools & Methods used in Cybercrimes: Case studies	
Module 3: Computer Laws & Ethics	Hrs
Intellectual Property Rights- Copyright Law & Publishing, Patent Law, The Law of	6
Confidence, The Law relating to Designs, Trade Mark and Passing off, Semiconductor	
Regulation, IPR Infringement and Handling, Technology Transfer Agreements, Digital	
Contracts and Checklists	
Module 4: Data Hiding & Forensic Detection	Hrs
Data Hiding Types, Steganography, Steganalysis, Access Control and Password	7
Management, Marcov Chains & Types, Network Security Monitoring and Analysis: Case	
studies	
Module 5: Software Security	Hrs
DoS Attacks, Buffer Overflow, SQL Injection, Session Hijacking, Software Security	6
Issues, Handling Safe Program Code	
Module 6: Operating System Security	Hrs
Introduction, System Security Planning & Maintenance, Operating Systems Hardening,	6
Linux/UNIX Security, Windows Security, Virtualization Security	

**Module 1:** To outline the behavioral study of malwares in sense of payload infection, propagation and corresponding vulnerability exploits.

**Module 2:** To discuss about cyberspace, cybercrimes and forensic processing of sized computer data and their terminologies along with case studies guiding the defense challenges.

**Module 3:** To explain a newbie about Judicial and Computer Law Enforcement extending knowledge of computer handling ethics, IPR, patenting and prosecutions.

**Module 4:** To illustrate data hiding techniques estimating against computer intrusions in terms of User and S/W trespass.

Module 5: To practice writing safe program codes resolving the issue of software security.

**Module 6:** To recommend OS security producing safe environment towards data protection achieving Confidentiality, Integrity & Authentication.

Title of	f the Course: Profe	essional	Electiv	e-4 Dat	a Ware	housing	g 3IT53	9	L	Т	Р	Cr
								-	3	0	0	3
Pre-Re	equisite Courses: []	Database	Engine	ering								
Textbo	ooks:											
1.	Ponniah Phulraj "Dat Publication,2 <sup>nd</sup> Editic Matthias Jarke, Maur	on, 2010	-			-	-		-			ïley
2.	Warehouses", Spring				issiiiou,	i anos v	assiliauli	s, run	uament		Jala	
Refere							a					
	Inmon W. H, "Buildi Humphries Mark , Ha Implementation", Dy	awkins M	fichael V	V, Miche	elle Č, "I	Data Wa	rehousin			re and		
	e Objectives :											
	To introduce fundam											
2. 3.	To provide fundamen							using				
3.	To interpret data desi	ign and da	ata ware	nouse in	npremen	tation pr	ocess					
Course	e Learning Outcom	nes:										
CO	After the completion		course	the stud	ent sho	uld be a	ble to		Blo	om's C	Cognitive	
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C01	To our or or the	- hadia		ta of D					leve II		Descript	or tanding
CO1 CO2	To summarize th		-				0		11			
	To analyze vario	ous data	model	for da	ta ware	ehouse.			IV		Analyzi	0
CO3To propose various solutions for information accessVICreating											g	
CO-PO	<b>O Mapping :</b>	<b></b>	1	1		1						
		~ ~ 1	PO1	PO2	PO3	PO4	PO5	PO6				
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	ter Examination (ES	E) havin	ıg 20%,	30% ar		<u> </u>	s respect	ively.				
Assess	sment				Ma	rks						
ISE 1 MSE					10							
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	and ISE 2 are based of	n assignn	nent/dec	lared tes		eminar et	tc.					I
	Assessment is based of							lules)				
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-	modules) covered after	r MSE.										
	e Contents:											
	ile 1: The compelli	<u> </u>				<u> </u>			<u> </u>	1		Hrs.
	for strategic inform			-			•		-			
	on-support systems, gence. Data Ware	-		•	2			,				
	tectural types, Over				-							6
	Warehousing, Con											
	ards, Web-enabled d					0, 5	0		,	8-1		

Module 2 : Planning and Requirements	Hrs.
Planning and project management, the data warehouse project, the development phases The project team, Project management considerations, defining the business requirements Dimensional analysis, Information packages—a useful concept, Requirements gathering methods	7
Requirements definition: scope and content, Data design, the architectural plan, Data storage specifications, Information delivery strategy	
Module 3: Architecture and Infrastructure	Hrs.
<b>Understanding data warehouse architecture,</b> Distinguishing characteristics, Architectural framework, Technical architecture, Architectural types. <b>Infrastructure as the foundation</b> , Infrastructure supporting architecture, Hardware and operating systems, Database software Collection of tools, Data warehouse appliances. <b>The Significant Role of Metadata</b> , Why metadata is important, Metadata types by functional areas, Business metadata, Technical metadata, How to provide metadata.	6
Module 4: Data design and data preparation	Hrs.
<ul> <li>Principles of dimensional modeling, From requirements to data design, Star schema keys, Advantages of the star schema, STARjoin and STARindex. Dimensional Modeling:</li> <li>Advanced Topics, Updates to the dimension tables, Miscellaneous dimensions, The snowflake schema, Aggregate fact tables, Families of stars. Data Extraction, Transformation, and Loading, ETL overview, ETLrequirements and steps, Data extraction, Data transformation, Data loading, ETL summary and ETL tool options, Other integration approaches. Data Quality:</li> <li>A Key To Success, Why is data quality critical?, Data quality challenges, Data quality tools, Data quality initiative, Master data management (MDM), MDM Categories, MDM Benefits, MDM and Data Warehousing.</li> </ul>	7
Module 5: Information access and delivery	Hrs.
Matching information to the classes of users, Information from the data warehouse, Who will use the information?, Information delivery, Information delivery tools. <b>OLAP in The Data</b> <b>Warehouse</b> , Demand for online analytical processing, Major features and functions, OLAP models, ROLAP versus MOLAP, OLAP implementation considerations, OLAP platforms, OLAP tools and products. <b>Data Warehousing And The Web</b> , Web-enabled data warehouse, Web-based information delivery, OLAP and the web, Building a web-enabled data warehouse. <b>Data Mining Applications</b>	7
Module 6: Data warehouse implementation.	Hrs.
<b>Physical Design Process,</b> Physical design steps, Physical design considerations, Indexing the data warehouse, Performance enhancement techniques. <b>Data Warehouse Deployment,</b> Data warehouse testing, Major deployment activities, Considerations for a pilot, Security, Backup and recovery. <b>Growth and maintenance,</b> Monitoring the data warehouse, User training and support, Managing the data warehouse.	6
Module wise Measurable Students Learning Outcomes :	
After the completion of the course the student should be able to:	
Module 1: Realize basic concepts of data warehousing.	
Module 2: Explain project planning of data warehouse and its specifications.	
Module 3: Design architecture of data warehouse.	
<b>Module 4:</b> Apply dimension modelling and ETL process to data warehouse. <b>Module 5:</b> Study the OLAP and web for data warehouse.	
<b>Module 5:</b> Study the OLAT and web for data watchouse. <b>Module 6:</b> Design process of data warehouse for data model.	
mount of Deorgin process of data watchouse for data mount.	

**Professional Core (Lab)** 

itle of	t the C	Course: Data	Mining	Metho	ds and .	Applica	ations L	ab 31T			Т	P	Cr
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Pre-Re	equisit	e Courses:											
<b>Fextbo</b>													
1.	Han Ji	awei and Kai	nber Mi	cheline	"Data ]	Mining	- Conce	epts and	l Techr	iques"	The M	lorga	n
	Kaufn	nann Series in	n Data M	anagen	nent Sys	,3 tems	<sup>1d</sup> Editio	on, , 201	1	nd	1		
		am M. H, "D	ata Mini	ng: Inti	oductor	y and A	dvance	d topics	", Pear	son, $2^{m}$	Editio	on, 2	003
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I.		mvelli Rajan	, "Data N	Aining	Method	s : Con	cepts &	Applica	ations",	Narosa	a Publi	ishing	g Hous
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CO3	· ·	ose a solution	for real	world	problem					VI		Creat	ing
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Week 1 indicates starting week of the semester Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments.

### **Course Contents:**

Programming assignments based on following broad topics :

- 1. Study of Data mining tools (WEKA, KNIME, ORANGE, Excel Miner etc.)
- 2. Perform data preprocessing tasks.
- 3. Implement and carryout association rule analysis.
- 4. Implement similarity measures, Correlation coefficient measures, regressions and statistical measures for any dataset and analyze the results.
- 5. Implement various clustering algorithms.
- 6. Implement various classification algorithms.
- 7. Perform advance data mining tasks on text, spatial and image dataset.
- 8. A small case study involving all stages of KDD. (Datasets are available online like UCI Repository etc.)

	the C	ourse: Image Processing And Pattern Recognition Lab	L	Т	Р	Cr	
3IT572					2	1	
Pre-Req	quisite	e: Applied Mathematics, MATRIX operations, Any computer pro-	grammin	g Knov	wledge.		
Textboo	ok:						
		Millan sonka, Vaclav Hiavac, Roger Boyle, "Image Processing 3rd Edition, CL Engineering, 2013.	-				
	2.	Rafel C. Gonzalez, Richard E. Woods, "Digital Image Proc Education, 2008.	cessing",	3rd E	dition, I	Pearso	
Referen	ces:						
	1.	Earl Gose, Richard Johnsonbaugh, "Pattern Recognition and Ima Prentice Hall of India Private limited, 2009.	age Analy	ysis", 1	st Editio	n,	
Course	Obje	ctives :					
	1.	Introduce foundational techniques of image processing and anal processing problems of real world application	ysis tech	niques	. to solve	e imag	
	2.	Provide directives to build a statistical classifier and know how t	<i>w</i> to use other classifiers				
	3.	Impart image processing and pattern recognition techniques to images and video.	detect ol	bjects	and activ	rities	
	4.	Instruct Matlab/python scripts to apply image processing algorith	hms.				
Course ]	Learı	ning Outcomes:					
С	Os	After the completion of the course the student should be	Bloom	's Cog	nitive		
		able to	level	Desc	riptor		
1.	•	Implement image enhancement techniques for image qualities.	III	App	lying		
				1			

2.	Analyze the different segmentation techniques.	IV	Analyze
3.	Perform various image operations and morphological operations.	VI	Creating

# **CO-PO Mapping :**

	<b>PO1</b>	PO2	PO3	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>
CO1				1		
CO2			2			
CO3	3					

## Lab Assessment

There are four components of lab assessment LA1, LA2, LA3 and Lab ESE IMP: Lab ESE is a separate head of passing

Assessment	Based on	Conducted by	Conduction and Marks	Marks
			Submission	
LA1	Lab activities,	By Course	During week 1 to week 4	25
	attendance, journal	Faculty	submission at the end of	
			week 5	
LA2	Lab activities,	By Course	During week 5 to week 8	25
	attendance, journal	Faculty	submission at the end of	
			week 8	

LA3	Lab activities, attendance, journal	By Course Faculty	During week 10 to week 14 submission at the end of week 14	25
Lab ESE	Lab performance and related documentation	By Course Faculty	During week 15 to week 18submission at the end of week 18	25

Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

The experimental lab shall have typically 8-10 experiments.

# List of Assignments (using MATLAB/Python)

Sr.No.	Experiment list
01	Program to perform digital negative of an image
02	Program to perform (a) Down sampling of an image and (b) Enhance image using Histogram equalization.
03	Program to introduce noise in an image
04	<ul><li>(a) Program to find contrast stretching of an image</li><li>(b) Program to perform bit plane slicing on an image</li></ul>
05	Program to perform Rotation, Scaling & Translation operation on an image
06	Program to find Edge using LOG and DOG functions
07	Program to implement Morphological operations on an image
08	Program to perform Huffman Coding on an Image
09	Program to perform image compression using RLE encoding
10	Develop mini project in image processing

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	Bruce Tate, "		0 0			,						
	. Dr. Mark Gar	denerr, "I	he Stat	istical	Program	mming	Langua	age'',20	012.			
References:	<b>F</b> 1											
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Course Obje			1.00						• 6			
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	. To demonstra										e problei	n
	. To provide gu	ildelines t	o prepa	re scie	ntific re	eport us	ing LA	IEX S	onware	•		
Course Learn	ning Outcomes:											
COs	After the com	nlation of	the equ	urgo the	studan	t chould	l ha ah	lata	Dloor	n'a Ca	gnitive	٦
COs	After the com	After the completion of the course the student should be able to									0	
									level		criptor	_
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2.	Use appropria							blem	III		olying	
3.	Generate scrip	ots to auto	mate da	ata forr	natting	and ana	lysis		VI	Cre	ating	
CO-PO Maj	pping :	r	1	r	[	1	r	r				
			PO1	PO2	PO3	PO4	PO5	<b>PO6</b>				
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		CO2	1									
		CO3				3						
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other suitable activities as per the nature of lab course. The experimental lab shall have typically 8-10 experiments .

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			level Descr						Descri	ptor		
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		e identified a									-	
CO2		eriment with new trends in industry III Apply.										
CO3		onstrate ver	n skills by	compa	ring and	1	III,	Apply	ing, Analy	yzing		
	reviewing literature survey.								IV			
CO-PO	Map	ping :										
			<u>CO1</u>	PO	1 PO2	PO3	PO4	PO5	PO6			
			CO1	2	-	1	2	1				
			CO2 CO3	1	2	1	2	3	2			
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LA	3	Lab ac	tivities,		By Co	ourse	Duri	ng weel	k 10 to w	eek 14	25	
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		related doc	cumentati	ion	Faculty/	Guide	18su		on at the	end of		
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Week 1 indicates starting week of the semester

Lab activities shall include performing experiments, mini-project, presentations, drawing, programming and other suitable activities as per the nature of lab course.

Project report (pre-defined template) should be prepared using Latex/Word and submitted along with soft copy on CD/DVD (with code, PPT, PDF, Text report document & reference material) or on online github.

Students should maintain a project log book containing weekly progress of the project.

### **Course Contents:**

**Topic Selection:** Significance and Scope of comprehensive topic with exploration at each level, technical competency with Research oriented topic, literature survey of reliable and valid sources. Responsibly summarized literature

**Relevance to Dissertation:** At least three topics in relevance to thirst area of dissertation need to be overlooked.

**Scope of Topic:** Relevance, significance and expected outcome discussion in stated problem statements for area of dissertations.

**Report writing:** Proper citation of sources, organized section of chapters, standard and valid references, nearly absolute contents.

This course will include carrying out a project considering the social needs, innovative designing, and implementation as well as exploring its commercialization / patenting of the project.