# SCHEME OF EXAMINATION

# &

# DETAILED SYLLABUS (2<sup>nd</sup> Year)

for

# BACHELOR OF TECHNOLOGY for ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

under the aegis of University School of Automation and Robotics offered at Affiliated Institutions of the University

from A.S. 2021-22 onwards



**University School of Automation and Robotics** 

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

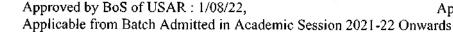


Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Suraimal Vihar, Delhi-110092



# Programme Outcomes (PO)

- 1. Engineering Knowledge (PO01): Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem Analysis (PO02): Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
- 3. Design/Development of Solutions (PO03): Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct Investigations of Complex Problems (PO04): Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of theinformation to provide valid conclusions for complex problems:
  - a) that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline as against problems given at the end of chapters in a typical textbook that can be solved using simple engineering theories and techniques;
  - b) that may not have a unique solution. For example, a design problem can be solved in many waysand lead to multiple possible solutions.
  - c) that require consideration of appropriate constraints / requirements not explicitly given in the problem statement such as cost, power requirement, durability, product life, etc.;
  - d) which need to be defined (modeled) within appropriate mathematical framework; and
  - e) that often require use of modern computational concepts and tools, for example, in the design of an antenna or a DSP filter
- 5. Modern Tool Usage (PO05): Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modelling to complex engineering activities withan understanding of the limitations.
- 6. The Engineer and Society (PO06): Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and Sustainability (PO07): Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics (PO08): Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and Team Work (PO09): Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.
- 10. Communication (PO10): Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project Management and Finance (PO11): Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Life-long Learning (PO12): Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.



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#### Programme Specific Outcomes (PSO)

- 1. **PSO1:** Comprehend the role of artificial intelligence and machine learning techniques and algorithms in various domains like predictive mining, computer vision, recommendation systems, trend analysis, etc.
- 2. **PSO2:** Gain the ability to independently investigate research problems in artificial intelligence and machine learning and find out optimal solutions.
- **3. PSO3:** Recognize the latest industrial patterns in machine learning and acquire the desired skills for the same.
- 4. **PSO4:** To develop a mindset for entrepreneurship and experiential learning in the field of artificial intelligence and machine learning

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		Third Semester			
Group	Paper Code	Paper	L	T/P	Credits
Theory Pa	pers				
PC	AIML201	Data Structures	3		3
PC	AIML203	Foundations of Data Science	3	<u>*</u>	3
PC	AIML205	Digital Logic Design	3		3
PC	AIML207	Principles of Artificial Intelligence	3		3
ES/BS	AIML209	Probability, Statistics and Linear Algebra	4		4
HS/MS	AIML211	Universal Human Values- II	3	-	3
HS/MS	AIML213	Critical Reasoning and Systems Thinking	2	-	2
HS/MS (NUES)	AIML215	Selected readings	1		L
Practical/	/iva-Voce				
PC	AIML251	Data Structures Lab		2	1
PC	AIML253	Foundations of Data Science Lab		2	1
PC	AIML255	Digital Logic Design Lab	-	2	1
PC	AIML257	Principles of Artificial Intelligence Lab	-	2	1
PC	AIML259	Web Programming Lab	)	2	1
Total		n	22	10	27

#### \*\*Selected readings

In Selected readings, the students will be required to select a book (non-technical book that is not related to engineering & technology) that they want to read in the semester and explore their content critically thereby get inspired to use the assimilated knowledge from the books to shape their personalities and to enhance their life skills.

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		Fourth Semester			
Group	Paper Code	Paper	L	T/P	Credits
Theory Papers					
PC	AIML202	Object Oriented Programming	3	-	3
PC	AIML204	Database Management Systems	3	<u> </u>	3
PC	AIML206	Software Engineering	3	-	3
PC	AIML208	Computer Networks and Internet Protocol	3	-	3
PC	AIML210	Fundamentals of Machine Learning	3	ŧ	3
ES/BS	AIML212	Computational Methods	3	×.	3
HS/MS/PC (NUES)	AIML214	Effective Technical Writing	1	-	1
HS/MS (NUES)	AIML216	Emerging Trends in Technological Industries	1	-	1
Practical/Viva-V	Voce				
PC	AIML252	Object Oriented Programming Lab		2	I
PC	AIML254	Database Management Systems Lab	-	2	1
PC	AIML256	Computer Networks and Internet Protocol Lab	-	2	1
PC	AIML258	Fundamentals of Machine Learning Lab	(a) >	2	1
PC	AIML260	Practicum (Integrated Project)	-	2	1
Fotal		<i>1</i>	20	10	25

\*\*Practicum (PM)-This is a semester Integrated Project work included in IV semester. The practical course constitutes an integrated Project work based on the concurrently studied theory in that semester or in previous semesters.

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# DETAILED SYLLABUS FOR 3<sup>rd</sup> SEMESTER

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Sem	ester:	3 <sup>rd</sup>														
Pape	er code	e: AIN	/L2(	)1									L	T/P	Cr	edits
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					ous Ev Exami											
INST	RUC	FION	STO	<b>PAP</b>	EXAND	TTT	n: 75 ] De.	Marks								
	Ther							0	vomin	otion		<u>IV</u>	laxim	um M	larks:	75
2.	Oues	tion N	la De	should	d be o	un me minite	lsory s	and co	xamm wer th	ation (	questic	on pape	er. Thia a	montin	n shoul	
	objec	tive o	r sho	rt ansv	wer tvi	e au	estion	s. It sh	ould b	e of 1	s marl	abus.	rms q	uestio	n snoui	a nave
3.	Apar	t from	ı Que	stion	No. 1,	the r	est of	the pa	aper sł	nall co	onsist d	of four	units	as per	the sy	llahus
	Ever	yunit s	shoul	d have	: two q	uestic	ons, H	oweve	er, stud	lents n	nay be	asked	to atte	empt of	nly 1 qu	uestion
	irom	each	unit.	Each (	luestic	on sho	uld be	e 15 m	arks.							
4.	The	questi	ons a	re to	be fra	med 1	ceepin	ıg in v	view tl	he lear	ming (	outcon	nes of	cours	e/paper	. The
5.	stand	ard/le	evel c	of the o	questic	ons to	be asl	ked sh	ould b	e at th	e leve	l of the	e preso	cribed	textboo	ke
	rse Ol	biecti	ves	t 01 (S	cientif	ic) ca	Iculate	ors/ log	g-table	es/ data	a-table	s may	be sp	ecified	if requ	ired.
	<u>l.</u>	-		stand	the had	vic co	ncente	ofdo	ta stru	oturos						
	2.	Tot	erfoi	m has	ic ope	ration	neepts	inkad	la stru list, st	ctures	nd au					
	3.	Tor	erfor	m sor	ting ar	nd sea	rching	T OD 9	given	eet of	data it	eues.				
4	4.	Tou	inder	stand	the cor	icents	s of tre	<u>son a</u> es ha	shing,	and a	ranh ti	enns.				
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CO		strat	egies	for sc	lving	a con	nutati	onal r	probler	menta	us of a	ata str	ucture	s and e	fficient	access
co		App	ly su	itable	data st	ructur	re for s	solving	o a giv	n. en nro	hlem	and dif	Ferent	into the	2 1100 00	of data
CO2		struc	tures	and t	heir ar	plica	tions.		54517	on pro	oronn a	uid dii	1¢rem	late the	e usage	of data
000		Ana	lyse t	he cho	pice of	data	struct	ures a	nd thei	ir usaa	e for s	sorting	and s	earchi	ng num	bers in
CO3		data	struc	tures.												
CO4		Crea	te the	e solut	ion for	a par	ticula	r probl	lem an	d gain	ability	y to pro	ovide	solutio	ns/appr	oaches
		with	file l	handli	ng and	tree a	structu	ires.			-	-				
Cour: CO/P	se Oute	comes	$\frac{(CO)}{\ln C}$	to Pro						and the second division of the second divisio	(S				um, 3: I	
0	01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO	PO	PO	PS	PS	PSO	1
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CO2	1	-	17	17	11	1	I*	14	11	14		2	1	11	11	11
	2	2	2	2	1	1	1	1	T	1	1.	10	1.	-		1
		2	2	2	1	1	1	1	1	1	1	2	1	-	-	-
C02		2 2	2 2	2 2	1	1	1 -	1	1	1	<b>1</b> 1	2 2	1 1	-	-	-

#### **Course Overview:**

This subject gives an overview of data structure concepts including array, stack queues, linked lists, trees, and graphs. Discussions shall be held of various implementations of these data structures

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in real life. This subject also examines algorithms for sorting and searching. The concepts of trees and graph-based algorithms shall be introduced.

#### **UNIT I:**

Introduction- Introduction to Algorithmic Complexity, Introduction to various data structures, Arrays and Strings operations, Stacks and Queues, Operations on Stacks and Queues, Array representation of Stacks, Applications of Stacks- Recursion, Polish expression and their compilation conversion of infix expression to prefix and postfix expression, Operations of Queues, Representations of Queues Applications of Queues, Priority queues, Overview of the list, set, tuples, and dictionary data structures.

#### **UNIT II:**

Searching and Sorting- Linear Search, Binary search, Insertion Sort, Quick sort, Radix sort, Merge sort, Heap sort. Linked Lists- Singly linked lists, Representation of linked list, Operations of the Linked list such as Traversing, Insertion, and Deletion, Searching, and applications of Linked List. Concepts of Circular linked list and doubly linked list and their applications. Stacks and Queues as a linked list.

#### UNIT III:

Trees- Basic Terminology, Binary Trees and their representation, binary search trees, various operations on Binary search trees like traversing, searching, Insertion and Deletion, Applications of Binary search Trees, Complete Binary trees, Extended binary trees. General trees, AVL trees, Threaded trees, B- trees, 2-3 trees, 2-3-4 trees, B\* and B+ trees.

#### **UNIT IV:**

File Structure- File Organization, Indexing & Hashing, Hash Functions, Application Dictionary-Telephone Directory. Graphs- Terminology and Representations, Graphs & Multi-graphs, Directed Graphs, Representation of graphs and their Transversal, Euler and Hamiltonian paths, Spanning trees, shortest path and Transitive Closure, Activity Networks, Topological Sort, and Critical Paths.

#### **Text Books:**

- 1. Tannenbaum. Data Structures, PHI, 2007 (Fifth Impression).
- 2. An introduction to data structures and application by Jean-Paul Tremblay & Pal G. Sorenson (McGraw Hill).

#### **Reference Books:**

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- 1. Data Structures with C By Schaum Series.
- 2. R.L. Kruse, B.P. Leary, C.L. Tondo. Data structure and program design in C, PHI, 2009 (Fourth Impression).
- 3. Gilberg, R. F., & Forouzan, B. A., Data structures: A pseudocode approach with C++. Brooks/Cole Publishing, 2001.

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Semester: 3 <sup>rd</sup>			
Paper code: AIML251	L	T/P	Credits
Subject: Data Structures Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

#### INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60 1. This is the practical component of the corresponding theory paper. 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which they appear is being offered from the list of practicals below. 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important. 4. At least 8 experiments must be performed by the students. **Course Objectives:** To teach students how to analyse different types of data structures. 1. To design applications based on different types of data structures. 2. **Course Outcomes:** Design programs using a variety of data structures such as stacks, queues, hash tables, **CO1** binary trees, search trees, heaps, graphs, B-trees, list, set, tuples, dictionary. Implement and analyse abstract data types such as lists, graphs, search trees to solve real **CO2** world problems efficiently. Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High) CO/ PO PO PO PO PO IPO PO PO PO PO PO PO PS PS PS PS PO 01 02 03 04 05 06 07 **08** 09 10 11 12 01 02 03 04 CO1 2 2 2 2 1 1 1 CO2|2 2 2 2 1 1 1 1 1 2 1 1

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#### LIST OF EXPERIMENTS:

- 1. Perform Linear Search and Binary Search on an array.
- 2. Create a stack and perform Pop, Push, and Traverse operations on the stack using a Linear Linked list.
- 3. Create a Linear Queue using Linked List and implement different operations such as insert, delete, and display the queue elements.
- 4. Implement sparse matrices using arrays.
- 5. Implement the following sorting techniques:
  - a. Insertion sort
  - b. Merge sort
  - c. Bubble sort
  - d. Selection sort
- 6. Create a linked list with nodes having information about a student. Insert a new node at the specified position.
- 7. Create a doubly linked list with nodes having information about an employee and perform Insertion at front of doubly linked list and perform deletion at end of that doubly linked list.
- 8. Create a circular linked list having information about a college and perform Insertion at the front end and perform deletion at the end.
- 9. Create a Binary Tree and perform Tree Traversals (Preorder, Postorder, Inorder) using the concept of recursion.
- 10. Implement insertion, deletion, and display (Inorder, Preorder, Postorder) on binary search tree with the information in the tree about the details of an automobile (type, company, year of make).

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#### Semester: 3rd Paper code: AIML203 L T/P Credits Subject: Foundations of Data Science 3 0 3

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

# INSTRUCTIONS TO PAPER SETTERS:

#### Maximum Marks: 75

- There should be 9 questions in the end term examination question paper. 1.
- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

#### **Course Objectives:** 1. To analyse different types of data using Python. 2. To prepare data for analysis and perform simple statistical analysis. 3. To create meaningful data visualizations and predict future trends from data. **Course Outcomes:** Understand and identify the basic concepts of data science for performing data analysis. **CO1** Apply & perform pre-processing steps along with data visualization to get insights from **CO2** data. Analyse and apply different modules of data science to evaluate mathematical, and CO3 scientific problems of data analysis. Develop the model for data analysis and evaluate the model's performance to optimize **CO4** business decisions and create competitive advantage with data analytics. Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High) CO/ PO PS PS PS PS. PO 01 02 03 04 05 06 07 08 09 10 11 12 01 02 03 04 CO1|3 3 3 3 1 1 2 2 1 1 1 CO2 2 3 3 3 3 1 1 1 1 1 1 2 2 2 1 1 CO3 2 3 3 3 1 2 2 1 1 CO4|3 3 3 3 1 1 1 1 2 2 2

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#### **Course Overview:**

Foundations of Data Science is a blend of statistical mathematics, data analysis tools and visualization, domain knowledge representation, tools and algorithms and computer science applications. The hidden insights or patterns are identified and analysed to form a decision.

#### UNIT I:

Introduction to data science, applications of data science, data scientist roles and responsibilities, skills needed to become a data scientist. Need of Python for data analysis, Introduction to Data Understanding and Pre-processing, domain knowledge, Understanding structured and unstructured data. Creation of synthetic dataset in MS Excel.

#### **UNIT II:**

Basics of Python programming: Variables, printing values, if condition, arithmetic operations, loops. Data Analysis process, Dataset generation, Importing Dataset: Importing and Exporting Data, Basic Insights from Datasets, Cleaning and Preparing the Data: Identify and Handle Missing Values.

#### **UNIT III:**

[12] Basics of essential Python libraries: Introduction to NumPy, Pandas, Matplotlib, SciPy. Data Processing, Data Visualization, Basic Visualization Tools, Specialized Visualization Tools, Seaborn Creating and Plotting Maps.

#### **UNIT IV:**

Mathematical and scientific applications for data Analysis, Basics of Supervised and Unsupervised Learning. Decision Making. Trend & predictive mining using Python, Recommender systems.

#### **Text Books:**

1. Wes Mckinney. Python for Data Analysis, First edition, Publisher O'Reilly Media.

2. Foundational Python for Data Science, 1st edition, Kennedy Behrman, Pearson Publication.

3. Data analytics using Python, Bharti Motwani, Wiley Publication.

#### **Reference Books:**

1. Allen Downey, Jeffrey Elkner, Chris Meyers, Learning with Python, Dreamtech Press.

2. Reema Thareja. Python Programming using Problem Solving approach, Oxford University press.

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Semester: 3 <sup>rd</sup>			1
Paper code: AIML253	L	T/P	Credits
Subject: Foundations of Data Science Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

## INSTRUCTIONS TO PAPER SETTERS:

- 1. This is the practical component of the corresponding theory paper.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. Atleast 8 experiments must be performed by the students.

#### **Course Objectives:**

- 1. To analyse different types of data using Python.
- 2. To perform statistical analysis and create meaningful data insights.

#### **Course Outcomes:**

CO1 Apply data science principles to identify meaningful solutions to actual problems.

CO2 Analyse and create programs based on statistical analysis using different libraries of Python programming language.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

PO	01	PO 02	РО 03	PO 04	PO 05		PO 07	PO 08	PO 09	PO 10	PO 11	PO 12			PS O3	PS O4
CO1	3	3	3	3	3	1	1	2	1	1	1	2	2	2	2	2
CO2	3	3	3	3	3	1	1	2	1	1	1	2	2	2	2	2

## LIST OF EXPERIMENTS:

- 1. Introduction and installation of Python and Python IDEs for data science (Spyder-Anaconda, Jupyter Notebook etc.)
- 2. Design a Python program to generate and print a list except for the first 5 elements, where the values are squares of numbers between 1 and 30.
- 3. Design a Python program to understand the working of loops.
- 4. Design a Python function to find the Max of three numbers.
- 5. Design a Python program for creating a random story generator
- 6. Create a synthetic dataset (.csv/.xlsx) to work upon and design a kython program to read and print that data.
- 7. Design a Python program using NumPy library functions.

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Prol. ryay J. Singholi

Maximum Marks: 60

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- 8. Perform Statistics and Data Visualization in python.
- 9. Design a Python program to implement Linear Regression
- 10. Design a Python program to create a recommender system

Faculties should also motivate students to make a project on the topics taught in theory and lab.

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	ster: 3 <sup>rd</sup>			
Paper	r code: AIML205	L	T/P	Credits
Subje	ect: Digital Logic Design	3	0	3
Mark	ting Scheme	8	<u> </u>	
1.	Teachers Continuous Evaluation: 25 Marks			
2.	End term Theory Examination: 75 Marks			
INST	<b>FRUCTIONS TO PAPER SETTERS:</b>	Maxi	mum M	arks: 75
1.	There should be 9 questions in the end term examination	auestion paper		
2.	Question No. 1 should be compulsory and cover the ent	ire syllabus Th	is questi	on should
	have objective or short answer type questions. It should l	be of 15 marks		
3.	Apart from Question No. 1, the rest of the paper shall	l consist of fou	r units a	as per the
	synabus. Everyunit should have two questions. However,	, students may h	e asked	to attemn
	only I question from each unit. Each question should be	15 marks.		_
4.	The questions are to be framed keeping in view the learning	ng outcomes of a	course/p	aper. The
	standard/ level of the questions to be asked should be	e at the level	of the p	prescribed
	textbooks.			
5.	The requirement of (scientific) calculators/ log-tables,	/ data-tables m	ay be s	pecified
	required.			
Cour	rse Objectives:			
1.	To teach various number systems, binary codes and th	eir applications	Q.	
2.	To familiarize the students with the importance of en	rror detection a	nd error	correctio
	codes.			
3.	To inculcate concepts of K-MAP to simplify a Boolea	n expression.		
4.	To facilitate students in designing a logic circuit.			
Cour	se Outcomes:			
CO1	Understand number systems and complements for	the basic funct	ionality	of digits
				שוצוע דס
	systems			
CO2	Identify the importance of canonical forms in the min	imization or oth	er optin	_

- CO2 Identify the importance of canonical forms in the minimization or other optimization of Boolean formulas in general and digital circuits.
   CO3 Apply and evaluate circuits of minimizing algorithms (Roolean algobre Karrowski and States)
- CO3 Apply and evaluate circuits of minimizing algorithms (Boolean algebra, Karnaugh map or tabulation method).
- CO4 Analyse the design procedures of combinational and sequential circuits.
- CO5 Design and implement real world projects involving combinational and sequential logics.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/ PO	<b>PO</b> 01		PO 03	PO 04		PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	2	2	2	2	1	8 <sup>20</sup>	-	-	<b></b> .	-	-	1	1	-	-	
CO2	2	2	2	2	1	-	-	-	-	<u>-</u> 1	-	1	1	110	-	-
CO3	2	2	2	2	1	-	-	-	-	-	2	1	1	1	-	-
CO4	2	2	2	2	1	-	-	-	-	-	-		11 Ajay	e e:-	eholi	
CO5	2	2	2	2	1	1	1	1	1	1	1		seor In-		USAR	1

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#### **Course Overview:**

The course addresses the concepts of digital systems logic design, and techniques of designing digital systems. The course teaches the fundamentals of digital systems applying the logic design and development techniques. This course forms the basis for the study of advanced subjects like Computer Organization and Architecture, Microprocessor through Interfacing, VLSI Designing.

#### UNIT I:

Digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, error detection and error correction codes. Boolean Algebra and Logic Gates: Basic definitions, axiomatic definition of Boolean algebra, basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, other logic operations, digital logic gates.

#### UNIT II:

[8] GATE level minimization, Logic gates and Logic families, The K-map method, four-variable map, five-variable map, product of sums simplification, don't-care conditions, NAND and NOR implementation, determination and selection of Prime Implicants, Essential and Nonessential prime Implicants.

#### UNIT III:

Combinational logic and their Design procedure, Binary Adder, Binary Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, and Demultiplexers. Memories such as ROM, RAM, EPROM.

#### UNIT IV:

Sequential logic and circuits, latches, flip-flops, analysis of clocked sequential circuits, State reduction and assignment, design procedure. REGISTERS AND COUNTERS: Registers, shift registers, ripple counters, synchronous counters, counters with unused states, ring counter, Johnson counter. Random access memory, memory decoding, error detection and correction, read only memory, programmable logic array, programmable array logic, sequential programmable devices. A/D and D/A converters.

#### Text Books:

1. M. Morris Mano, Michael D. Ciletti (2008), Digital Design, 4th edition, Pearson Education Inc, India.

2. Donald D. Givone (2002), Digital Principles and Design, Tata McGraw Hill, India.

#### **Reference Books:**

1. C. V. S. Rao (2009), Switching and Logic Design, 3rd Edition, Pearson Education, India. 2. Roth (2004), Fundamentals of Logic Design, 5th Edition, Thomson, India.

Sungnoli olessor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Suraimal Vihar, Delhi-110092

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#### [10]

#### [10]

#### [12]



Semester: 3 <sup>rd</sup>		Î	1
Paper code: AIML255	L	T/P	Credits
Subject: Digital Logic Design Lab	0	2	1

#### Marking Scheme

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

# **INSTRUCTIONS TO PAPER SETTERS:**

**Maximum Marks: 60** 1. This is the practical component of the corresponding theory paper.

- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- 1. To familiarize with the understanding of various aspects of designing real life applications through digital logic.
- 2. Design and analysis of the digital circuits and systems.

#### **Course Outcomes:**

- Design an experiment to validate through hypothesis, a Boolean logic gates, truth table CO1 and circuit simulation.
- Create circuits to solve real life problems via digital logic design. CO2

Cours	se Out	comes	(CO	) to P	rogran	nme (	Outcon	mes (P	O) M	Гаррія	g (Sca	le 1: L	.ow, 2:	Mediu	m, 3: I	High)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	2	2	2	2	1	-	-	-	-	-	-	1	-	-	-	-
CO2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1

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# LIST OF EXPERIMENTS:

- 1. a) Introduction to Digital Logic Trainer kits and their function.
  - b) Verify the truth table of Basic logic gates using their ICs.
  - c) Realize logic functions of NOT, AND, OR, EX-OR, EX-NOR with the help of universal gates-NAND and NOR Gates.
- a) Verify De-Morgan's theorem for two variables using basic gates.
  b) Realize Sum of Product (SOP) and Product of sum (POS) summarized in the sum (POS) su
  - b) Realize Sum of Product (SOP) and Product of sum (POS) expressions using universal gates.
- 3. Realize Binary to Gray & Gray to Binary code converter and their truth table.
- 4. Design and test the Adder circuit.
  - a) Half Adder
  - b) Full Adder
  - c) Parallel Adder using 7483
- 5. Design and test the Subtractor circuit.
  - a) Half Subtractor
  - b) Full subtractor
- 6. Design and test the Multiplexer circuit.
  - a) 8:1 Multiplexer using IC 74151
  - b) 1:8 Demultiplexer circuit using IC 74138
- 7. Verify and test the Counter circuit.
  - a) BCD Counter using ICs 7493
  - b) Ring counter using 7495
  - c) Johnson Ring Counter using 7495
- 8. Design and implement Comparator circuit.
  - a) 1 bit comparator
  - b) 4 bit magnitude Comparator using 7485
- 9. Design and implement Encoder circuit.
  - a) Decimal to BCD Encoder using IC 74147
  - b) Octal to Binary Encoder using IC 74148
- 10. Verify 2:4 Decoder using seven segment decoder and using ICs 7447.
- 11. Investigate the operation of various Flip-Flops using IC 7400, 7410.
  - a) SR & Clocked Flip flop
  - b) D flip flop
  - c) T flip flop
  - d) JK flip flop
- 12. Realize Shift Register using ICs 7495.
  - a) SISO (Serial in Serial out)
  - b) SIPO (Serial in Parallel out)
  - c) PIPO (Parallel in Parallel out)
  - d) PISO (Parallel in Serial out)

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	ter: 3 <sup>rd</sup> code: AIML207	L	T/P	Credits
	et: Principles of Artificial Intelligence	3	0	3
Subjet	A Theopes of the inclusion gener	5		3
Marki	ng Scheme			
1. 1	Feachers Continuous Evaluation: 25 Marks			
	End term Theory Examination: 75 Marks			
INST	RUCTIONS TO PAPER SETTERS:	Aaximu	m Mar	ks: 75
1.	There should be 9 questions in the end term examination questi	on pape	r	
2. (	Question No. 1 should be compulsory and cover the entire syll	labus. T	his ques	tion shoul
1	have objective or short answer type questions. It should be of 1	5 marks		
3	Apart from Question No. 1, the rest of the paper shall consi	st of fo	ur units	as per th
5	syllabus. Everyunit should have two questions. However, stude	nts may	be asked	I to attem
- 0	only 1 question from each unit. Each question should be 15 ma	rks.		6
4. ´	The questions are to be framed keeping in view the learning ou	tcomes of	of the co	urse/pape
-	Thestandard/ level of the questions to be asked should be at	the leve	l of the	prescribe
1	textbooks.			
5. l	instructors can add any other additional experiments over and a	bove the	e mentio	ned in the
¢	experiment list which they think is important.			
6. [	The requirement of (scientific) calculators/ log-tables/ data-	tables r	nay be	specified
1	required,			
	se Objectives:			
1.	To understand the basic concepts of Artificial Intelligence, its	princip	les, and	technique
2.		presenta	tion, re	ason und
	uncertainty, develop a plan for concrete computational	problem	is, and	learn fro
	experiences to solve various problems			
3.	To Investigate applications of AI techniques in intelligent agen	nts, expe	ert syster	ns, artific
	neural networks and other machine learning models.			
4.	To devise development tools such as prediction models, expe	rt syster	ms, and	data minin
~	tools.			
Cours	e Outcomes:			
CO1	Understand theories and concepts necessary for building an	Artificia	l Intellig	gent Syste
001	for knowledge representation.			
1.1.1.2	Apply bounded algorithms to develop but and ' 1'	thms for	r solving	real-wor
CO2	Apply heuristic algorithms to develop better searching algori		-	/
	problems.			
CO2	problems. Analyse and understand concepts of Neural Networks and	1 Fuzzy	data to	deal wi
	problems. Analyse and understand concepts of Neural Networks and uncertainty and imprecision, subsequently apply suitable soft	i Fuzzy -comput	data to ting tech	deal wi
	problems. Analyse and understand concepts of Neural Networks and uncertainty and imprecision, subsequently apply suitable soft approximate reasoning and build computational models capa	i Fuzzy -comput	data to ting tech	deal wi
	problems. Analyse and understand concepts of Neural Networks and uncertainty and imprecision, subsequently apply suitable soft approximate reasoning and build computational models capa patterns from data.	1 Fuzzy -comput able of 1	data to ting tech earning	o deal wi nique to a meaningf
	problems. Analyse and understand concepts of Neural Networks and uncertainty and imprecision, subsequently apply suitable soft approximate reasoning and build computational models capa	I Fuzzy -comput able of I decisio	data to ting tech earning	deal wi

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Cours	Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)															igh)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS 01	PS O2	PS 03	PS O4
CO1	2	3	3	3	1			-			1	2	3	2	1	2
CO2	2	3	3	3	1	1	1	1	1	1	1	1	3	2	1	2
CO3	2	3	3	3	1	Ā					2	2	3	2	1	2
CO4	2	3	3	3	1	1	1	1	1	1	2	3	3	3	1	2

#### **Course Overview:**

Principles of artificial Intelligence is the simulation of intelligence process by computer systems. It gives understanding of the main abstractions and reasoning techniques used in artificial intelligence including understand of AI, reasoning by machines, planning techniques, and basic machine learning methods.

#### UNIT I:

Introduction to AI, History of Artificial Intelligence, Applications of AI in the real world (Gaming, Computer Vision, Expert Systems, Natural Language Processing, Robotics & others). AI techniques, Problem Solving: Production Systems, State Space Search, Depth First Search, Breadth First Search, Heuristic Search, Hill Climbing, Best First Search, best-first search, A\*, Problem Reduction, AO\*, Constraint Satisfaction, Means-End Analysis.

#### UNIT II:

[8] Knowledge representation, Knowledge representation using Predicate logic, Propositional logic, Inferences, First-Order Logic, Inferences, Unification, Resolution, Natural Deduction, Procedural versus declarative knowledge, logic programming, forward versus backward reasoning.

#### **UNIT III:**

[10] Reasoning, Introduction to Uncertainty, Bayesian Theory, Bayesian Network, Dempster-Shafer Theory. Overview of Planning and its Components. Overview of Learning and basic Techniques. Introduction of Fuzzy Reasoning and Neural Networks.

#### **UNIT IV:**

Game Playing and Current Trends in AI, MinMax search procedure, Alpha-Beta Cutoffs, Game Development using AI, Applications of AI, Emerging Trends in AI Research in various domains.

#### **Text Books:**

1. Rich and Knight. Artificial Intelligence, Tata McGraw Hill, 1992.

2. S. Russel and P. Norvig. Artificial Intelligence - A Modern Approach, Second Edition, Pearson Edu.

#### **Reference Books:**

- 1. Kheemani, Deepak, A First Course in Artificial Intelligence, McGraw Hill Education, 1 Edition, 2017.
- 2. Artificial Intelligence: foundations of computational agents, Cambridge University Press, 2017.
- 3. Poole, David L., and Alan K. Mackworth. Artificial Intelligence: foundations of computational agents. Cambridge University Press, 2010.
- 4. Luger, G.F. Artificial Intelligence -Structures and Strategies for Complex Pr Solving, 6th edition, Pearson, 2008.

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#### [12]

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[10]



Semester: 3 <sup>rd</sup>	
Paper code: AIML257	

Semester: 5 <sup></sup>			· · · · · · · · · · · · · · · · · · ·
Paper code: AIML257	L	T/P	Credits
Subject: Principles of Artificial Intelligence Lab	0	2	1
M http://www.			

**Marking Scheme** 

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

#### Maximum Marks:60 INSTRUCTIONS TO PAPER SETTERS:

- 1. This is the practical component of the corresponding theory paper.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

Course	<b>Objectives:</b>
Course	Objectives

- 1. To understand the basics of Prolog Programming.
- 2. To solve different mathematical problems using Prolog Programming.
- 3. To apply Prolog Programming for solving different real time problems.
- 4. To determine the rules for creating Expert Systems.

#### **Course Outcomes:**

- Students will be able to understand and apply Prolog Programming for solving different **CO1** real-life problems.
- Students will be able to create different expert systems using Prolog Programming CO2

Cours	se Out	comes	(CO	) to P	rograr	nme (	Outcor	mes (P	0) Ma	pping	(Scale	e 1: Lo	w, 2: N	<b>Aediun</b>	n, 3: H	igh)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS 01	PS O2	PS 03	PS O4
C01	3	1	2	1	1	2	2	-	1	1	1	1	2	1	1	3
C02	2	1	2	2	1	1	1	1	-	1	1	2	2	1	1	3

#### List of Experiments

- 1. Write a program to implement syntax, basic list manipulation functions and numeric functions in Prolog.
- 2. Write a program to implement input, output and predicates in Prolog.
- 3. Write a program to implement local variables and conditional statements using Pro
- 4. Write a program to calculate factorial of a given number using Prolog.
- 5. Write a program to solve 4-Queen problem using Prolog.
- Prof. Ajay S. Singholi Professor In-charge, USAR 6. Write a program to solve any real-life problem using depth first Stating Singh Indraprastha University (East Dethi Campus)
- 7. Write a program to solve TIC-TAC-TOE Problem using Prolog. Suraimal Vihar, Delhi-110092

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- 8. Write a program to solve Monkey Banana Problem using Prolog.
- 9. Write a program to solve Water Jug Problem using Prolog.
- 10. Write a program to solve 8 Puzzle Problem using Prolog
- 11. Write a program to solve Tower of Hanoi Problem using Prolog.
- 12. Write a program for medical diagnosis using Prolog.

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Cours CO1	To eng etc. e Out rand forr Tra real	create ineeri tcome dersta dom v n, S nsfor	e syst ng an es: nd th variat olutio natio proble	tems ad scie he fun bles, s ons cons, Ei ems.	dame ampli dame ampli of sy	proba ke dia ntals ng dia stem ralues	abilist sease of pro- stribut of , and	ic and model obabil ion, n linear Eigen	l stati ing, c ity, C nean, a equ Vecto	stical limate conditi and ot ations ors tec	analys predi- onal I her sta , Veo hniqu	sis in ction a Probab atistica ctor a es and	and co bility, al row Space, I apply	mpute Baye' reduc Bas	s theo ed ech	oren oren nelo ine
Cours CO1 CO2	To eng etc. Und rand form Tran real Per	create ineeri tcome dersta dom v n, S nsforn I-life j form	e syst ng an es: nd th variat olutionatio proble hypot	tems ad scie ne fun bles, s ons cons, Ei ems. thesis	dame ampli dame ampli of sy gen v testin	proba ke dis ntals ng dis stem ralues g to a	abilist sease of pro- stribut of , and unalys	ic and model obabil ion, n linear Eigen e vario	l stati ing, c ity, C nean, a equ Vecto ous Er	stical limate Conditi and ot ations ors tec	analys predi- onal I her sta , Vec hniqu- ring p	sis in ction a Probab atistica ctor s es and roblen	oility, al row Space, l apply	mpute Baye' reduc Bas	s theo ed ect is, L to va	oren nelo ine rio
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# **Course Overview:**

Probability, statistics and linear algebra gives and allows to access and examine the certainty of outcomes of a study or experiment that is executed. The course also addresses the statistics to gather, review, analyse and draw conclusion from raw data, as well as quantified mathematical models to understand machine learning algorithms.

#### UNIT I:

Probability - Probability spaces, conditional probability, independence; Discrete random variables, continuous random variables and their properties, distribution functions and densities, exponential and gamma densities. Independent random variables, the multinomial distribution, Chebyshev's Inequality, Bayes' rule.

#### UNIT II:

Basic Statistics- Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression - Rank correlation.

#### **UNIT III:**

Applied Statistics- Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance- large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

#### UNIT IV:

Linear Algebra- Cramer's rule, Singular Value decomposition, Euclidian vector spaces, Projection. Hermitian and Unitary Matrix, Gram -Schmidt orthogonalization, LU- decomposition.

#### **Text Books:**

1. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003.

2. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

3. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

#### **Reference Books:**

- 1. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
- 2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
- 3. Veerarajan T. Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
- 4. Mathematics For Machine Learning-Marc Peter Deisenroth, A. Aldo Faisal, Cheng soon ong.



Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Suraimal Vihar, Delhi-110092 Approved by AC sub-committee : 29/08/22 Page | 28

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Semester: 3 <sup>rd</sup>			
Paper code: AIML211	L	T/P	Credits
Subject: Universal Human Values II	3	0	3

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

#### INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 75

- 1. There should be 9 questions in the end term examination question paper
- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

#### **Course Objectives:**

- 1. To develop a holistic perspective based on self-exploration about themselves (human beings), family, society, and nature/existence and to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- 2. To understand the harmony in the human being, family, society, and nature/existence.
- 3. To Strengthen the power of self-reflection.
- 4. To develop commitment and courage to act.

#### **Course Outcomes:**

- CO1 Understand and become more aware of self and our surroundings (family, society, and nature).
- CO2 Become more responsible in life for handling problems with sustainable solutions while keeping human relationships and human nature in mind.
- CO3 Enhance critical ability for self-reflection.
- CO4 Boost sensitivity to our commitment in terms of human values, human relationships, and human society.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS 01	PS O2	PS 03	PS 04
CO1	-	-	-	-	•	1	-	3	2	1	-	3	-	-	-	
CO2	-	-		-	-	1	-	3	2	1	-	3	-	-	-	=
CO3	-	-			-	1	-	3	2	1	-	3	-	-	-	1
<b>CO4</b>	-	<u></u>	<u>-</u> 2		-	1	-	3	2	1	-	3	1	3.8	<u>a</u>	-

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Prof. Ajay S. Singholi



#### **Course Overview:**

This course is aimed at giving inputs that will help to ensure the right understanding and right feelings in the students in their life and profession, enabling them to lead an ethical life. In this course, the students learn the process of self-exploration, the difference between the Self and the Body, the naturally acceptable feelings in relationships in a family, the comprehensive human goal in the society, the mutual fulfilment in the nature and the co-existence in existence.

#### UNIT I:

Introduction to Value Education - Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration, Natural Acceptance, Experiential Validation as the mechanism for Self Exploration. Continuous Happiness and Prosperity, Basic Human Aspirations. Right Understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their priority, Understanding Happiness and Prosperity, Method to fulfill the above human aspirations: Understanding and living in harmony at various levels.

#### **UNIT II:**

Understanding Harmony in the Human Being, human being as a Co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body', happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health, correct appraisal of Physical needs, meaning of Prosperity, Programs to ensure Sanyam and Health.

#### **UNIT III:**

Harmony in Human-Human Relationship, Understanding values in human-human relationship, meaning of Justice (Nine universal values in relationships) and program for its fulfillment to ensure Mutual Happiness, Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust, Difference between Intention and Competence, Understanding the meaning of Respect, Difference between Respect and Differentiation, the other salient values in relationship, Understanding the harmony in the society (society being an extension of family), Resolution, Prosperity, Fearlessness (trust) and Co-existance as comprehensive Human Goals, Visualizing a universal harmonious order in society: Undivided Society, Universal order from family to world family.

#### UNIT IV:

Understanding Harmony in Nature. Interconnectedness: Self-regulation and Mutual Fulfillment among the Four Orders of Nature: Recyclability and Self-regulation in Nature, Realizing Existence as Co-existence at All Levels. The Holistic Perception of Harmony in Existence Matural Acceptance of Human Values. Definitiveness of (Ethical) Human Conduct. A Basis for Humanistic Education, Humanistic Constitution and Universal Humanistic Order. Prof. Ajay S. Singholi Professor In-charge, USAR

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# Text Books:

- R. R. Gaur, R. Asthana & G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
- Teacher's Manual for: A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Asthana & G. P. Bagaria,2<sup>nd</sup> Revised Edition, Excel Books, New Delhi, 2019, ISBN 978-93-87034-53-2.

#### **Reference Books:**

- 1. A. Nagraj, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak, 1999.
- 2. A. N. Tripathy, Human Values, New Age International Publishers, 2004.
- 3. B. L. Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
- 4. P. L. Dhar & R. R. Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University

(East Delhi Campus) Surajmal Vihar, Delhi-110092

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Semester: 3 <sup>rd</sup>			
Paper code: AIML259	L	T/P	Credits
Subject: Web Programming Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

#### INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60

- 1. This is only the practical subject.
- The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. Atleast 8 experiments must be performed by the students.

		Objectives:														
Cours	e Ob	jectiv	es:										_			
1.	and		lop,	plan	and d	ebug	web	pages						create , this		pages e will
2.		To understand how browsers represent webpage data using the Document Object Model (DOM), how to develop dynamic, interactive web pages using JavaScript in the browser.														
Cours	se Ou	Outcomes:														
CO1	Ap	Apply different core scripting modules to design a server.														
CO2		sign a 2d to r						licatio	ns, int	eracti	ve and	l dyna	mic w	ebsite:	s that (	can be
Cours	e Out	comes	(CO)	) to Pı	ogran	nme (	Outcor	nes (P	0) Ma	pping	(Scale	l: Lo	w, 2: N	/lediun	1, 3: H	igh)
CO/ PO	PO 01															
C01	2															
CO2	2	2     2     2     2     2     1     1     1     1     1     3     1     1     1     1														

#### Course Overview:

This course will cover JavaScript technologies that power a modern full-stack development workflow, including server-side scripting, single-page web applications with MVC structure, package management, and JSON data storage. The students will learn server-side JavaScript with web frameworks such as Node.js making it simple to create and deploy complex, data-driven web applications.

Prof. Alay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Approved by BoS of USAR : 1/08/22, Approved by AC Subiced Athentices (high 20/08/22 Applicable from Batch Admitted in Academic Session 2021-22 Onwards Page | 32



#### LIST OF EXPERIMENTS:

- 1. Create a web page that covers your CV using various HTML Tags (UL, OL, Table, etc).
- 2. Create a webpage that displays brief details of various Programming Languages using various types of CSS.
- 3. Create a webpage using JavaScript and HTML to demonstrate Simple Calculator Application.
- 4. Create a web page covering the basic CRUD operations (Create, Read, Update, Delete) that implements To-do/Grocery lists using JavaScript and HTML
- 5. Create a JavaScript application based on various Data Types, Statements, Keywords and Operators.
- 6. Create a JavaScript application with Window Objects and Document Object.
- 7. Create a JavaScript application with Object Creation and by adding methods of objects.
- 8. Create a JavaScript application with Loops to incorporate the concept of Iteration.
- 9. Create a JavaScript application for random number generation.
- 10. Build a unit convertor application using HTML & JavaScript.

#### **Text Books:**

- 1. Chris Bates, Web Programming, building internet applications, 2nd edition, WILEY.
- 2. Deitel, Deitel and Nieto, Internet and Worldwide Web How to Program, 5th Edition, PHI, 2011.

#### **Reference Books:**

- 1. Bai and Ekedhi, The Web Warrior Guide to Web Programming, 3rd Edition, Thomson, 2008.
- 2. L. Richardson and S. Ruby, Restful Web Services, 1/e, O Reilly, 2007.

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Subject Markin 1. T	code: AIML213 t: Critical Reasoning and Systems Thinking ng Scheme	L 2	T/P 0	Credits
Subject Markin 1. T	t: Critical Reasoning and Systems Thinking			Credits
Markin 1. T	ng Scheme	4		and the second se
1. T				2
1. T				
2. E	eachers Continuous Evaluation: 25 Marks			
	nd term Theory Examination: 75 Marks			
INSTE	RUCTIONS TO PAPER SETTERS:			
1. T	here should be 9 questions in the end term examination que	Maximum	Marks:	75
2. Q	uestion No. 1 should be compulsory and cover the entire	lestion paper		
h	ave objective or short answer type questions. It should be	syllabus. The	is questio	on should
3. A	part from Question No. 1, the rest of the paper shall co	or 15 marks.	•.	
sy	Ilabus. Everyunit should have two questions. However, str	udente man l	r units a	s per the
01	<sup>11</sup> I guesholl from cach unit. Each meetion should be 15	100 cml cm		
4. 11	ne questions are to be framed keeping in view the learning.	outcomes of a		771
50	and the guestions to be asked should be	at the level	of the m	iper. The
ι	ALOUORS,			
5. Tl re	he requirement of (scientific) calculators/ log-tables/ data quired.	ata-tables ma	iy be sp	ecified i
Course	Objectives:			
1.	To inculcate critical reasoning and system thinking to take			
2.	To understand Critical reasoning, examine assumptions, u	decisions.		
	evidence, accomplish actions, and assess conclusions.	ncover hidde	n values	, evaluate
3.	To learn a holistic approach to analysis that focuses on the nterrelated and how systems work analysis that focuses on the		• •	
i	nterrelated and how systems work overtime and within the co	way a system	's constit	uent part
	to formulate solutions for social and business enterprise	in maine it	1 .1 .	
	ramstorning and cover opportunities into inpovation and	ducts and con	ical thin	king and
Course	Outcomes:	ducts and ser	vices.	
CO1 /	Apply critical reasoning so as to have clarity and wisdom v	while decision	n makine	T
CO2 /	Apply systems thinking concepts to enhance individua	al and soll 1	i making	··

recognize opportunities and find innovative solutions for the same. Apply and analyse systems thinking, critical thinking, lateral thinking, creative thinking to CO3

different real-life scenarios. **CO4** 

Understand how to translate broadly defined opportunities into innovation products and services and create a business or social enterprise. Course Outcomes (CO) to

CO13		05	04	05	PO 06	PO 07	PO 08	PO 09	PO   10	PO	PO 12	PS O1	PS	PS	PS
	3	3	3	1	1	1	1	-	1	11	3		102	03	104
CO2 2	3	3	3	1	1	-	-	2	1		2		<u> </u>	-	<u>  </u>
CO3 2	3	3	3	1	1	-	1	2 2	in the second se	1	$\frac{2}{2}$		<u>  </u>	1	<u>  </u>
CO4 3	3	3	3	1	1			1	-	1	2		N.		1

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#### **Course Overview:**

This is a perspective course which exposes students to the disciplines of building and evaluating rational arguments and using a system perspective in applied engineering. Critical reasoning and system thinking enhances the though process with reasoning and critical analysis to take to the final decision in order to solve any specific problems. It enables seeing and understanding systems as wholes rather than as collections of parts, as a web of interconnections that work together to deliver an outcome.

#### UNIT I:

Introduction, foundations and principles of critical reasoning, concepts in critical reasoning, analyzing reasoning, evaluating reasoning, Integrated reasoning, uncritical and critical reasoning, scientific reasoning, strategic reasoning, analytical reasoning, different kinds of biases, recognizing implications, drawing conclusion.

#### UNIT II:

[8] Arguments, structure of an argument, premises, claims, Inductive and deductive arguments, valid & invalid arguments, sound & unsound arguments, inductive and deductive arguments, descriptions, explanations, clarifications, illustrations and summary.

#### UNIT III:

What is problem solving, steps in problem solving, problem definition, idea generation, brainstorming, fish bone analysis, thinking out of the box, lateral thinking tools & techniques, Information and data gathering and analysis, evaluating & prioritizing ideas, six thinking hats method, problem solving in teams, planning in teams, Tools and applications in project and risk management, problem solving in teams, planning in teams.

#### Unit IV:

System structures and behavior, Abilene paradox, fallacies in reasoning, barriers in critical thinking, cognition and perception in Indian knowledge systems (Nyaya Darshana), systems thinking, operational and design thinking, system thinking for social change, critical thinking, the art of asking questions, Tools and applications in project and risk management.

#### Text Books:

- 1. Concise Guide to Critical Thinking by Lewis Vaughn
- 2. Critical Thinking by Tom Chatfield
- 3. Managing Complex Systems Thinking Outside the Box by Howard Eisner A
- 4. Critical Thinking Tools for Taking Charge of Your Professional and Personal Life By Richard Paul, Linda Elder · 2020

#### **Reference Books:**

- 1. Thinking Fast and Slow by Daniel Kahneman
- 2. Strategies for creative problem solving by H Scott Fogler and Steven ELEBLARY S. Singholi
- 3. Critical Thinking A Concise Guide By Tracy Bowell, Gary Kemp · 2002 fessor In-charge, USAR

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# [8]

[8]

[8]



Semester: 3 <sup>rd</sup>			1
Paper code: AIML215		Т/Р	0.11
Subject: Selected Readings	L	1/P	Credits
and selected Readings	1	0	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

# **INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks: 75

- 1. There should be 9 questions in the end term examination question paper
- Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

#### **Course Objectives:**

- 1. To enhance comprehension skills.
- 2. To learn and enhance communication and speaking skills.

## **Course Outcomes:**

- CO1 Apply and analyse comprehension and reading skills.
- CO2 Develop presentation and report writing skills.

Cours	se Ou	tcome	s (CC	)) to P	rogra	mme	Outco	mes (I	PO) M	appin	g (Scal	e 1: La	ow, 2:	Mediu	m, 3: H	ligh)
CO/ PO	<b>PO</b> 01	PO 02	<b>PO</b> 03	<b>PO</b> 04	<b>PO</b> 05	PO 06	<b>PO</b> 07	PO 08	<b>PO</b> 09	PO 10	PO 11	<b>PO</b> 12	PS O1	PS O2	PS O3	PS
CO1	-	-	24	1	-	-		1	1	3	-	3	-	-	-	<b>04</b>
CO2	1	1	1	1	1	1	1	1	1	3		3	1	1	1	14

#### **Course Overview:**

Reading books other than one's curriculum expands the imaginative horizon of a student. Under Selected readings, the students will be required to select a book (a non-technical book that is not related to engineering) that they want to read in the semester. Reading fiction, non-fiction and science books are beneficial for students as it is a vital means to imagine a life other than our own, which in turn makes us more empathetic beings. The students will prepare a summary of the report and will be



evaluated based on the presentation that they give on the book read. The whole idea is to present the story in a customized manner. That might also include a video/poster created for the same.

Evaluation Rubrics might be based on:

- Remembering: Recalling or retrieving previously read information.
- Understanding: Comprehending the content and expressing in one's own words.
- Relating and Interpreting: Relating and interpreting the theme or message of the book with a new context or situation.
- Critical Evaluation: Making critical comments about the choice of subject, handling of the subject, author's style of writing, etc.
- Communication Skills: Speaking skills, Report writing, Presentation skills.

Sample Books (not limited to these):

S. No	Title	Authors	Language		
1.	Exam Warriors	Narendra Modi	English		
2.	Work Ethics	Narendra Modi	English		
3.	स्टेफेन हार्किंग	महेश शर्मा	Hindi		
4.	Jeff Bezos: Biography of A Billionaire Business Titan	Elliot Reynolds	English		
5.	Bill Gates: A Biography	Michael B. Becraft	English		
6.	स्टील किंग लक्ष्मी मित्तल	प्रतीक्षा ऍम तिवारी	Hindi		
7.	फेसबुक निर्माता: मार्क जुकेरबर्ग	संजय भोला 'धीर	Hindi		
8.	Stay हंगरी Stay फुलिश	रश्मि बंसल	Hindi, Gujrati Tamil		
9.	मैं, स्टीव: मेरा जीवन मेरी जुबानी	नीरू	Hindi		
10.	अमीर न १ एलन मस्क की बायोग्राफी	पूर्णिमा मजूमदार	Hindi		
11.	सुन्दर पिचाई : Google का भविष्य	जगमोहन भानवेरी	Hindi		
12.	Dream With Your Eyes Open	Ronnie Screwvala	English		
13.	डॉट्स कनेक्ट करें	रश्मि बंसल	Hindi		
14.	Take Me Home	Rashmi Bansal	English		
15.	Bhujia Barons: The Untold Story of How Haldiram Built A 5000 Crore Empire	Pavitra Kumar	English		
16.	The Z Factor: My Journey as The Wrong Man at The Right Time	Subhash Chandra And Pranjal Sharma	English		
17.	The Hard Things About Hard Things	Ben Horowitz	English		
18.	Blue Ocean Strategy	Harvard Business School Pro	English Ajay S. Singholi		

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19.	Zero to One: Notes on Start Ups, or How to Build the Future	<ul> <li>Peter Thiel &amp; Blake</li> <li>Masters</li> </ul>	English
20.	The Holy Book of Luck	A Saed Alzein	English
21,	How To Begin	Michael Bungay Stanier	English
22.	Start-up Myths and Models	Rizwan Virk	English
23.	80/20 सिद्धांत - कम के साथ अधिक प्राप्त करने का रहस्य	रिचर्ड कोचो	Hindi
24.	Discover Your Destiny: 7 Stages of Self Awakening	Robin Sharma	English
25.	Hyper Focus	Chris Bailey	English
26.	How To Talk to Anyone	Leil Lowndes	English
27.	Never Split the Difference	Voss, Chris,Raz, Tahl	English
28.	Games People Play	Berne, Eric	English
29.	Achieving Meaningful Success Unleash the Power of Me	Dr. Vivek Mansubgh	English
30,	गेटिंग टू यस	रोजर फिशर	Hindi
31.	Your Next Five Moves	Patrick Bet-David	English
32.	बड़ी सोच का बड़ा जादू	श्वार्ट्ज, डेविड जू	Hindi
33.	How To Become a People Magnet	Marc Reklau	English
34.	सबसे मुश्किल काम सबसे पहले	ब्रायन ट्रेसी	Hindi
35.	Show Your Work	Austin Kleon	English
36.	How To Find Fulfilling Work	Roman Krznaric	English
37.	जीवन के अद्भुत रहस्य	गौर गोपाल दास	Hindi
38.	Attitude Is Everything	Jeff Keller	English
39.	The World is yours to change	Daisaku Ikeda	English
40.	The Defining Decade: Why Your 20's Matter and How the Make the Most of Them Now	Jay, Meg	English
41.	Quiet: The Power of Introvert in A World That Can't Stop Talking	Susan Cain	English
42.	Find Your Why: A Practical Guide for Discovering Purpose You and Your Team	Simon Sinek	English
43.	डीप वर्क	कैल न्यूपोर्ट	Hindi
44.	कैसे करे स्टार्ट उप बिज़नेस शुरू : बिज़नेस का सपना पूरा करने की गाइड	पंकज गोयल	Hindi
45.	Alex Adventure in Number land	Alex Bellos	English

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46.		Gaurav Suri	English
47.	· _···· j all j ····· internitesto	Robin Sharma	English
48.	Buddhism	3	English
49.	My Life in Full: Work, Family, And Our Future (With A Special Epilogue for India)	r Indra Nooyi	English
50.	India's Greatest Minds: Spiritual Masters, Philosophers, Reformers	Rao, Mukunda	English
51.	Inspiring Thoughts	Swami Vivekananda	English
52.	The Man Behind the Wheel: How Onkar S. Kanwar Created a Global Giant	Tim Bouquet	English
53.	Azim Premji: The Man Beyond the Billions	Varun Sood	, English
54.	Warren Buffett: Inside the Ultimate Money Mind Warren Buffett: Inside the Ultimate Money Mind	Robert G. Hagstrom	English
55.	Rahul Bajaj: An Extraordinary Life   Official Biography of The Chairman of Bajaj Group	Gita Piramal	English
56,	5 Am क्लब: अपनी सुबह का मालिक बनें, अपना जीवन बढ़ाएं	रॉबिन शर्मा	Hindi
57.	Happiness Becomes You: A Guide to Changing Your Life for Good		English
58.	एटॉमिक हैबिट्स: छोटे बदलाव, असधरन परिनाम	डॉ सुधीर दीक्षित	Hindi
59.	हाउ टू डेवेलोप सेल्फ कॉन्फिडेंस एंड इन्फ्लुएंस पीपल बी पब्लिक स्पीकिंग	(अनुवादक) डेल कारनेगी	Hindi
60.	धन-संपत्ति का मनोविज्ञान	मॉर्गन हाउसेल	Hindi
61.	रिच डैड पुअर डैड	रॉबर्ट टी. कियोसाकी	Hindi, Bengali
62.	इकिगाई	फ्रांसेस मिरेलस हेक्टर गार्सिया	Hindi, Marathi, Bengali
63,	आपके अवचेतन मन की शक्ति	जोसेफ मफी	Hindi, Bengali
64.	सोचा और अमीर हो जाओ	नेपोलियन हिल	Hindi, Bengali
65.	पर्सनालिटी डेवेलोप्मेटन हैंडबुक	डीपी सभरवाल	Hindi
66.	पावर ऑफ़ पॉजिटिव ऐटिटूड	रोजर फ्रिट्ज	Hindi
67.	चिंता छोडो सुख से जियो	डेल कारनेगी	Hind Bangla, Maratili, Gujrati &
68.	मुट्ठी में तकदीर	रॉबिन शर्मा 🛛 🗖	Alaydis. Singholi

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69.	जैसे विचार, वैसा जीवन	जेम्स एलन (लेखक), डॉ	Hindi
		सुधीर दीक्षित	
		(अनुवादक)	
70,	चाणक्य के टॉप 100 प्रेरक विचार	महेश शर्मा	Hindi
71.	· लोक व्यवहार <sup>,</sup>	डेल कारनेगी	Hindi, Bangla
			Marathi, Gujrati & Oria
72.	रहसय	रोंडा बर्न	Hindi
73.	मेमोरी: हाउ टू डेवेलोप, ट्रैन, एंड यूज़ इट	विलियम वॉकर एटकिंसन	Hindi
74.	बड़ा सोचै, बड़ा करै	अंकुर वारिकू	Hindi
75.	द लॉ ऑफ अट्रैक्शन	एस्थर और जेरीहिक्स	Hindi
76.	गोरा	रवींद्र नाथ	Hindi, Bengali
77.	सफलता शब्दों का खेल है	डॉ. सुधीर दीक्षित	Hindi
78.	पॉजिटिव थिंकिंग	नेपोलियन हिल	
79.	हाउ टू एन्जॉय योर लाइफ एंड जॉब		Hindi
80.	Swami Vivekananda Bani O Rachana	डेल कारनेगी	Hindi, Bengali
	(Set) - 10 Volumes - Bengal	Swami Vivekananda	Bengali
81,	The Wisdom of Lotus Sutra	Daisaku Ikeda	English
82.	स्वामी विवेकानंद पुस्तक: जीवन, विचार आणि कार्य	Rajeev Ranjan, Kailas Kalkate	Marathi
83.	विश्वगुरु विवेकानंद	एम. आई. राजसवे	Hindi
84.	बिजनेस कोहिनूर रतन टाटा	बी.सी. पाण्डेय	Hindi
85.	Rattan Tata	P M Tiwari	Bengali
86.	गीतांजलि	रवींद्र नाथ	Hindi, Bengali
87.	सन्यासी जिसने अपनी संपति बीच दी	रॉबिन शर्मा	Hindi
88.	Ignited Minds: Unleashing the Power	Dr APJ Abdul Kalam	English
	Within India: Unleashing the Power Within India		Lagnali
89.	आपका भविष्य आपके हाथ में	ए पीजे कलाम	Hindi
90.	द स्टोरी ऑफ़ माय एक्सपेरिमेंट्स विथ दूथ		
91.	मैं कलाम बोल रहा हूँ		Hindi
92.	कौन रोयेगा आपकी मृत्यु पर	<u>vn</u>	Hindi
93.	अग्नि की उड़ान		Hindi
94.	आनन्द मठ		Hindi
95.		-	Hind
	The Science of Mind Management		English Alay S. Singholi

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44	Soak Education		
96.		Daisaku Ikeda	English
97.	7 Mindsets for Success Fulfilment and Happiness	Mukundanadan	English
98.	Business Sutra: A Very Indian Approach to Management	Devdutt Pattanaik	English
99.	The Five Steps to Success	Yandamoori Veerendranath	English
100.	You Are Born to Blossom	Dr APJ Abdul Kalam	English
101.	7 Divine Laws to Awaken Your Best Self	Swami Mukundanadan	English
102.	The Way of Youth	Daisaku Ikeda	English
103.	बेबीलोन का सबसे अमीर आदमी	जॉर्ज एस. क्लैसन	Hindi, Telugu
104.	अमीर होना आपका अधिकारी	जोसेफ मर्फी	Hindi
105.	Buddha: Spirituality for Leadership & Success	Pranay	English
106.	सीक्रेट्स ऑफ़ द मिलियनेअर माइंड	टी. हार्व एकर	Hindi
107.	The Almanack of Naval Ravikant: A Guide to Wealth and Happiness	Eric Jorgenson	English
108.	Ananda: Happiness Without Reason	Achrya Prashant	English
109.	The Awakening of Intelligence (New Edition)	J. Krishnamurti	English
110.	दुनिया का महान सेल्समैन	ओ जी मैंडिनो	Hindi
111.	जिंदगी वो जो आप बनायें	प्रीति शेनॉय	Hindi
112,	The White Tiger	Arvind Adiga	English
113.	Inspirational Thoughts	Swami Vivekananda	English
114.	जीत आपकी: कामयाबी कीऔर ले जाने वाली सीडी	शिव खेरा	Hindi
115.	The God of Small Things	Arundhati Roy	English
116.	Buddhism A Way of Values	Prof. Lokesh Chandra and Dr. Daisaku Ikeda	English
117.	Buddha At Work: Finding Purposes, Balance, And Happiness at Your	Geetanjali Pandit	English
118.	Workplace Hope Is a Decision		

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## DETAILED SYLLABUS FOR 4<sup>th</sup> SEMESTER

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Surajmal Vihar, Delhi-110092



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Ma		Sahar				_							_			
		Scher		•										_		
		achers							S							
4	. En	d term	Inec	ory Ex	amina	ation:	75 M	arks								
IN	<u>stri</u>	UCTIO	ONS	TO P	APE	R SET	TER	S:					Max	imun	ı Mar	Ires 7
1	. Th	ere sho	ould l	5e 9 q	uestio	ns in	the er	nd terr	n exar	ninati	on aue	estion	naner			
2	. Qu	estion	No.	l sho	uld be	com	pulsor	rv and	cover	• the e	ntire s	vllahi	ie Thi	s que	stion s	hould
	nav	∕e obje	cuve	or sh	ort an	swer	type c	uestic	ons. It	should	d he o'	f 15 m	arke			
3.	. Ар	art fro	m Q	uestic	on No	. 1, tl	ne res	t of t	he par	per sh	all co	nsist a	of four	r unit	s as p	er the
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	oni	y i qu	estio	n fron	n each	unit.	Each	quest	ion sh	ould h	ne 15 r	narke				-
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#### **Course Overview:**

This course provides an introduction to object oriented programming (OOP) using the Java programming language. This course will provide the students with a solid theoretical understanding of, as well as practical skills. Its main objective is to teach the basic concepts and techniques which form the object-oriented programming paradigm. It aims to design solutions for the complex problems.

#### UNIT I:

Introduction of Object-Oriented Programming, Benefits of Object Oriented Development, Classes and Objects, Inheritance, Polymorphism, Object- Oriented Design. Overview & characteristics of Java, Program Compilation, Execution Process Organization of the Java Virtual Machine and security aspects, sandbox model.

#### UNIT II:

[10] Java Fundamentals, Data Types & Literals Variables, Wrapper Classes, Arrays, Arithmetic Operators, Logical Operators, Control of Flow, Loops, Classes and Instances, Class Member Modifiers Anonymous Inner Class Interfaces and Abstract Classes, Inheritance using java, Exception Handling. Collection API Interfaces, Vector, stack, Hashtable, enumeration, set, List, Map, Iterators.

#### UNIT III:

Multithreading- Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization. GUI components in Java: AWT Components, Component Class, Container Class, Layout Managers, swing package. Event Handling: AWT Events, Event, Listeners, Class Listener, Action Event Methods, Focus Event Key Event, Mouse Event, Window Event Adapters.

#### **UNIT IV:**

[10] Java I/O: Input/Output Streams, Readers and Writers. JDBC (Database connectivity with MS-Access, Oracle, MS-SQL Server), Object serialization, Socket Programming, development of client Server applications, Design of multithreaded server.

#### **Text Books:**

1. Patrick Naughton and Herbertz Schidt. Java-2 the complete Reference, TMH.

2. Sierra & bates. Head First Java, O"Reilly.

#### **Reference Books:**

- 1. E. Balaguruswamy. Programming with Java, TMH.
- 2. Horstmann. Computing Concepts with Java 2 Essentials, John Wiley.
- 3. Decker & Hirshfield. Programming. Java, Vikas Publication.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Suraimal Vihar, Delhi-110092

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Semester: 4 <sup>th</sup>			
Paper code: AIML252			
Subject: Object-Oriented Programming Lab		P	Credits
Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

### **INSTRUCTIONS TO PAPER SETTERS:**

#### Maximum Marks: 60

- This is the practical component of the corresponding theory paper. 1.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below. 3.
- Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- 1. To implement real-world entities like inheritance, hiding, polymorphism, etc in developing
- 2. To understand how binding together the data and the methods operating on them helps in developing the applications.

#### **Course Outcomes:**

Apply object-oriented principles to design programming solutions to actual problems. **CO1** 

Analyse different packages of object-oriented programming language. CO<sub>2</sub>

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

	-	PO 02	РО 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
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CO2	2	2	2	2	1	-						-	Ľ.	2		ľ
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Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Suraimal Vihar, Delhi-110092

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#### LIST OF EXPERIMENTS:

- 1. Generate a random number up to 100 and print whether it is prime or not.
- 2. A. Design a program to generate first 10 terms of Fibonacci series.

B. Find the factorial of a given number using Recursion.

- 3. Find the average and sum of array of N numbers entered by user.
- 4. Create a class to find out the Area and perimeter of rectangle.
- 5. Design a class that perform String operations (Equal, Reverse the string, change case).
- 6. Demonstrate the use of final keyword with data member, function and class.
- 7. Demonstrate the use of keywords try, catch, finally, throw and throws.
- 8. Design a program to demonstrate multi-threading using Thread Class.
- 9. Design a program to create game 'Tic Tac Toe'.
- 10. Design a program to basic calculator using Applet and Event Handling.
- 11. Design a program to read a text file and after printing that on scree write the content to another text file.
- 12. Design a program to count number of words, characters, vowels in a text file.
- 13. Design a program to create simple chat application using Socket Programming.
- 14. Design a program to connect to access database and display contents of the table.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Delhi Campus) Surajmal Vihar, Delhi-110092



Semester: 4 <sup>th</sup>			1
Paper code: AIML204	L	T/P	Credits
Subject: Database Management Systems	3	0	3

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

#### **INSTRUCTIONS TO PAPER SETTERS:**

#### Maximum Marks: 75

- 1. There should be 9 questions in the end term examination question paper
- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

#### **Course Objectives:**

- 1. To introduce the concepts of databases, database models, and their uses.
- 2. To assess the need for Database design to create a strong foundation for application.
- 3. To understand the various complications & its solution for Transaction management.
- 4. To understand advanced data bases and its application.

#### **Course Outcomes:**

- CO1 Understand the principles of Database Management Systems.
- CO2 Apply Structured Query Language to a varied range of queries and work on database using state of art tools.
- CO3 Analyse various techniques and various models used for designing databases for different real-life situations.

CO4 Investigate normalized database schema and prepare a report for a real-life scenario.

CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	2	3	2	2	1	-	9	<b>a</b> 1	-	-	1	2	-	2	1	-
CO2	2	3	2	2	3	-	-	-	-	-	1	1		-	1	1
CO3	2	3	3	2	1	1	1	1	1	1	1	3	n,	1	1	1
<b>CO4</b>	2	3	2	2	1		-		-	-	1	3	1	×	-	1

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#### **Course Overview:**



The objective of the course is to present an introduction to database management systems with advanced topics of DBMS, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from databases. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an Introduction to SQL, MongoDB.

#### UNIT I:

[8] Introduction-Overview of Database System and various Data Models (Hierarchical, Network, and Relational Models), Views of Data, Database Management System, Architecture of DBMS, components of DBMS. Data Independence. Entity-Relationship Model- Entities, Entity Types, Attributes, Relationships, Relationship types, E/R diagram notation.

#### UNIT II:

[12] Relational Data Model- Concept of Relations, Overview of Various Keys, Referential Integrity, and foreign keys. Relational Language- Relational Algebra, Tuple and Domain Relational Calculus, SQL, DDL and DML, embedded SQL. Introduction and basic concepts of PL/SQL. Query Processing and Optimization. Study of various open Source and Commercialized Database Management Systems-MySQL, PostgreSQL, Oracle, DB2, SQL Server

#### UNIT III:

Database Design- Dependencies and Normal forms, Functional Dependencies, 1NF, 2NF, 3NF, and BCNF. Higher Normal Forms-4NF and 5NF. Transaction Management: ACID properties, Serializability, Concurrency Control, Database recovery management. Data Storage and Indexes, Hashing Techniques.

#### **UNIT IV:**

Advanced Topics- CAP Theorem, Data Security, Object Oriented Database, Web Database, Distributed Database, Data Warehousing, and Mining. NOSql, MongoDB: Introduction, History of MongoDB, Installation and configuration. Key Features. Core servers & tools. Basic commands. Queries & Indexes.

#### **Text Books:**

1. Silberschatz, A., Korth, Henry F., and Sudharshan, S., Database System Concepts, 5th Edition, Tata McGraw Hill, 2016.

2. Elmasri, Ramez and Navathe, Shamkant B., Fundamentals of Database Systems 7th Edition, Pearson, 2015.

#### **Reference Books:**

1. Date, C. J, Kannan, A. and Swamynathan, S., An Introduction to Database y tems, 8th edition, Pearson Education, 2012.

2. J. D. Ullman, Principles of Database Systems, 2nd Ed., Galgotia Publications, 1999.

3. Vipin C. Desai, An Introduction to Database Systems, West Publishing Fort, Ajay S. Singholi

Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Delhi Campus) Suraimal Vihar, Delhi-110092

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#### GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

	Semester: 4 <sup>th</sup>			
-	Paper code: AIML254	L	T/P	Credits
	Subject: Database Management System Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

#### INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60

- 1. This is the practical component of the corresponding theory paper.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- 1. To create a database as per the proper rules.
- 2. To organize, maintain and efficiently, and effectively retrieve information from a database. Course Outcomes:
- CO1 Apply Database management principles to fetch and maintain details efficiently and effectively from the data bases of the real world.
- CO2 Use the basics of SQL, MongoDB commands and construct queries using in database creation and interaction.

Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)

CO/ PO	PO 01					PO 06	PO 07	PO 08	PO 09	PO 10	РО 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	2	3	3	2	2	1	1	1	1	1	1	2	1	1	1	1
CO2	2	3	3.	2	3		-			6	-	2	9)	<u>()</u>	3	1

#### LIST OF EXPERIMENTS:

- Study and practice various database management systems like MySQL/Oracle/PostgreSQL/SQL Server and others.
- 2. Implement simple queries of DDL and DML.
- 3. Implement basic queries to Create, Insert, Update, Delete and Select Statements for two different scenarios (For instance: Bank, College etc.)
- 4. Implement queries including various functions- mathematical, string, da Prof. Ajay S. Singholi Professor In-charge, USAR

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- 5. Implement queries including Sorting, Grouping and Subqueries- like any, all, exists, not exists.
- 6. Implement queries including various Set operations (Union, Intersection, Except etc.).
- 7. Implement various JOIN operations- (Inner, Outer).
- 8. Write a PL/SQL program using FOR loop to insert ten rows into a database table.
- 9. Given the table EMPLOYEE (Emp No, Name, Salary, Designation, DeptID), write a cursor to select the five highest-paid employees from the table.
- 10. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java And demonstrates how a banking debit transaction might be done.

The students should be motivated to make a project using MySql and MongoDb.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Surajmal Vihar, Dethi-110092



Semester: 4 <sup>th</sup>			
Paper code: AIML206	$\mathbf{L}$	T/P	Credits
Subject: Software Engineering	3	0	3

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 50 Marks
- 3. End term Practical Examination: 25 Marks

<ol> <li>There should be 9 questions in the end term examination question paper</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This question s have objective or short answer type questions. It should be of 15 marks.</li> </ol>							
2. Question No. 1 should be compulsory and cover the entire syllabus. This question s							
have objective or short answer type questions. It should be of 15 marks	shoul						
have objective of short answer type questions. It should be of 15 marks.							
3. Apart from Question No. 1, the rest of the paper shall consist of four units as p	per th						
syllabus. Everyunit should have two questions. However, students may be asked to a							
only 1 question from each unit. Each question should be 15 marks.	•						
4. The questions are to be framed keeping in view the learning outcomes of course/pape	er. Th						
standard/ level of the questions to be asked should be at the level of the pres							
textbooks.							
5. Instructors can add any other additional experiments over and above the mentioned	in the						
experiment list which they think is important.							
6. The requirement of (scientific) calculators/ log-tables/ data-tables may be spec	cified						
required.							
Course Objectives:							
<b>1.</b> To familiarize students with basic Software engineering methods and practices and	nd the						
applications.							
2. To explain layered technology in software engineering							
3. To teach software metrics and software risks.							
4. To familiarize students with software requirements and the SRS documents.							
5. To facilitate students in software design.							
Course Outcomes:							
CO1 Understand software systems of the real world and their life cycle.	_						
CO2 Design the software solutions per the SRS requirement and proper tools.							
CO3 Estimate software development cost and its maintenance.							
CO4 Deploy various testing techniques to test software.							
CO4Deploy various testing techniques to test software.Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3:							
CO4Deploy various testing techniques to test software.Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3:CO/POPOPOPOPOPOPOPSPSPS	S P						
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CO4         Deploy various testing techniques to test software.           Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3:           CO/         PO	S P 3 0 - - - - - - - - - - - - - - - - - - -						



Software Engineering comprises the core principles consistent in software construction and maintenance: fundamental software processes and life cycles, mathematical foundations of software engineering, requirements analysis, software engineering methodologies, and standard notations, principles of software architecture and re-use, software quality frameworks and validation, software development, and maintenance environments and tools. It's an introduction to the object-oriented software development process and design.

#### **UNIT I:**

Introduction to Software- Nature of Software, Introduction to Software Engineering, Software Engineering Layers, Software Myths, The Software Processes, Project, Product, Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model. COCOMO Model. UML diagrams and DFDs

#### UNIT II:

Requirements Engineering- Functional and Non-Functional Requirements, The Software Requirements Document, Requirements Specification, Requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management, DFD, Data Dictionary. Introduction to ER diagrams

#### UNIT III:

Software Design- Design concepts and principles - Abstraction - Refinement - Modularity Cohesion coupling, Architectural design, Detailed Design Transaction Transformation, Refactoring of designs, Object-oriented Design User-Interface Design. Software Testing: White-Box Testing, Black Box Testing. Stress Testing. Alpha, Beta, and Acceptance Testing. Debugging.

#### UNIT IV:

Software Maintenance and Management- Software Maintenance, Types of Maintenance, Software Configuration Management, Overview of RE-engineering Reverse Engineering, Reliability: Failure and Faults, Reliability Models. Quality and Risk Management: Product Metrics, Software Measurements, Metrics for Software Quality, Risk Management: Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation Monitoring and Management (RMMM). Overview Of Quality Management. CMM, ISO 9000, and Six Sigma.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Delhi Campus) Surajmal Vinar, Denhi-10092

Approved by BoS of USAR : 1/08/22,Approved by AC sub-committee : 29/08/22Applicable from Batch Admitted in Academic Session 2021-22 OnwardsPage | 52

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#### **Practical Component:**

**Unit 1:** Introduction to UML diagrams and DFDs (using Edraw Max/Adobe Spark). Introduction to the basic functioning of SE tools for model visualization (Tableau Public /Gallery)

Unit 2: Introduction to ER diagrams (Lucidchart)

Unit 3: Debugging Tools: Visual Studio Debugger, GNU Debugger

Unit 4: Project Management Tools: HubSpot Project Management Tool; Toggl Plan. Requirements Analysis Tools; Testing Tools: Loadium, Qase, RedLine 13

Faculty can teach the above-mentioned tools & techniques (through unit 1 to unit 4) to students through the following experiments:

- a. Create a UML diagram using Edraw Max/Adobe Spark for library management system
- b. Create an ER diagram using Lucidchart for student management system
- c. Explore debugging of an existing system using Visual Studio Debugger/GNU Debugger
- d. Create a detailed requirement analysis report for a software project and perform testing using Loadium/Qase/RedLine 13

#### Text Books:

1. Roger S. Pressman (2011), Software Engineering, A Practitioner's Approach, 7th edition, McGraw Hill International Edition, New Delhi.

2. Sommerville (2001), Software Engineering, 9th edition, Pearson Education, India.

#### **References:**

1. K. K. Aggarwal, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India.

2. Lames F. Peters, Witold Pedrycz (2000), Software Engineering an Engineering approach, John Wiley & Sons, New Delhi, India.

3. Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, India

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Surajmal Vihar, Delhi-110092



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Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Surajmal Vihar, Delhi-110092



#### Course Overview:

This course deals with fundamentals of computer networks and Internet protocols. It addresses various network models, Data link protocols, network layer protocols and implementation of computer network models and OSI layers. The course also deals with Transport layer protocols. The main emphasis of this course is on the organization and management of networks and internet protocols.

#### UNIT I:

Introduction to Layered Network Architecture- What are computer networks, Layered models for networking, different types of communication models, ISO-OSI Model, TCP/IP.

#### UNIT II:

Data Link Protocols- Stop and Wait protocols, Noise-free and Noisy Channels, Performance and Efficiency, Sliding Window protocols, MAC Sublayer: The Channel Allocation Problem, Carrier Sense Multiple Access Protocols, Collision Free Protocols, FDDI protocol. IEEE Standard 802.3 & 802. 11 for LANs and WLANs

#### **UNIT III:**

Network Layer protocols- Design Issues: Virtual Circuits and Datagrams, Routing Algorithms, Optimality principle, shortest path routing Algorithms, Flooding and Broadcasting, Distance Vector Routing, Link State Routing, Flow-Based Routing, Multicast Routing; Flow and Congestion Control.

#### UNIT IV:

Transport Layer Protocols- Design Issues, Quality of Services. The Internet Transport Protocols. IPV4 vs IPV6. Session Layer protocol: Dialog Management, Synchronization, Connection Establishment. Quality of service, security management, Firewalls. Application layer protocols: HTTP, SMTP, FTP, SNMP, etc.

#### **Text Books:**

- 1. Tanenbaum, S., Computer Networks, Fifth Edition, Prentice Hall, India, 2013.
- 2. Behrouz A. Forouzan, Data communication and networking, 5E, Tata McGraw Hill, 2013.

#### Reference Book:

1. Computer networking- A top-down approach, Pearson Publications. 2017 edition.

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Semester: 4 <sup>th</sup>			
Paper code: AIML256	L	Р	Credits
Subject: Computer Networks and Internet Protocol Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

#### **INSTRUCTIONS TO PAPER SETTERS:**

- 1. This is the practical component of the corresponding theory paper.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- 1. To analyse various computer network protocols and components of computer network.
- 2. To design and evaluate the challenges in building networks and as per the requirement of an organization.

#### Course Outcomes:

	Design and analyse network protocols using state of art simulation tools.
CO2	Design, analyse and evaluate network services for homes, data centres, IoT, LANs and WANs.

Cours	se Out	comes	6 (CO	) to P	rograt	nme (	Jutco	mes (F	PO) Ma	apping	g (Scal	e 1: Lo	w, 2: 1	Mediur	n, 3: H	i <b>gh)</b>
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	2	2	2	2	3	-	-	-	-	1	-11	-	-	-	1	1
CO2	2	2	2	2	2	1	1	1	2	1	1	2	1	1	2	1

#### LIST OF EXPERIMENTS:

- 1. Introduction to basic networking tools: Wireshark and Network Miner.
- 2. Introduction to Datadog tool for data monitoring in network.
- 3. Running and using services/commands like ping, trace, route, nslookup, arn, ftm etc.
- 4. Introduction to Network Bandwidth analyser tool for network monitoring.
- 5. Implementation of Packet Capture and observations using packet Snifter Alay S. Singhold
- 6. Explore various aspects of HTTP Protocol.

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Maximum Marks: 60



- 7. Tracing DNS with Wireshark.
- 8. Analyzing various parameters for TCP protocol in action.
- 9. Create Ring, Bus, Star and Mesh topology using Cisco Packet Tracer.
- 10. Configure a network using distance vector routing and link state vector routing protocol.
- 11. Implement dijkstra's shortest path algorithm in network routing.

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Semester: 4 <sup>th</sup>			
Paper code: AIML210	L	T/P	Credits
Subject: Fundamentals of Machine Learning	3	0	3
Fundamentals of Machine Learning	3	U	

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

#### INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 75

- 1. There should be 9 questions in the end term examination question paper
- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Cour	se Objectives:
1.	To understand regression, classification and prediction algorithms to classify data.
2.	To gain knowledge about feature selection.
3.	To analyse feature engineering techniques to formulate the solutions for the complex problems
4.	To apply machine learning techniques in real world problems.
Cours	se Outcomes:
CO1	Understand machine learning tools and techniques with their applications.
CO2	Apply machine learning techniques for classification and regression.
CO3	Perform feature engineering techniques.
CO4	Design supervised and unsupervised machine learning based solutions for real-world problems.

Cours	se Ou	tcome	s (CC	) to P	rogra	mme	Outco	mes (I	PO) M	apping	g (Scal	e 1: Lo	w, 2:1	Mediu	m, 3: H	ligh)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	<b>PO</b> 06	PO 07	PO 08	PO 09	PO 10	<b>PO</b>	PO 12	PS O1	PS O2	PS 03	PS 04
CO1	3	3	3	3	3	1	1	1	1	1	1	2	2	3	3	3
CO2	3	3	3	3	2	1	1	1	1	1	1	1	2	3	2	3
CO3	3	3	3	3	2	-	-	-	-	-	1 <u></u> 0	- 1	2 1	2	2.	3
CO4	3	3	3	3	2	1	1	1	1	1	1	2	A	3	3	3

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#### **Course Overview:**

This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in machine learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is a statistical inference as it provides the foundation for most of the methods covered.

#### UNIT I:

Introduction to machine learning-Basic concepts, developing a learning system, Learning Issues, and challenges. Types of machine learning: Learning associations, supervised, unsupervised, semisupervised and reinforcement learning, Feature selection Mechanisms, Imbalanced data, Outlier detection, Applications of machine learning like medical diagnostics, fraud detection, email spam detection

#### UNIT II:

Supervised Learning- Linear Regression, Multiple Regression, Logistic Regression, Classification; classifier models, K Nearest Neighbour (KNN), Naive Bayes, Decision Trees, Support Vector Machine (SVM), Random Forest

#### UNIT III:

Unsupervised Learning- Dimensionality reduction; Clustering; K-Means clustering; C-means clustering; Fuzzy C means clustering, EM Algorithm, Association Analysis- Association Rules in Large Databases, Apriori algorithm, Markov models: Hidden Markov models (HMMs).

#### UNIT IV:

Reinforcement learning- Introduction to reinforcement learning, Methods and elements of reinforcement learning, Bellman equation, Markov decision process (MDP), Q learning, Value function approximation, Temporal difference learning, Concept of neural networks, Deep Q Neural Network (DQN), Applications of Reinforcement learning.

#### **Text Books:**

- 1. Tom M. Mitchell, Machine Learning, McGraw-Hill, 2010.
- 2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.
- 3. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995

#### **Reference Books:**

1. Ethem Alpaydin, (2004), Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press

2. T. Astie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning pringer (2nd ed.), 2009

3. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springerol Aing S. Singholi Professor in charge, USAR

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Semester: 4 <sup>th</sup>			
Paper code: AIML258	L	Р	Credits
Subject: Fundamentals of Machine Learning Lab	0	2	1

#### **Marking Scheme**

- 3. Teachers Continuous Evaluation: 40 Marks
- 4. End term Examination: 60 Marks

#### **INSTRUCTIONS TO PAPER SETTERS:**

- 1. This is the practical component of the corresponding theory paper.
- The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which the appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- 3. To formulate and analyse algorithm based on machine learning.
- 4. To design the use cases of machine learning algorithms as per the user requirement.

#### **Course Outcomes:**

CO1 Apply and differentiate machine learning algorithms for regression, classification and prediction problems.

CO2 Implement supervised and unsupervised machine learning models to analyse data for executing feature engineering and feature selection for real-life scenarios.

Cours	se Out	comes	6 (CO	) to P	rogran	nme (	Outcor	mes (P	'O) Ma	apping	(Scal	e 1: Lo	<b>w, 2:</b> ]	Mediu	m, 3: I	High)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS 03	PS O4
C01	3	3	3	3	3	1	1	1	1	1	1	2	2	3	3	3
CO2	3	3	3	3	3	1	1	1	1	1	2	1	2	3	2	3

#### LIST OF EXPERIMENTS:

- 1. Study and Implement Linear Regression.
- 2. Study and Implement Logistic Regression.
- 3. Study and Implement K Nearest Neighbour (KNN).
- 4. Study and Implement classification using SVM.
- 5. Study and Implement Bagging using Random Forests.
- 6. Study and Implement Naive Bayes.
- 7. Study and Implement Decision Trees.



Maximum Marks: 60

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- 8. Study and Implement K-means Clustering to Find Natural Patterns in Data.
- 9. Study and Implement Gaussian Mixture Model Using the Expectation Maximization.
- 10. Study and Implement Classification based on association rules.
- 11. Study and Implement Evaluating ML algorithm with balanced and unbalanced datasets.
- 12. Comparison of Machine learning algorithms based on different-different parameters.

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Semester: 4 <sup>th</sup>	14			
Paper code: AIML212		L	T/P	Credits
Subject: Computational Methods		3	0	3

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

INST	RUCTIONS TO PAPER SETTERS: Maximum Marks: 75
1. 1	There should be 9 questions in the end term examination question paper
2, (	Question No. 1 should be compulsory and cover the entire syllabus. This question should
	ave objective or short answer type questions. It should be of 15 marks.
3. /	Apart from Question No. 1, the rest of the paper shall consist of four units as per the
5	yllabus. Everyunit should have two questions. However, students may be asked to attempt
C	nly 1 question from each unit. Each question should be 15 marks.
	he questions are to be framed keeping in view the learning outcomes of course/paper. The
S	tandard/ level of the questions to be asked should be at the level of the prescribed
t	extbooks.
5.	he requirement of (scientific) calculators/ log-tables/ data-tables may be specified if
	equired.
	e Objectives:
1.	To develop a practical approach to mathematical problem solving.
2.	To introduce many commonly used tools and techniques in numerical work.
	To convert algorithms and techniques to working computer codes.
4.	To understand the nuances of the numerical techniques and computer applications of the
	same.
Cours	e Outcomes:
CO1	Ability to understand numerical techniques to find the roots of non-linear equations and
	solution of system of linear equations.
CO2	Ability to understand the solution of the linear simultaneous equations using iterative
	methods and apply them to real world applications.
CO3	Ability to understand numerical differentiation and integration and numerical solutions of
	ordinary and partial differential equations.
CO4	Ability to understand numerical methods to solve the ordinary differential equation and
	partial differential equation.

Cours	se Out	comes	5 (CO	) to P	rograi	nme (	Jutco	mes (P	O) M	apping	g (Sca	ile 1: L	.ow, 2:	Mediu	ım, 3: I	ligh)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	3	2	2	3		-	· -	-	:=)	-		-		9 5	-	
CO2	3	2	3	3	1	1	1	1	1	1	1	1	1	<u>Ai</u>	1	1
CO3	3	2	3	3	=	-		-	1961	-	-	س		10	-	8
CO4	3	2	3	3		-		7	17			-Pr	of. Aja	ys.s	ngholi	-

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#### UNIT I:

Numerical solution to Linear algebraic & transcendental equations- Numerical algorithms and their complexities, Computer implementation and efficiency, Root finding- bracketing methods: Bracketing Methods, graphical methods, Bisection method, False Position (Regula Falsi), Root finding -Open Methods: Simple Fixed-Point Iteration, Newton-Raphson method, Secant methods, Brent's method

#### UNIT II:

Numerical linear algebra- Gauss elimination, Pivoting, Tridiagonal systems, LU factorization, Gauss elimination as LU factorization, Cholesky factorization, Matrix inverse and condition, Error analysis and system condition. Iterative Methods: Gauss-Seidel method, Nonlinear Systems. Eigenvalues: The Power Method, Interpolations, Lagrange's, piecewise/splines

#### UNIT III:

[10] Numerical Differentiation- High-Accuracy differentiation formulas, Richardson Extrapolation, Derivatives of unequally spaced data, Partial Derivatives. Numerical Integration: Newton-Cotes Formulas, The trapezoidal rule, Simpson's Rules, Higher-Order Newton-Cotes formulas, Integration with unequal segments, Numerical Integration of Functions, Romberg integration, Gauss quadrature, Adaptive quadrature

#### **UNIT IV:**

Ordinary differential equations- Euler's Method, Runge-Kutta Methods, Adaptive methods, finite difference methods, Initial value problems, Boundary value problems, Partial differential equations

#### Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

#### **Reference Books:**

1.Numerical Methods in Engineering & Science (with Programs in C,C++ & MATLAB), B. S. Grewal, Khanna Publishers.

2. Numerical Methods for Engineers, Steven Chapra, Raymond Canale, McGraw-Hill Higher Education, 2010



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L	T/P	Credits
1	0	1
	L 1	L T/P 1 0

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 25 Marks
- 2. End term Theory Examination: 75 Marks

#### **INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks: 75 1. There should be 9 questions in the end term examination question paper

- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Everyunit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

#### **Course Objectives:**

1.	To understand the fundamentals of effective technical writing.
2.	To develop the skill of preparing logical and persuasive technical papers/proposals/ reports.
3.	To apply standard technical formats for drafting protocol and research papers.
4.	To inculcate habits of effective technical writing applying precision, conciseness, and lucidity.
Cours	e Outcomes:
CO1	The concepts of effective technical writing
CO2	Apply precision, conciseness and lucidity while writing
CO3	Demonstrate by writing a technical paper/article by using global standard formats.

Cours	se Ou	tcome	s (CC	) to P	rogra	mme	Outco	mes (I	PO) M	appin	g (Scal	e I: Lo	w, 2: 1	Mediur	n, 3: H	ligh)
CO/ PO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	<b>PO</b> 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	-	-	-	÷	2	-	-	-	1	3	-	2 /	-	1	-	1
CO2	-	-	-	-	2	-	20	-	1	3	-	2	*	-	-	-
CO3	1	1	1	1	2	1	1	1	1	3	1	2	1	1	1	1
-								-				Prof.	Ajay (	S. Sing	holi	

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**Course Overview: -**

Under Effective Technical Writing, students are expected to understand the process of writing technical research papers/ articles. The students are required to take up a topic of their choice and write a research paper/ article on the same using state-of-art document preparation software like Latex, overleaf, etc. Students must be familiar with all primary international template styles of a research paper like IEEE, Springer, ACM, etc. Students will also be taught various referencing formats (for example: APA). Research paper/ article writing is a must-have skill for future scientists & researchers, and it opens up their domain of knowledge. The research paper/article/proposal submitted by students will be checked for plagiarism. This will lead to the development of skills including proper paper format, proper referencing, inclusion of figures, tables, use of keywords, writing abstract, title etc.

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Sem	ester:	<b>4</b> <sup>th</sup>										6				
Pap	er cod	e: AI	ML2	16								L	T/	PC	Credits	
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2.	End	term '	Theor	ry Exa	amina	tion:	75 Ma	arks								
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#### **Course Overview:**

In this, the faculty coordinator will invite experts from the industry/ academia to give seminars/webinars/expert lectures to students on recent technological advances in the industry. In every semester, at least 8 seminars/webinars/expert lectures should be conducted. An evaluation would be conducted by the faculty coordinator based on quiz, report submissions, etc. on the seminars/webinars/expert lectures conducted. The aim is to give the latest technical and research exposure to the students.

Approved by BoS of USAR : 1/08/22, Applicable from Batch Admitted in Academic Session 2021-22 Onwards Applicable from Batch Admitted in Academic Session 2021-22 Onwards Applicable from Batch Admitted in Academic Session 2021-22 Onwards Applicable from Batch Admitted in Academic Session 2021-22 Onwards Applicable from Batch Admitted in Academic Session 2021-22 Onwards



**Maximum Marks: 60** 

L	T/P	Credits
0	2	1
	L 0	L T/P 0 2

1. Teachers Continuous Evaluation: 40 Marks

2. End term Examination: 60 Marks

#### **INSTRUCTIONS TO EVALUATOR:**

1. This is an Integrated Project to be created by the students on the basis of the knowledge gained by them.

- 2. The instructor will continuously evaluate the student's performance in the semester.
- 3. Practicum shall be evaluated based on the novelty, originality of work, contribution towards society.
- 4. Project report of the practicum will be submitted at the end of the semester.

Cou	rse O	bject	ives:													
1.	To thr	To enhance experiential learning component by applying the knowledge and skills gained through various subjects in developing a solution for real-world problems.														
2.	To the	To give an exposure to multi-disciplinary domains to identify problems that exist around them to develop solutions thereby improving their technical skillset and their employability.														
3.	To	To increase the collaboration skills.														
4.	To understand the feasibility, quality, novelty, innovation and the application of the project.															
Cou	rse O	utcon	nes:													
COI	- 11 A	ply e sible	ngine solut	ering	conce	epts le	earnec	l so fa	ar for	projec	t ider	ntificat	ion, f	ormula	ation,	and a
CO2		velop vic.	and	demo	nstrat	e a co	ompre	hensiv	ve tecl	nnical	know	ledge	on th	e sele	cted p	roject
CO3	De int	sign egrate	nove d apj	l and proach	inno 1.	vative	e tech	nolog	ical s	olutio	ons to	real	probl	ems 1	utilizir	ig an
Cours	se Out	come	s (CO	) to P	rograi	nme (	Jutco	mes (P	O) M:	apping	g (Se	ale 1:1	Low, 2	: <b>Me</b> di	um, 3:	High)
CO/ PO	<b>PO</b> 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
C01	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2	3
CO2	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2	3
CO3	3	3	3	3	2	2	1	2	1	1	3	3	2	2	2 .	3

Prof. Alay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Delhi Campus) Approved by AC sub-committee Delaj 108/22 Page | 67

Approved by BoS of USAR : 1/08/22,

Applicable from Batch Admitted in Academic Session 2021-22 Onwards



#### Course Overview:

Under practicum the students will be involved in experiential learning. The students are required to apply the knowledge and skills gained through various subjects in developing a solution for solving real world problems. Interdisciplinary projects give an opportunity to students to identify problems that exist around them for which they could develop solutions. Working as a team for the project also increases their collaboration skills.

Prof. Ajay S. Singholi Professor In-charge, USAR Guru Gobind Singh Indraprastha University (East Dethi Campus) Surajmal Vihar, Dethi-110092

# DETAILED SYLLABUS (THIRD YEAR)

for

### **BACHELOR OF TECHNOLOGY**

for

#### **ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

#### **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

#### **INDUSTRIAL INTERNET OF THINGS**

under the aegis of University School of Automation and Robotics offered at Affiliated Institutions of the University

from A.S. 2021-22 onwards



**University School of Automation and Robotics** 

GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, EAST DELHI CAMPUS, SURAJMAL VIHAR-110092



## DETAILED SYLLABI FOR 5<sup>th</sup> SEMESTER AIDS/AIML



Semes	ster: 5 <sup>th</sup>											
Paper	code: A	IDS301/	AIML30	1					L	T/P	Cre	dits
Subje	ct: Oper	ating Sy	stems						4	0	4	
Marki	ng Schei	me:							L.	•		
1.	Teache	ers Conti	nuous Ev	valuatio	n: 25 Ma	arks						
2.	End Te	rm Theo	ry Exam	ination:	75 Mark	(S						
Instru	ctions fo	or Paper	Setters:					Μ	aximum	Marks:	75	
1. Th	ere shou	uld be 9	questior	ns in the	end terr	n exami	nation q	uestion	paper.			
2. Qı	uestion N	lo. 1 shc	ould be c	ompulso	ory and o	cover the	e entire s	syllabus.	This qu	estion sł	nould ha	ve
	-					t should						
-					-	paper sh				-	-	
				•		ever, stu	idents n	hay be as	sked to a	attempt	only 1 q	uestion
	om each		•				I			/		
	-					view the		-		-		
	-		•			d should log-tabl						
	se Objec		i (scient	iiic) caic	ulators/	iog-tabl		-lables l	nay be s	pecified	ii requir	eu.
1.	_		the basi	c concer	ots and f	unctions	of oner	ating sv	stems			
2.				•		prithms a	•			niques ta	achiev	e better
			•	outer sys	00					inques te	, active t	
3.						d Deadl	ocks and	d Memo	ry Man	agemen	t algorit	hms of
		ing syste								U	U	
4.	To ana	lyze the	several	operatin	g system	ns and th	eir utilit	ies such	Linux, U	nix <i>,</i> Win	dow to d	develop
	operat	ing syste	em funct	ions in p	rogrami	ming.						
Cour	se Outco	omes:										
CO1	Unders	stand fu	Indamer	ntal ope	rating s	ystem a	bstracti	ons suc	h as pr	ocesses,	thread	s, files,
	semap	hores, IF	PC abstra	actions, s	shared n	nemory	regions,	etc.				
CO2	Apply p	process	scheduli	ng and n	nemory	managei	ment co	ncepts.				
	Analy :=	a +b a -	norotire -		la react	1800 100-	0000-	<b>nt</b> to al-		doodloo	( man ===================================	
CO3	-			system anagem		urce ma	nageme	ni techi	iiques,	ueauloc	k mana	gement
CO4						ading lik	varios f	or a tin		ad dava	lon ann	lication
04	-			ystem ca		uung in					ioh ahh	meation
Cours						omes (P	0)					
- Juin			-,	- 8- 4111				ping (So	ale 1: L	ow, 2: M	ledium,	3: High
<b>CO</b> /	PO01	PO02	<b>PO03</b>	<b>PO04</b>	PO05	<b>PO06</b>	PO07	<b>PO08</b>	PO09	<b>PO10</b>	<b>PO11</b>	PO12
PO												
CO1	1	-	-	-	-	-	-	-	1	1	1	-
CO2	3	1	-	-	-	-	-	-	1	1	1	-
CO3	2	2	-	1	1	-	-	-	2	1	1	1
	2	1	2	1	1		1		2	1	2	



#### **Course Overview:**

This course covers the fundamentals of operating systems, mechanisms, and their implementations. The core of the course contains concurrent programming (threads and synchronization), inter process communication, process scheduling and memory management. The course is split into four sections: (1) Introduction, (2) Process and Thread Management, (3) Resource Management and Communication, and (4) I/O management and Disk scheduling.

#### Unit I

**Introduction**: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating System Structure: System Components, System structure, Operating System Services.

**CPU Scheduling:** Scheduling Concept, process scheduling strategies- First-Come, First-Served (FCFS) Scheduling, Shortest-Job-Next (SJN) Scheduling, Priority Scheduling, Shortest Remaining Time, Round Robin (RR) Scheduling, Multiple-Level Queues Scheduling, Performance Criteria of Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

#### Unit II

**Concurrent Processes:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Binary and counting semaphores, P() and V() operations, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling.

**Deadlocks:** examples of deadlock, resource concepts, necessary conditions for deadlock, deadlock solution, deadlock prevention, deadlock avoidance with Bankers algorithms, deadlock detection, deadlock recovery.

#### Unit III

**Memory Organization & Management:** Memory Organization, Memory Hierarchy, Memory Management Strategies, Contiguous versus non- Contiguous memory allocation, Partition Management Techniques, Logical versus Physical Address space, swapping, Paging, Segmentation, Segmentation with Paging Virtual Memory: Demand Paging, Page Replacement, Page-replacement Algorithms, Performance of Demand Paging, Thrashing, Demand Segmentation, and Overlay Concepts.

#### Unit IV

**I/O Device and the organization:** I/O Device and the organization of the I/O function, I/O Buffering, Disk I/O, Disk Scheduling Algorithms, File system: File Concepts, attributes, operations, File organization and Access mechanism, disk space allocation methods, Directory structure, free disk space management, File sharing, Implementation issues. Case studies: Unix system, Windows XP.

#### Textbooks:

- 1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, 9th Edition
- 2. Tannenbaum, "Morden Operating Systems", Pearson, 4th Edition, 2014

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#### **Reference Books:**

- 1. William Stallings, "Operating Systems –Internals and Design Principles", 8/E, Pearson Publications, 2014.
- 2. Dietel, "An introduction to operating system", Addison Wesley, 1983

#### **Online Resources:**

- 1. <u>https://nptel.ac.in/courses/106106144</u> Course "Introduction to Operating Systems" by Prof. Chester Reberio, IIT Madras.
- 2. <u>https://nptel.ac.in/courses/106105214</u> "Operating System Fundamentals" by Prof. Santunu Chattopadhyay, IIT Kharagpur.



Semest	Semester: 5 <sup>th</sup>													
Paper c	ode: Al	DS351/	AIML3	51					L	T/P	Credi	ts		
Subject	: Oper	ating S	ystems	Lab					0	2	1			
Markin	Marking Scheme: 1. Teachers Continuous Evaluation: 40 Marks													
1.	Teache	rs Conti	nuous	Evaluati	on: 40 🛚	Marks								
2.	2. End term Examination: 60 Marks													
Instruct	Instructions for Evaluators:Maximum Marks: 601. This is the practical component of the corresponding theory paper.													
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.					
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week o	f the	class		
com	mence	ment u	nder th	intim	ation to	the of	fice of t	he HOD	)/ Instit	ution in	which	they		
арр	ear is b	eing off	ered fr	om the	list of p	racticals	below.							
3. Inst	<ul><li>appear is being offered from the list of practicals below.</li><li>3. Instructors can add any other additional experiments over and above the mentioned in the</li></ul>													
exp	experiment list which they think is important.													
4. At le	<ol> <li>At least 8 experiments must be performed by the students.</li> </ol>													
Course	e Objec	tives:												
1.	То ар	ply the	concep	ots of st	orage m	nanagen	nent, pr	ocess so	chedulin	g using	program	nming		
	lang	uages.	•		-	-	•					-		
2.	To st	udy Se	veral C	) peratin	g syste	ms and	l their o	commai	nds to	analyze	the m	emory		
	man	agemer	nt, proc	ess sche	eduling	concept	s.							
Course	e Outco	mes:												
CO1	Apply	the te	chnique	es used	to imple	ement p	rocesse	s and th	reads a	s well a	s the dif	fferent		
	algor	ithms fo	or proce	ess sche	duling.									
CO2	Imple	ement t	he basi	c comn	nands o	f the O	S and w	/ill exec	ute the	various	systen	n calls,		
	proce	ess sync	hroniza	tion pro	blems	using se	maphor	ſe.			-			
Course	Outcon	nes (CO	) to Pro	gramm	e Outco	omes (P	0)							
						-	Марр	ing (Sca	le 1: Lo	w, 2: Me	edium, 3	3: High		
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12		
CO1	2	2	-	1	1	-	-	-	1	1	1	1		
CO2	3	2	2	1	1	-	1	-	2	1	2	1		

#### List of Experiments

- 1. Write a C program to implement FCFS scheduling algorithm.
- 2. Write a C program to implement a round robin scheduling algorithm.
- Implementation of the following Memory Allocation Methods for fixed partition a) First Fit b) Worst Fit c) Best Fit.
- 4. Write a program to implement reader/writer problems using semaphore.



- 5. Write a program to implement Banker's algorithm for deadlock avoidance.
- 6. To study of basic UNIX commands and various UNIX editors such as vi, ed, ex and EMACS
- 7. Process Management a) fork() b) execv() c) execlp() d) wait() and e) sleep()
  - A. Program to implement the fork function using C.
  - B. Program to implement execv function using C.
  - C. Program to implement execlp function.
  - D. Program to implement wait function using C.
  - E. Program to implement sleep function using C.
- 8. To write simple shell programs by using conditional, branching and looping statements.
- 9. Write a Shell Program to swap the two integers.



Semes	ter: 5 <sup>th</sup>													
Paper	code: Al	DS303/	AIML303	3					L	T/P	Cre	dits		
Subjec	t: Desig	n and A	nalysis o	of Algori	thms				4	0	4			
Markir	ng Schen	ne:												
1.	Teache	rs Contii	nuous Ev	valuatior	n: 25 Ma	irks								
	End Ter			ination:	75 Mark	S								
Instruc	ctions fo	r Paper	Setters:					Μ	aximum	Marks:	75			
	nere should be 9 questions in the end term examination question paper.													
	uestion No. 1 should be compulsory and cover the entire syllabus. This question should have													
-	bjective or short answer type questions. It should be of 10 marks.													
-	part from Question No. 1, the rest of the paper shall consist of four units as per the syllabus.													
	very unit should have two questions. However, students may be asked to attempt only 1 question													
	rom each unit. Each question should be 10 marks. The questions are to be framed keeping in view the learning outcomes of course/paper. The													
								-						
	tandard/ level of the questions to be asked should be at the level of the prescribed textbooks. he requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.													
	e Objec		i (scienti	nc) calci	ulators/	iog-tabl			nay be s	pecifieu	n requi	eu.		
1.			and app	ly the al	porithm	analysis	technia	ues to g	enerate	solution	space			
2.					-	ernative	•				•	lem		
3.						echnique								
4.		•	-			ally trac		r intract	able. an	d discus	ss strate	egies to		
		s intract				,			,			0		
Cours	e Outco		,											
CO1	Unders	tand the	e asympt	totic per	formand	ce of alg	orithms	to analy	ze form	al correc	ctness p	roof for		
01	algorith	nms												
CO2	Apply n	najor alg	orithms	' knowle	dge and	data-st	ructures	corresp	onding t	o each a	lgorithm	n design		
02	paradig	gm												
CO3	Design	efficient	algorith	nms for a	commor	n compu <sup>r</sup>	ter engir	neering	design p	roblems				
CO4	Classify	a probl	em as co	mputat	ionally t	ractable	or intra	ctable, a	nd discu	iss strate	egies to	address		
_	intracta				, -			-, -			5			
Course	Outcon		to Prog	ramme	Outcom	es (PO)								
			Ū			•	Ma	pping (S	cale 1: L	ow, 2: M	ledium,	3: High)		
<b>CO</b> /	PO01	PO02	PO03	PO04	PO05	PO06	<b>PO07</b>	PO08	PO09	PO10	PO11	PO12		
PO														
CO1	2	1	1	1	1	-	-	1	1	1	1	2		
CO2	2	2	1	1	1	-	-	1	1	1	1	2		
CO3	2	2	2	1	1	-	-	-	-	-	1	3		
<b>CO4</b>	2	2	2	2	1	1	-	-	-	-	1	2		

#### **Course Overview:**

This course is designed to enable the student to design and analyze algorithms for the problems. This course covers basic strategies of algorithm design: top-down design, divide and conquer, asymptotic costs, applications to sorting and searching, matrix algorithms, shortest-path and spanning tree problems, dynamic programming, greedy algorithms and graph algorithms.



#### Unit I

**Introduction to Algorithms:** Time Complexity and Space Complexity, Asymptotic analysis, Growth rates, some common bounds (constant, logarithmic, linear, polynomial, exponential), Complexity Analysis techniques: Master theorem, Substitution Method, Iteration Method, Time complexity of Recursive algorithms. art of problem-solving and decision making, role of data structure in algorithm design, Basic algorithmic structures of problem-solving and optimization algorithms, constraints, solution space, and feasible reasons, and representation of solution space. Sorting and searching algorithms: Selection sort, bubble sort, insertion sort, Sorting in linear time, count sort, Linear search.

# Unit II

**Divide and Conquer Algorithms:** Overview of Divide and Conquer algorithms, Quick sort, Merge sort, Heap sort, Binary search, Matrix Multiplication, Convex hull and Searching, Closest Pair of Points. **Greedy Algorithms:** Greedy methods with examples, Huffman Coding, Knapsack, Minimum cost Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths – Dijkstra's and Bellman Ford algorithms.

#### Unit III

**Dynamic programming:** Dynamic programming with examples such as Knapsack, shortest path in graph All pair shortest paths –Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Traveling Salesman Problem, longest common sequence, n-Queen Problem.

# Unit IV:

**Graph Algorithms:** Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Bipartite graphs. Graph Coloring, Hamiltonian Cycles and Sum of subsets.

**Computational complexity**: Problem classes: P, NP, NP-complete, NP-hard. Reduction. The satisfiability problem, vertex cover, independent set and clique problems Cook's theorem. Examples of NP-complete problems.

# Textbooks:

- 1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI ,4th Edition
- 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third Edition, Pearson Education, 2006

# **Reference Books:**

- 1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2011.
- 2. Anany Levitin. "Introduction to the Design and Analysis of Algorithms", Pearson.

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Semest	er: 5 <sup>th</sup>												
Paper c	ode: Al	DS353/	AIML3	53					L	T/P	Credi	ts	
Subject	: Desig	n and A	Analysis	of Algo	orithms	Lab			0	2	1		
Markin	g Schen	ne:											
1.	Teache	rs Conti	nuous	Evaluati	on: 40 M	Marks							
2.	End ter	m Exam	ninatior	i: 60 Ma	irks								
Instruct	tions fo	r Evalua	ators:						1	Maximu	ım Marl	ks: 60	
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.				
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week c	of the	class	
com	imence	ment u	nder th	ne intim	ation to	o the of	fice of t	he HO	D/ Instit	ution in	which	they	
арр	ear is b	eing off	ered fr	om the	list of p	racticals	s below.						
3. Inst	ructors	can ado	d any of	ther add	ditional	experin	nents ov	er and a	above th	ne ment	ioned ir	n the	
exp	experiment list which they think is important.												
4. At le	east 8 e	xperim	ents mi	ust be p	erforme	ed by th	e studer	nts.					
Course	e Objec	tives:											
1.	To tea	ach stu	dents h	ow to a	nalyses	solutior	n space (	of probl	ems				
2.	To de	sign alg	orithm	s based	on dyn	amic pro	ogramm	ing and	greedy	algorith	nms.		
Course	Outco	mes:											
CO1	Apply	, impor	tant al	gorithm	ic desig	gn para	digms a	nd met	hods o	f analys	is in pr	oblem	
	solvir	ıg.											
CO2	Desig	n and d	levelop	dynami	ic progra	amming	gand gre	eedy alg	orithms	5.			
Course	Outcon	nes (CO	) to Pro	ogramm	e Outco	omes (P	0)						
							Mappi	<b>ng (</b> Scal	le 1: Lov	v, 2: Me	dium, 3	: High)	
CO/PO	PO01	PO02	PO03	PO04	PO05	P006	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	
CO1	2	2	2	2	1	-	-	-	-	-	-	1	
CO2	2	2	2	2	1	1	1	1	1	1	1	2	

# List of Experiments

- 1. Sort a given set of elements using the quick sort algorithm and find the time complexity for different values of n.
- 2. Implement merge sort algorithm using divide & conquer method to sort a given set of elements and determine the time and space required to sort the elements.
- 3. Write a program to implement knapsack problem using greedy method.
- 4. Program to implement job sequencing with deadlines using greedy method.



- 5. Write a program to find minimum cost spanning tree using Prim's Algorithm.
- 6. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
- 7. Implement 0/1 Knapsack problem using dynamic programming.
- 8. Write a program to perform Single source shortest path problem for a given graph.
- 9. Program for finding shortest path for multistage graph using dynamic programming.
- 10. Program to implement 8-queens problem using backtrack method.



Semes	ter: 5 <sup>th</sup>												
Paper	code: A	DS305							L	T/P	Cre	dits	
Subjec	t: Data	Mining							4	0	4		
Marki	ng Scher	ne:							I	•	•		
1.	Teache	rs Conti	nuous Ev	/aluatio	n: 25 Ma	irks							
2.	End Te	rm Theo	ry Exam	ination:	75 Mark	s							
Instru	ctions fo	r Paper	Setters:							Maxim	um Mar	ks: 75	
	ere shou		-										
	estion N			•					This qu	estion sł	nould ha	ve	
	jective o												
-	art from				-	-				-	-		
	ery unit			•			idents m	hay be as	sked to a	attempt	only 1 q	uestion	
	om each unit. Each question should be 10 marks. he questions are to be framed keeping in view the learning outcomes of course/paper. The												
	andard/level of the questions to be asked should be at the level of the prescribed textbooks.												
	ne requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required. recompletives:												
1.	_		differen	t types	of data	and usin	g data p	re-proc	essing te	chnique	s annlic	able on	
	the dat	-	uncren	it types			g uata p			cinique	.s applie		
2.			rious cla	ssificatio	n and cl	ustering	techniq	ues on r	eal worl	d datase	ts		
3.							ita types						
4.		-		-		-	l sequen		ng techn	iques.			
Cours	se Outco	·							0				
			basic col	ncepts c	of data i	mining t	echniqu	es to id	entify ir	nterestin	g and r	elevant	
CO1	patterr			•		0	·		,		0		
<b>CO1</b>	-		orm pre-	process	ing step	s to prep	oare the	data and	d get ins	ights int	o the da	taset.	
CO2	,	•	•	•	0 1				0	0			
CO3	-			iation ru	ules ider	ntified us	sing asso	ciation	rule min	ing or se	equence	mining	
		life data											
CO4	Design	and Dev	elop mo	dels usir	ng classif	ication a	nd clust	ering teo	chniques	on com	plex dat	a types.	
Cours	e Outco	mes (CC	)) to Pr	noramn	ne Outco	mes (P	0)						
Cours	e Guill		<i>c</i> , to i i	-81 ann		, in co (1 ,	,	ping (So	cale 1: L	ow, 2: N	ledium.	3: High	
<b>CO</b> /	<b>PO01</b>	PO02	PO03	<b>PO04</b>	PO05	<b>PO06</b>	PO07	<b>PO08</b>	<b>PO09</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	
PO													
CO1	2	1	2	-	3	-	-	1	-	-	-	-	
CO2	2	2	2	3	-	-	-	-	1	-	-	-	
CO3	2	-		2	3	-	1	-	-	1	-	-	
CO4	2	2		3	3	-	-	-	-		1	2	



**GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** 

# **Course Overview:**

The subject gives a detailed overview on data mining as a process starting from pre-processing the dataset to classification/clustering techniques on the data. The students are introduced to different techniques that can be applied to various types of complex data. Concepts like association rule mining and ensemble methods are also discussed in this subject.

#### Unit I

**Data Mining Basics-** What is Data Mining, Kinds of Patterns to be Mined, Tasks of Data Mining, Data Mining Applications- The Business Context of Data Mining, Data Mining as a Research Tool, Data Mining for Marketing, Benefits of data mining.

**Data Pre-processing-** Review of Data Pre-processing: Types of Data, Data Quality, Measurement and Data Collection Issues, Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature Creation, Data Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity.

# Unit II

**Classification-** Types of classifiers, Rule based classifiers, Model Selection, Model Evaluation, Artificial Neural Networks: Activation Functions (Sigmoid, Tanh, ReLU, Leaky ReLU, Selu), Perceptron, Multilayer Feed-Forward Neural Network, Backpropagation, Semi-supervised classification, Active Learning, Ensemble Methods: Methods for Constructing an Ensemble Classifier, Bias-Variance Decomposition, Bagging, Boosting, GBM, XGBoost, Stacking, Random Forest. Metrics for Evaluating Classification Performance: Holdout method, Cross Validation, Bootstrap

Handling Class Imbalance Problem: Evaluating Performance with Class Imbalance, Finding an Optimal Score Threshold, Multiclass Problem.

# Unit III

**Association Rule Mining-** Mining Frequent Patterns, Associations and correlations, Market Basket Analysis, Apriori algorithm, Support Counting, Improving the efficiency of Apriori, Rule generation in Apriori algorithm, FP growth algorithm, Eclat algorithm, Mining Various kinds of Association Rules, Maximal Frequent Itemsets, Closed Itemsets, Evaluation of Association Patterns. Handling Categorical Attributes, Handling Continuous Attributes.

**Sequential Patterns-** Sequential Pattern Discovery, GSP algorithm, SPADE algorithm, Timing Constraints.

# Unit IV

**Cluster detection-** Different Types of Clusters, Hierarchical Methods: Agglomerative and Divisive Clustering, Density based Clustering: DBSCAN algorithm, Comparing K-means and DBSCAN, Self-Organizing Maps (SOM), Cluster Evaluation. Outlier Analysis, Outlier Detection Methods. Mining Complex Data Types.

**Avoiding False Discoveries-** Significance Testing, Hypothesis Testing, Multiple Hypothesis Testing, Pitfalls in Statistical Testing

# Textbooks:



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- 1. Tan Pang- Ning, Steinbach M., Viach, Kumar V., "Introduction to Data Mining", Second Edition, Pearson, 2013.
- 2. Han J., Kamber M. and Pei J., "Data Mining Concepts and Techniques", Second Edition, Hart Court India P. Ltd., Elsevier Publications, 2001.

# **Reference Books:**

- 1. Zaki M.J., Meira W., "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Second Edition, Cambridge University Press, 2020
- 2. Witten, E. Frank, M. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Publishers, 2011.



Semest	er: 5 <sup>th</sup>											
Paper c	ode: Al	DS355							L	T/P	Credi	ts
Subject	: Data	Mining	; Lab						0	2	1	
Markin	g Schen	ne:										
1.	Teache	rs Conti	nuous l	Evaluati	on: 40 I	Marks						
2.	End ter	m Exam	nination	i: 60 Ma	irks							
Instruct	tions fo	r Evalua	ators:						N	laximur	n Mark	s: 60
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	oer.			
2. The	practi	cal list	shall	be not	ified b	y the t	teacher	in the	first	week c	of the	class
com	mence	ment u	nder th	ne intim	ation to	o the of	fice of t	he HOD	0/ Instit	ution in	which	they
арр	ear is b	eing off	ered fr	om the	list of p	racticals	below.					
3. Inst	ructors	can ado	d any of	ther add	ditional	experim	nents ov	er and a	above th	ne ment	ioned in	n the
exp	eriment	t list wh	ich the	y think i	s impor	tant.						
4. At le	east 8 e	xperim	ents mi	ust be p	erforme	ed by the	e studei	nts.				
Course	e Objec	tives:										
1.	То ре	rform p	reproc	essing c	on real v	vorld da	tasets.					
2.	To de	velop n	nodels	using di	fferent	data mii	ning tec	hniques	on com	nplex da	tasets.	
Course	Outco	mes:										
CO1	Analy	ze and	apply p	re-proc	essing t	echniqu	es to pr	epare a	nd proc	ess real	life dat	asets.
CO2	Imple	ement d	ifferent	t cluster	ing or c	lassifica	tion tec	hniques	for var	ying set	s of pro	blems.
Course	Outcon	nes (CO	) to Pro	ogramm	e Outco	omes (P	0)					
							Mappi	<b>ng (</b> Scal	e 1: Lov	v, 2: Me	dium, 3	: High)
CO/PO	PO01	PO02	PO03	PO04	PO05	P006	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12
CO1	2	1	-	2	3	-	1	-	-	1	-	-
CO2	2	2	-	3	3	-	-	-	-	-	1	2

# List of Experiments

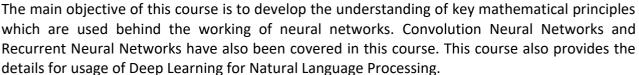
- 1. Introduction and installation of WEKA tool.
- 2. Perform data pre-processing including cleaning, integration and transformation on ARFF files using WEKA.
- 3. Apply association rule mining on ARFF files using WEKA.
- 4. Implementation of Neural Network technique on ARFF files using WEKA.
- 5. Implementation of Bagging and Boosting techniques on ARFF files using WEKA.



- 6. Apply the concept of Voting ensemble method to ARFF files and compare the results with single classifiers.
- 7. Implementation of Visualization technique on ARFF files using WEKA.
- 8. Implementation of Clustering technique on ARFF files using WEKA.
- 9. Study of DBMINER tool.
- Apply pre-processing and classification/regression techniques on a real-world dataset.
   Evaluate the performance of classification techniques using different parameters.



Semes	ter: 5 <sup>th</sup>												
Paper	code: Al	ML305							L	T/P	Cre	dits	
Subjec	t: Fund	amenta	ls of Dee	ep Learn	ing				4	0	4		
Markin	ng Scher	ne:								•			
1.	Teache	rs Conti	nuous Ev	aluatior/	n: 25 Ma	irks							
2.	End Tei	rm Theo	ry Exam	ination:	75 Mark	(S							
Instruc	ctions fo	r Paper	Setters:							Maxim	um Mar	ks: 75	
			•			n examii	•						
				-		cover the			This qu	estion sł	nould ha	ive	
	-					t should							
•					•	paper sh				•	-		
				•		ever, stu	udents n	hay be as	sked to a	attempt	only 1 q	uestion	
	om each unit. Each question should be 10 marks.												
	e questions are to be framed keeping in view the learning outcomes of course/paper. The and and a learning outcomes of the prescribed textbooks												
	andard/ level of the questions to be asked should be at the level of the prescribed textbooks. e requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.												
	se Objec			inc) care				tables i	nay be s	peemeu	nicqui	cu.	
1.	· · · · ·		computa	tional u	nits insp	ired fron	n biolog	ical syste	ems (bra	in).			
2.			-		-	rning for	-	-	-	,			
3.	To und	erstand	fundam	ental ma	ichine le	arning c	oncepts	w.r.t. ne	eural net	tworks.			
4.	То арр	ly deep l	earning	models	to solve	sequend	ce and vi	ision pro	blems.				
Cours	se Outco	mes:											
CO1	Interp	ret the b	asic con	nputatio	nal units	s inspire	d from b	iological	system	s (brain)	•		
CO2	Identify	the de	ep learn	ing algo	rithms w	hich are	e more a	ppropria	ate for v	arious ty	pes of l	earning	
02	tasks ir	n various	domain	IS.									
CO3	Define	the fund	lamenta	l machir	ne learni	ng conce	epts w.r.	t. neura	l networ	·ks.			
CO4	Apply b	asic dee	ep learni	ng mode	els to so	lve sequ	ence-ba	sed prob	lems an	d vision	problen	าร.	
Course	Outcor												
						-	Ma	pping (S	cale 1: L	ow, 2: M	ledium,	3: High)	
<b>CO</b> /	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
PO													
CO1	3	1	1	1	2	-	-	-	2	1	2	1	
CO2	3	1	1	1	2	1	1	1	2	1	2	2	
CO3	3	1	1	1	2	1	1	1	2	1	2	2	
<b>CO4</b>	3	1	1	1	2	1	1	1	2	1	2	2	



# Unit I:

Introduction to Deep Learning, Bayesian Learning, Overview of Shallow Machine Learning, Difference between Deep Learning and Shallow Learning,Linear Classifiers ,Loss Function and Optimization Techniques -Gradient Descent and batch optimization.

# Unit II:

Introduction to Neural Network, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation through time. Architectural Design Issues.

# Unit III:

Difficulty of training deep neural networks, Activation Function, Evaluating, Improving and Tuning the ANN. Hyper parameters Vs Parameters, Greedy layer wise training, Recurrent Neural Networks, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

# Unit IV:

Convolutional Neural Networks, , Building blocks of CNN, Transfer Learning , Pooling Layers , Convolutional Neural Network Architectures.Well known case studies: LeNet, AlexNet, VGG-16, ResNet, Inception Net.Applications in Vision, Speech, and Audio-Video.

# Text Books

- 1. Richard O. Duda," Pattern classification, Wiley, 2022
- 2. Adam Gibson and Josh Patterson, "Deep Learning: A Practical approach", 2017
- 3. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

# **Reference Books**

- 1. Charu C. Aggarwal, "Neural Networks and Deep Learning", 2018
- 2. Duda, R.O. and Hart, P.E., Pattern classification. John Wiley & Sons, 2006.

# GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY, EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

# **Course Overview:**

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Semeste	er: 5 <sup>th</sup>												
Paper co	ode: Al	ML355							L	T/P	Credi	ts	
Subject:	Funda	amenta	ls of De	ep Lea	rning La	b			0	2	1		
Marking	g Schen	ne:											
1. 1	Feacher	rs Conti	nuous l	Evaluati	on: 40 N	Marks							
2. E	End teri	m Exam	ination	: 60 Ma	ırks								
Instruct	ions fo	r Evalua	ators:						1	Maximu	m Mar	ks: 60	
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	oer.				
2. The	praction	cal list	shall	be not	ified b	y the t	teacher	in the	first	week d	of the	class	
com	mence	ment u	nder th	ie intim	ation to	o the of	fice of t	he HO	)/ Instit	ution in	which	they	
арре	ear is be	eing off	ered fr	om the	list of p	racticals	below.						
3. Instr	uctors	can ado	d any of	ther add	ditional	experim	ients ov	er and a	above th	ne ment	ioned iı	n the	
expe	Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.												
4. At le	east 8 e	xperime	ents mu	ist be p	erforme	ed by the	e studer	nts.					
Course	Object	tives:											
1.	Imple	mentat	ion of	deep le	earning	models	in Pytł	non and	l train t	them w	ith real	-world	
	datas			•	0								
2.							letwork	(CNN)	Recur	rent Ne	ural Ne	etwork	
			eep Lea	rning N	LP in Py	thon.							
Course	Outco	mes:											
CO1	Desig	n and Ir	npleme	nt Conv	olution	Neural	Networ	k for obj	ect clas	sificatio	n from i	mages	
	or vid	eo.											
CO2	Imple	ment A	utoenc	oder, R	ecurren	t Neura	Netwo	rk, LSTN	/I, its va	riants ai	nd Deep	NLP.	
Course	Outcom	nes (CO	) to Pro	gramm	e Outco	omes (P	0)						
							Марр	i <b>ng (</b> Sca	le 1: Lo	w, 2: Me	edium, S	3: High	
CO/PO	PO01	PO02	PO03	PO04	PO05	P006	PO07	P008	PO09	PO10	PO11	PO12	
CO1	2	1	1	1	2	1	1	1	2	1	2	2	
CO2	2	1	1	1	2	1	1	1	2	1	2	2	

# LIST OF EXPERIMENTS:

- 1. To explore the basic features of Tensorflow and Keras packages in Python
- 2. Implementation of ANN model for regression and classification problem in Python.
- 3. Implementation of Convolution Neural Network for MRI Data Set in Python.
- 4. Implementation of Autoencoders for dimensionality reduction in Python.



- 5. Application of Autoencoders on Image Dataset.
- 6. Improving Autocoder's Performance using convolution layers in Python (MNIST Dataset to be utilized).
- 7. Implementation of RNN model for Stock Price Prediction in Python
- 8. Using LSTM for prediction of future weather of cities in Python
- 9. Implementation of transfer learning using the pre-trained model (MobileNet V2) for image classification in Python.
- 10. 10. Implementation of transfer learning using the pre-trained model (VGG16) on image dataset in Python.
- 11. NLP Analysis of Restaurant Reviews in Python.
- 12. Building a NLP model for Spam Detection using TFIDF (Term Frequency Inverse Document Frequency Vectorizer).



Semes	ster: 5 <sup>th</sup>												
Paper	code: A	IDS307/	AIML30	7					L	T/P	Cre	dits	
Subje	ct: Com	puter Or	rganizati	on & Ar	chitectu	re			3	0	3		
Marki	ng Schei	ne:											
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	irks							
	End Te		•		75 Mark	(S							
Instru	ctions fo	or Paper	Setters:							Maxim	um Mar	ks: 75	
	ere shou		-										
	uestion N			-	•			•	This qu	estion sl	nould ha	ave	
	jective c												
-	art from				-	-				-	-		
	ery unit			-			udents n	hay be as	sked to a	attempt	only 1 q	uestion	
	om each unit. Each question should be 10 marks.												
	e questions are to be framed keeping in view the learning outcomes of course/paper. The and and ard/ level of the questions to be asked should be at the level of the prescribed textbooks.												
	e require		•						•				
	se Objec		i (scient	inc) care	ulators/	iog-tabl	es/ uala		nay be s	pecifieu	nrequi	eu.	
1.	1		the basi	c concei	ots of co	mputer	operatio	on.					
2.				-		-	-	ir mappi	ng.				
3.			nalyze d						0				
4.						• ·		peratior	ns with d	ligital ha	rdware.		
Cours	se Outco			-	-			•		-			
CO1	Interpr	eting th	e basic c	oncepts	of regis	ter trans	sfer lang	uage and	d compu	iter oper	rations.		
CO2			yze varic	ous instru	uction fo	ormats fo	or CPU/G	iPU toge	ther wit	h a varie	ty of add	dressing	
	modes			( )									
CO3	Analyz	e differe	nt types	of Para	liel Com	puter M	odels.						
CO4	Implen	nenting	arithmet	ic opera	itions wi	th digita	l hardwa	are.					
Course	e Outcor	nes (CO	) to Prog	gramme	Outcom	es (PO)		• 17			a 1.	<b>2</b>	
<u> </u>	DO01	0002	0002	0004	DOOF	DOOC		apping (S					
CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
CO1	1	1	1	1		1						2	
CO1	2	1	1	1		L _					1	2	
CO2 CO3	3	2	3	2	1	1	1				1	3	
CO3	1	1	1	1	_ <b>_</b>	-	_ <b>_</b>				_ <b>_</b>	2	
004	1	1	1	L							L	2	



#### **Course Overview:**

This course enables the students to understand the principles of computer organization and the basic architectural concepts. It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

#### Unit 1

**Register Transfer Language:** Register transfer language, bus and memory transfer, bus architecture using multiplexer and tri-state buffer, micro-operation: arithmetic, logical, shift micro-operation with hardware implementation, arithmetic logic shift unit.

**Computer Organization and Design**: Instruction codes, general computer registers with common bus system, computer instructions: memory reference, register reference, input-output instructions, timing and control, instruction cycle, input-output configuration, and interrupt cycle. Levels of programming languages: Machine language, Assembly language, High level language.

#### Unit II

**Central processing Unit**: Introduction, general register organization, stack organization, instruction format, addressing modes. Overview of GPU, CPU vs GPU computing difference. **Memory Hierarchy:** Introduction, basics of cache, measuring and improving of cache performance, cache memory: associative mapping, direct mapping, set-associative mapping, cache writing and initialization, virtual memory, common framework for memory hierarchies. Case study of PIV and AMD opteron memory hierarchies.

# Unit III

**Parallel Computer Models:** The state of computing, classification of parallel computers, multiprocessors and multicomputers, multivector and SIMD computers. Program and Network Properties: conditions of parallelism, data and resource dependences, hardware and software parallelism, program partitioning and scheduling, grain size and latency, program flow mechanisms, control flow versus data flow, data flow Architecture, demand driven mechanisms, comparisons of flow mechanisms.

#### Unit IV

**Pipelining:** Introduction to Flynn's classification, arithmetic pipeline, instruction pipeline, pipeline conflict and hazards, RISC pipeline, vector processing.

**Arithmetic for Computers:** Unsigned, signed 1's, 2's compliment notations, addition, subtraction, multiplication and division (hardware implementation), CPU performance and its factors, evaluating performance of CPU.

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# Textbooks:

- 1. M. Morris, Mano, "Computer System Architecture", PHI 3rd Edition 2007.
- 2. Kai Hwang, "Advanced computer architecture"; TMH. 2000
- 3. D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002

# **Reference Books:**

- 1. W. Stallings, "Computer organization and Architecture", PHI, 7th ed, 2005.
- 2. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication. 1998
- 3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI. 2002
- 4. R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003.



Semes	ster: 5 <sup>th</sup>												
Paper	code: A	IDS309/	AIML30	9					L	T/P	Cre	dits	
Subjec	t: Intro	duction	to Inter	net of Tl	hings				3	0	3		
Marki	ng Schei	me:							·		·		
1.	Teache	ers Conti	nuous Ev	valuation	n: 25 Ma	irks							
			ry Exam		75 Mark	s							
		-	Setters:							Maxim	um Mar	ks: 75	
			•				nation q						
							e entire :	•	This qu	estion sl	nould ha	ve	
	-						be of 10						
							all consi						
	very unit should have two questions. However, students may be asked to attempt only 1 question om each unit. Each question should be 10 marks.												
	om each unit. Each question should be 10 marks. The questions are to be framed keeping in view the learning outcomes of course/paper. The												
	andard/ level of the questions to be asked should be at the level of the prescribed textbooks.												
	-		•				es/ data		-				
Cours	se Objec	tives:								-			
1.	To lear	n funda	mentals	of IoT ar	nd how t	o build I	loT base	d system	าร				
2.	-			-			applicat						
3.							e emerge						
4.			mpleme	nt solid t	heoreti	cal found	dation of	f the loT	Platforr	n and Sy	stem De	esign.	
Cours	se Outco												
CO1	Ability	to unde	rstand d	esign flo	w of loT	based s	systems						
CO2	Analys	e and ur	derstan	d differe	nt comr	nunicati	on proto	cols for	connect	ing loT r	nodes to	server	
CO3	Apply	design co	oncept t	o loT sol	utions								
CO3						systems	, suitable	e for rea	l life and	Industr	v annlic:	ations	
			) to Prog				, suitable			mausti			
course			,	, anne	outcom		Ma	apping (S	Scale 1: I	Low. 2: N	/ledium.	3: High	
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
PO													
CO1	-	-	2	2	2	-	1	1	-	-	1	1	
CO2	-	-	2	2	2	-	1	-	-	-	1	1	
CO3	-	-	2	2	2	-	1	-	-	-	1	1	
<b>CO4</b>	1	1	3	2	2	1	1	1	1	1	1	1	

# **Course Overview:**

The course enables student to understand the basics of Internet of things and protocols. It introduces some of the application areas where Internet of Things can be applied. Students will learn about the middleware for Internet of Things. The course addresses various components of Internet of things such as Sensors, internetworking, protocols. In the end students will also be able to design and implement IoT circuits and solutions.



#### Unit I

**The Internet of Things:** An Overview of what is IoT? Why IoT? Explain the definition and usage of the term "Internet of Things (IOT)" in different contexts. Design Principles for Connected Devices, internet principles: internet communications-An overview, Physical Design of IoT, Logical Design of IoT, IoT standards, IoT generic architecture and IoT protocols. IoT future trends, Understand IoT Applications and Examples. Understand various IoT architectures based on applications. Understand different classes of sensors and actuators. Sensors: sensor terminology, sensor dynamics and specifications. Understand the basics of hardware design needed to build useful circuits using basic sensors and actuators.

#### Unit II

**Communication protocols and Arduino Programming:** Understand various network protocols used in IoT, Understand various communication protocols (SPI, I2C, UART). Design and develop Arduino code needed to communicate the microcontroller with sensors and actuators, build circuits using IoT supported Hardware platforms such as Arduino, ESP8266 etc., Use of software libraries with an Arduino sketch that allows a programmer to use complicated hardware without dealing with complexity, Learning IoT application programming and build solutions for real life problems and test them in Arduino and Node MCU environments. Understand various wireless Technologies for IoT and its range, frequency and applications.

# Unit III

**Fundamentals of IEEE 802.15.4, Zigbee and 6LOWPAN:** Importance of IEEE 802.15.4 MAC and IEEE 802.15.4 PHY layer in constrained networks and their header format, Importance of Zigbee technology and its applications, use of IPv6 in IoT Environments, Understanding importance of IPv6 and how constrained nodes deal with bigger headers (IPv6). Understand IPv6 over Low-Power WPAN (6LoWPAN) and role of 6LoWPAN in wireless sensor network. Various routing techniques in constrained network. Understanding IoT **Application Layer Protocols**: HTTP, CoAP Message Queuing Telemetry Transport (MeTT).

# Unit IV

**Application areas and Real-time Case Studies:** Role of big data, cloud computing and data analytics in a typical IoT system. Analyze various case studies implementing IoT in real world environment and find out the solutions of various deployment issues. Smart parking system, Smart irrigation system-block diagram, sensors, modules on Arduino and Node MCU.

# **Text Books**

- 1. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of things" by David Hanes, Cisco Press.
- 2. Internet of things with ESP 8266, Macro Schwartz, Pact publication.
- 3. Bahga, A., & Madisetti, V. (2014). Internet of Things: A hands-on approach. Vpt.
- 4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

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# **Reference Books:**

- 1. Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications, Daniel Minoli, Wiley Publications.
- 2. Mastering internet of things by Peter Waher, Pact publication.
- 3. The Internet of Things: connecting objects to the web, Hakima chaouchi, Wiley Publications.
- 4. Course Era: "Interfacing with the Arduino" by Ian Harris, University of Irvine, California.



Semest	er: 5 <sup>th</sup>											
Paper c	ode: Al	DS357/	AIML3	57					L	T/P	Credi	ts
Subject	: Intro	ductior	n to Inte	ernet of	<sup>-</sup> Things	Lab			0	2	1	
Markin	g Schen	ne:										
1.	Teache	rs Conti	nuous	Evaluati	on: 40 N	Marks						
2.	End ter	m Exarr	ninatior	i: 60 Ma	irks							
Instruct	ions fo	r Evalua	ators:						Maximu	um Mar	ks: 60	
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.			
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week c	of the	class
com	imence	ment u	nder th	ne intim	ation to	o the of	fice of t	he HO	D/ Instit	ution in	which	they
арр	ear is b	eing off	ered fr	om the	list of p	racticals	below.					
3. Inst	ructors	can ado	d any of	ther add	ditional	experin	nents ov	er and a	above tl	ne ment	ioned i	n the
exp	eriment	t list wh	ich the	y think i	s impor	tant.						
4. At le		-	ents mi	ust be p	erforme	ed by th	e studer	nts.				
Course	e Objec	tives:										
1.	To te	ach stu	dents h	ow to a	nalyse c	lifferent	contro	ller boa	rds, sim	ulation	platforr	ns and
	applic	cations	of IoT									
2.	To de	sign Io	۲ based	system	s and ap	oplicatio	ons to sc	lve rea	l time p	roblems		
Course	Outco	mes:										
CO1	Apply	loT pri	nciples	to desig	gn progi	rams us	ing a so	ftware a	and har	dware to	o using	variety
					eate loT							
CO2	Imple	ement a	pplicat	ions bas	sed on I	oT for s	olving d	ifferent	proble	ms usin	g Arduii	no and
	Node	MCU –	ESP 82	66								
Course	Outcon	nes (CO	) to Pro	gramm	e Outco	mes (P	0)					
							Mappi	<b>ng (</b> Scal	le 1: Lov	v, 2: Me	dium, 3	: High)
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	1	1	2	2	2	-	1	1	-	-	1	1
CO2	1	1	2	2	3	1	1	1	1	1	1	1

# LIST OF EXPERIMENTS

- 1. Introduction to Arduino platform and programming and Introduction to various actuators & its applications.
- 2. Introduction with running a blinking LED and fading LED with PWM
  - A. Arduino IDE and Operators in IDE.
  - B. Frequently used Functions in Arduino IDE



- 3. Control Structure writing programs for if else, for and while
- 4. Custom functions that can be created for specific Needs.
- 5. Reading and writing digital and analog values. Digital and analog read/write demonstration.
- 6. Measuring light with Lux and a photoresistor demonstration
- 7. Measuring temperature and humidity.
- 8. Adding an LCD screen and sketch walkthrough.
- 9. Create an echo server with the Ethernet Shield over Arduino.
- 10. Upload data from a single sensor to ThingSpeak using ESP8266 (NodeMCU),
- 11. Upload data from multiple sensors to ThingSpeak using ESP8266 (NodeMCU).
- 12. Setting up logging and visualizing data on ThingSpeak.
- 13. Making Project- on real-world Problems.
- 14. Introduction to Arduino platform and programming and Introduction to various actuators & its applications.



Semes	ter: 5 <sup>th</sup>												
Paper	code: A	IDS 311/	AIML 3	11					L	T/P	Cre	dits	
Subjec	t: Prine	ciples of	Entrepr	eneursh	ip Mind	set			2	0	2		
Marki	ng Scher	me:											
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	ırks							
2.	End Te	rm Theo	ry Exam	ination:	75 Mark	s							
Instrue	ctions fo	or Paper	Setters:					Μ	aximum	Marks:	75		
							-	uestion					
				•	•			syllabus.	This qu	estion sł	nould ha	ive	
-	-						be of 10						
-						-		st of fou		-	-		
	-			-			udents n	hay be as	sked to a	attempt	only 1 q	uestion	
			ch quest						r	/	· · · · -		
	•							g outcon		••	•		
	andard/ level of the questions to be asked should be at the level of the prescribed textbooks. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.												
	e requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.												
1.	_		only the	attitude	es value	s chara	cteristic	s, behav	viour an	d proce		ociated	
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3.								nd servi					
4.			te a busi			/ · · · · · · ·				-			
Cours	se Outco												
CO1			udes, val	ues, cha	racterist	ics, beha	aviour, a	nd proce	esses ass	ociated	with pos	ssessing	
01	an en	ntrepren	eurial	& inno	vation	mindset	and	engagin	g in s	successf	ul appi	ropriate	
	entrep	reneuria	al and ini	novative	behavio	our.							
CO2	Concep	otualize	the basi	concep	ts of fina	ance and	d market	ing.					
	Evaluat	te the bu	usiness r	nodel ca	invas an	d apply t	the same	e for pro	duct and	d service	s area.		
CO3 CO4			te a busi					•					
			) to Prog			es (PO)							
			,	, annie			Ma	pping (S	cale 1: L	ow, 2: M	ledium.	3: High)	
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
PO													
CO1	1	2	3	3	1	1	-	1	1	-	-	2	
CO2	2	2	3	3	1	1	-	1	1	-	-	2	
CO3	2	2	3	3	1	1	-	1	2	-	-	2	
CO4	2	2	3	3	2	1	1	1	2	-	-	2	



#### **Course Overview:**

This course gives exposure to the students for the core entrepreneurship concepts. Three real time case studies have been covered to give the students real time understanding of setting up a startup. Business canvas model has been covered under the syllabus followed by the finance and marketing skills for budding entrepreneurs. Students will be able to create and write a business plan after the completion of the course.

#### Unit I

**Introduction to Entrepreneurship and Innovation:** Entrepreneurship: Concepts, entrepreneurship mindset, challenges; Innovation: What is innovation, role of technology, creating new ventures through innovative initiatives; Business opportunities: concepts & techniques for identifying opportunities, writing a problem statement, tools and techniques for idea generation; Introduction to social entrepreneurship.

Study and Analyze at least three case studies of startups in computing (mixture of both successful and failed startups, an Indian startup, startup by a student)

#### Unit II

**Understanding Business Model Canvas:** Introduction to Business Model Canvas; customer segments; value proposition, distribution channels; Customer Relationship, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structure, Preparing a business model canvas of a problem statement

#### Unit III

**Finance and Marketing for early entrepreneurs:** Basic understanding of P&L, Balance sheet and cash flow; Understanding of terms like CAGR, NPV, Angle funding, Venture capital, Debt funding, Equity, private equity, valuation, Break-even analysis, Return on Investment, Working Capital, Cost of Good Sold, Customer Acquisition cost, Customer life time value, profit margins.

**Marketing for budding entrepreneurs:** Understanding customer requirements, Customer Profiling and segmentation, Marketing strategy, 4Ps of Marketing, Network effect.

#### Unit IV

**Creating and writing a Business Plan:** Introduction to different Business Models. Process of Business Planning - Purpose, structure and content, business plan outline, how to write Business plan, Preparing a business plan of a problem statement. Application of Business Model Canvas in creating the business plan. Understand customer needs, design and conduct a survey. Presentation of Business Plan. Process of incorporating a new company in India.

#### Textbooks:

- 1. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder, Yves Pigneur
- 2. "Making Breakthrough Innovation Happen" by Porus Munshi
- 3. Ries Eric (2011), "The lean Start-up: How constant innovation creates radically successful businesses", Penguin Books Limited.

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# **Reference Books:**

- 1. Blank, Steve (2013), "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K&S Ranch.
- 2. S. Carter and D. Jones-Evans, "Enterprise and small business- Principal Practice and Policy", Pearson Education (2006)
- 3. T. H. Byers, R. C. Dorf, A. Nelson, "Technology Ventures: From Idea to Enterprise", McGraw Hill (2013)
- 4. Osterwalder, Alex and Pigneur, Yves (2010) "Business Model Generation".
- 5. Kachru, Upendra, "India Land of a Billion Entrepreneurs", Pearson
- 6. Bagchi, Subroto, (2008), "Go Kiss the World: Life Lessons for the Young Professional", Portfolio Penguin
- 7. Bagchi, Subroto, (2012). "MBA At 16: a Teenager's Guide to Business", Penguin Books
- 8. Mitra, Sramana (2008), "Entrepreneur Journeys (Volume 1)", Booksurge Publishin
- 9. Abrams, R. (2006). "Six-week Start-up", Prentice-Hall of India
- 10. Verstraete, T. and Laffitte, E.J. (2011). "A Business Model of Entrepreneurship", Edward Elgar Publishing.
- 11. Johnson, Steven (2011). "Where Good Ideas comes from", Penguin Books Limited.
- 12. Gabor, Michael E. (2013), "Awakening the Entrepreneur Within", Primento.
- 13. Guillebeau, Chris (2012), "The \$100 startup: Fire your Boss, Do what you love and work better to live more", Pan Macmillan
- 14. Kelley, Tom (2011), "The ten faces of innovation, Currency Doubleday"
- 15. Prasad, Rohit (2013), "Start-up sutra: what the angels won't tell you about business and life", Hachette India.



# DETAILED SYLLABI FOR 5<sup>th</sup> SEMESTER IIOT



Semes	ster: 5 <sup>th</sup>											
Paper	code: IC	DT301							L	T/P	Cre	dits
Subjec	t: Data	Transm	ission M	lethodo	logies				4	0	4	
Marki	ng Schei	ne:							•			
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	irks						
2.	End Te	rm Theo	ory Exam	ination:	75 Mark	(S						
Instru	ctions fo	or Paper	Setters:					M	aximum	Marks:	75	
			questior				-					
			ould be c	-	•				. This qu	estion sl	nould ha	ive
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			ch quest to be fra				learnin	goutcor	nes of c	nurse/na	iner Th	2
	-		the ques					-		-	-	
	-		f (scient						-			
	se Objec		(	-,		-0	,		- /			
1.	To pro	vide stu	dents wi	th a con	nprehen	sive und	erstandi	ing of an	alog and	digital	commu	nication
	system	s and its	applica	tions in	the mod	lern wor	ld.					
2.				-	-	-		-			-	ncluding
	-		lulation				-					
3.			udents w				-	-			ques	
4.			the fund	damenta	ls of dat	a transn	nission a	ind acqu	isition sy	/stems		
Cours	se Outco											
CO1			able to d	-			ing of ar	halog and	adigital	commur	lication	systems
			tions in t				tion in		adulati	on tochr		ncluding
CO2			Julation									iciuuiiig
			ain dee									vstems
CO3		-	al modula	-	-	-						,,
CO4			e able t				-	-	a transr	nission	and acc	uisition
	system											
Course	e Outcor	nes (CO	) to Prog	gramme	Outcom	es (PO)						
							Ma	apping (S	Scale 1:	Low, 2: N	/ledium,	3: High
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
РО												
CO1	3	1	-	-	-	2	1	-	-	2	-	-
CO2	3	3	3	3	3	-	-	-	-	2	-	-
CO3	3	3	3	2	2	-	-	-	-	2	-	-
CO4	3	3	3	2	3	-	1	-	-	2	-	-

# **Course Overview**

Information Transmission and Methodologies is a comprehensive course that covers the fundamental principles, techniques, and technologies used in the transmission and reception of information. The course provides a solid understanding of both analog and digital communication systems, including their underlying theories, practical implementations, and relevant signal processing techniques.

# Unit I

**Introduction:** Communication systems and its types, elements of a communication system, types of signals. Analog and digital communication, advantages, and limitations of analog communication. Digital versus analog communication, digital modulation techniques, elements of digital communication

# Unit II

**Amplitude Transmission Methodologies:** Modulation index and its effect on the transmitted signal, Double sideband (DSB) modulation and its variants, Single sideband (SSB) modulation.

**Frequency Modulation (FM):** Modulation index and its effect on the transmitted signal, Narrowband FM (NBFM) and wideband FM (WBFM), Phase Modulation (PM).

#### Unit III

**Digital Transmission Methodologies: Pulse code modulation:** Introduction to PCM, analog-todigital conversion, sampling, quantizing, coding, and decoding. Companding in PCM, A-law, and  $\mu$ law, quantization noise.

**Pulse Modulation:** Introduction to pulse modulation, pulse amplitude modulation (PAM), pulse width modulation (PWM), pulse-position modulation (PPM), and their calculations **Digital modulation schemes**: (ASK, PSK, FSK, QAM)

# Unit IV

**Transmission and Acquisition Techniques:** Basics of Telemetry system, Land line & radio frequency telemetering systems, Transmission channels and media, Data receiver & transmitter, Analog data acquisition system, Digital data acquisition system, Modern digital data acquisition system

# **Text Books**

- 1. Digital Communications by J.G. Proakis and M. Salehi
- 2. Principles of Communication Systems by H. Taub and D. Schilling
- 3. Modern Digital and Analog Communication Systems by B.P. Lathi

#### **Reference Books**

- 1. Analog Communication by A.P.Godse and U.A.Bakshi
- 2. Electronics Communication System by G. Kennedy and B. Davis
- 3. Communication Systems: Analog and Digital by R.P. Singh and S.D. Sapre
- 4. Wireless Communications by Andrea Goldsmith.

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Semest	er: 5 <sup>th</sup>											
Paper c	ode: IO	T351							L	T/P	Credi	ts
Subject	: Data	Transm	nission	Method	dologies	: Lab			0	2	1	
Marking	-											
				Evaluati		Marks						
				: 60 Ma	irks							
Instruct	ions fo	r Evalua	ators:							Maximu	m Mar	ks: 60
1. This	is the p	oractica	l compo	onent o	f the co	rrespon	ding the	eory pap	ber.			
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week d	of the	class
com	mence	ment u	nder th	ie intim	ation to	o the of	fice of t	he HO	D/ Instit	ution in	which	they
app	ear is b	eing off	ered fro	om the	list of p	racticals	below.					
3. Insti						•	nents ov	er and a	above th	ne ment	ioned i	n the
				y think i								
4. At le	east 8 e	xperime	ents mu	ist be p	erforme	ed by th	e studer	nts.				
Course	Object	tives:										
1.	To far	niliarize	e studer	nts with	the bas	ics of ar	nalog an	d digita	l comm	unicatio	n syster	ms and
						nunicati	-	-				
2.	To de	velop t	he stu	dents' p	ractical	skills ir	n design	ing and	analyzi	ing anal	og and	digital
	comr	nunicat	tion cire	cuits, su	ich as ai	mplitud	e and fr	equenc	y modu	lation, d	lemodu	lation,
	samp	oling, ar	nd quan	itization	ı.							
Course	Outco	mes:										
CO1	Demo	onstrate	e an u	ndersta	nding	of sign	al proc	essing	techniq	ues an	d the	theory
	under	lying va	arious c	ommur	nication	blocks a	and circ	uits.				
CO2	-								ation sy	stems i	n const	ructing
	comm	nunicati	ion circ	uits and	l equipn	nent.						-
Course	Outcon	nes (CO	) to Pro	gramm	e Outco	omes (P	0)					
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CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12
CO1	2	2	2	1	2	-	-	-	-	-	-	1
CO2	3	2	3	2	3	-	-	-	-	-	-	1

# List of Experiments

- 1. Demonstration of different signals and their properties. Explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time-shifting)
- 2. Identify type of system as linear or non-linear. Explore the properties of systems such as time variance, time invariance, causality and non-causality, etc.
- 3. Visualize the relationship between the continuous-time and discrete-time Fourier series and Fourier transform of a signal and relationship among Fourier analysis methods.



- 4. To demonstrate the convolution and correlation of two continuous-time and discrete-time signals.
- 5. Study of Sampling Process and Signal Reconstruction by familiarisation with Oscilloscope and Function Generator
- 6. To study the function of Amplitude Modulation & Demodulation (under modulation, perfect modulation & over modulation) and also to calculate the modulation index, efficiency
- 7. Generate random data for transmission and transmit it using BPSK modulation. After modulation, demodulate the data using (a) Squaring loop and (b) Costas loop
- 8. To virtually simulate the functioning of frequency modulation & demodulation and to calculate the modulation index.
- 9. Realization of different modulation schemes using I/Q modulators
- 10. To Simulate virtually and Interpret Amplitude shift keying Modulation and De modulation waveforms and also to demonstrate how the signal is modulated as the binary inputs are varied
- 11. To study the Analog to digital and digital to analog conversion of sinusoidal signal.
- 12. To study the Delta modulation process by comparing the present signal with the previous signal of the given modulating signal



Semes	ster: 5 <sup>th</sup>													
Paper	code: IC	DT303							L	T/P	Cre	dits		
Subjec	ct: Desig	gn and A	nalysis o	of Algori	ithms				4	0	4			
Marki	ng Schei	ne:												
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	irks								
2.	End Te	rm Theo	ry Exam	ination:	75 Mark	s								
Instru	ctions fo	or Paper	Setters:						Ma	ximum I	Marks: 7	75		
1. Th	ere shou	ıld be 9	question	is in the	end terr	n exami	nation q	uestion	paper.					
2. Qu	estion N	lo. 1 shc	ould be c	ompulso	ory and o	cover the	e entire	syllabus.	This qu	estion sł	nould ha	ive		
	jective c			•••••										
	art from													
	ery unit			-			udents n	hay be a	sked to a	attempt	only 1 q	uestion		
	om each unit. Each question should be 10 marks. e questions are to be framed keeping in view the learning outcomes of course/paper. The													
	e questions are to be framed keeping in view the learning outcomes of course/paper. The													
	ndard/ level of the questions to be asked should be at the level of the prescribed textbooks.													
	-	e requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.												
1.			and ann	ly the al	gorithm	analysis	techniq	ues to g	enerate	solution	space			
2.				-	-	-	algorith					lem		
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Cours	se Outco													
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	algorit													
CO2			gorithms	í knowle	edge and	l data-st	ructures	corresp	onding t	o each a	Igorithn	n design		
	paradi	-												
CO3	Design	efficien	t algoritł	nms for	commor	n compu	ter engiı	neering	design p	roblems				
CO4	Classify	/ a probl	em as co	omputat	ionally t	ractable	or intra	ctable, a	nd discu	iss strate	egies to	address		
	intract													
Course	e Outcor	nes (CO	) to Prog	ramme	Outcom	es (PO)								
							1			· ·	-	3: High		
CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12		
CO1	2	1	1	1	1	-	-	1	1	1	1	2		
CO2	2	2	1	1	1	-	-	1	1	1	1	2		
CO3	2	2	2	1	1	-	-	-	-	-	1	3		
CO4	2	2	2	2	1	1	-	-	-	-	1	2		

# **Course Overview:**

This course is designed to enable the student to design and analyze algorithms for the problems. This course covers basic strategies of algorithm design: top-down design, divide and conquer, asymptotic costs, applications to sorting and searching, matrix algorithms, shortest-path and spanning tree problems, dynamic programming, greedy algorithms and graph algorithms.



#### Unit I

**Introduction to Algorithms:** Time Complexity and Space Complexity, Asymptotic analysis, Growth rates, some common bounds (constant, logarithmic, linear, polynomial, exponential), Complexity Analysis techniques: Master theorem, Substitution Method, Iteration Method, Time complexity of Recursive algorithms. art of problem-solving and decision making, role of data structure in algorithm design, Basic algorithmic structures of problem-solving and optimization algorithms, constraints, solution space, and feasible reasons, and representation of solution space. Sorting and searching algorithms: Selection sort, bubble sort, insertion sort, Sorting in linear time, count sort, Linear search.

#### Unit II

**Divide and Conquer Algorithms:** Overview of Divide and Conquer algorithms, Quick sort, Merge sort, Heap sort, Binary search, Matrix Multiplication, Convex hull and Searching, Closest Pair of Points. **Greedy Algorithms:** Greedy methods with examples, Huffman Coding, Knapsack, Minimum cost Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths – Dijkstra's and Bellman Ford algorithms.

#### Unit III

**Dynamic programming:** Dynamic programming with examples such as Knapsack, shortest path in graph All pair shortest paths –Warshal's and Floyd's algorithms, Resource allocation problem. Backtracking, Branch and Bound with examples such as Traveling Salesman Problem, longest common sequence, n-Queen Problem.

# Unit IV:

**Graph Algorithms:** Graphs and their Representations, Graph Traversal Techniques: Breadth First Search (BFS) and Depth First Search (DFS), Applications of BFS and DFS, Bipartite graphs. Graph Coloring, Hamiltonian Cycles and Sum of subsets.

**Computational complexity**: Problem classes: P, NP, NP-complete, NP-hard. Reduction. The satisfiability problem, vertex cover, independent set and clique problems Cook's theorem. Examples of NP-complete problems.

# Textbooks:

- 3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI ,4th Edition
- 4. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Third Edition, Pearson Education, 2006

# **Reference Books:**

- 1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Second Edition, Universities Press, 2011.
- 2. Anany Levitin. "Introduction to the Design and Analysis of Algorithms", Pearson.

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Semester: 5 <sup>th</sup>													
Paper code: IOT353										T/P	Cre	Credits	
Subject: Design and Analysis of Algorithms Lab021											1		
Marking Scheme:													
1.	Teachers Continuous Evaluation: 40 Marks												
2. End term Examination: 60 Marks													
Instructions for Evaluators: Maximum Marks: 60												ks: 60	
1. This is the practical component of the corresponding theory paper.													
2. The practical list shall be notified by the teacher in the first week of the class													
com	commencement under the intimation to the office of the HOD/ Institution in which they												
арр	appear is being offered from the list of practicals below.												
3. Instructors can add any other additional experiments over and above the mentioned in the													
experiment list which they think is important.													
4. At least 8 experiments must be performed by the students.													
Course	e Objec	tives:											
1.	To tea	To teach students how to analyses solution space of problems											
2.	To design algorithms based on dynamic programming and greedy algorithms.												
Course	Outco	mes:											
CO1	<b>CO1</b> Apply important algorithmic design paradigms and methods of analysis in problem												
	solving.												
CO2	CO2 Design and develop dynamic programming and greedy algorithms.												
Course Outcomes (CO) to Programme Outcomes (PO)													
Mapping (Scale 1: Low, 2: Medium, 3: High)													
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	
CO1	2	2	2	2	1	-	-	-	-	-	-	1	
CO2	2	2	2	2	1	1	1	1	1	1	1	2	

# List of Experiments

- 1. Sort a given set of elements using the quick sort algorithm and find the time complexity for different values of n.
- 2. Implement merge sort algorithm using divide & conquer method to sort a given set of elements and determine the time and space required to sort the elements.
- 3. Write a program to implement knapsack problem using greedy method.
- 4. Program to implement job sequencing with deadlines using greedy method.



- 5. Write a program to find minimum cost spanning tree using Prim's Algorithm.
- 6. Write a program to find minimum cost spanning tree using Kruskal's Algorithm.
- 7. Implement 0/1 Knapsack problem using dynamic programming.
- 8. Write a program to perform Single source shortest path problem for a given graph.
- 9. Program for finding shortest path for multistage graph using dynamic programming.
- 10. Program to implement 8-queens problem using backtrack method.



Seme	ster: 5 <sup>th</sup>													
Paper code: IOT305									L	T/P	Cre	dits		
Subje	ubject: Sensors and Control Systems										4			
Marki	ing Schei	me:							•					
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	irks								
	End Te		-		75 Mark	(S								
Instru	ructions for Paper Setters: Maximum Marks: 75													
	ere should be 9 questions in the end term examination question paper.													
	estion No. 1 should be compulsory and cover the entire syllabus. This question should have													
	expective or short answer type questions. It should be of 10 marks.													
-	part from Question No. 1, the rest of the paper shall consist of four units as per the syllabus.													
	very unit should have two questions. However, students may be asked to attempt only 1 question om each unit. Each question should be 10 marks.													
	The questions are to be framed keeping in view the learning outcomes of course/paper. The													
	tandard/ level of the questions to be asked should be at the level of the prescribed textbooks.													
	The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.													
Cour	se Objec	tives:								-				
1.					h the co	onstructi	ons and	workin	g princip	le of dif	ferent	types of		
_	sensors and transducers.													
2.	To gain comprehensive understanding of how these devices convert physical quantities into													
3.	electrical signals for measurement and control purposes. To state the performance characteristics of control systems with specific design requirements													
5.		-		nce char	acteristi	cs of co	ntroi sys	stems wi	th speci	nc desig	n requi	rements		
4.		and design objectives To demonstrate applications of sensors and transducers in control systems												
	se Outco				3013013		nsuucci		101 3 9 3 1 0	.1115				
CO1	-		nd apply	principl	es of dif	ferent ty	pes of s	ensors a	nd trans	ducers.				
	To und	derstand	l of hov	v these	devices	conver	t physic	al quant	tities in	o electi	rical sig	nals for		
CO2		To understand of how these devices convert physical quantities into electrical signals for measurement and control purposes												
CO3	Analyze and apply block diagram and signal flow graph (SFG) techniques to describe the working													
05	of different control systems and analyze the performance characteristics of control systems with													
	-		requirer			-								
CO4														
Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)														
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12		
PO														
CO1	3	1	-	-	-	1	1	-	-	2	-	-		
CO2	3	3	3	3	3	-	-	-	-	2	-	-		
CO3	3	3	3	2	2	-	-	-	-	2	-	-		
CO4	3	3	3	2	3	2	1	-	-	2	-	-		



#### **Course Overview:**

This course addresses the basic understanding about operational characteristics and applications of various sensors and actuators. This course also provides the fundamental concepts of Control systems and mathematical modeling of the system. This subject also examines the application of sensors and transducer within a control system.

#### Unit I

**Sensors and Transducers**: Introduction, Definition and differences of sensors and transducers, Performance terminology, static and dynamic characteristics of transducers, Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications

Displacement Measurement: Transducers for displacement, displacement measurement, potentiometer, LVDT. Strain Measurement: Theory of Strain Gauges, Bridge circuit, Strain gauge based load cells and torque sensors, Velocity and Motion: Electromagnetic tachometer, photoelectric tachometer, variable reluctance tachometer, Digital Encoders. Vibration and acceleration: Eddy current type, piezoelectric type; Accelerometer: Principle of working, practical accelerometers, strain gauge based and piezoelectric accelerometers. Pressure Measurement: Elastic pressure transducers viz. Bourdon tubes, diaphragm, bellows and piezoelectric pressure sensors. Flow Measurement: Bernoulli flowmeter, Ultrasonic flowmeter, Magnetic flow meter, Rotameter. Miscellaneous Sensors: Leak detector, Flame detector, Smoke detector, pH sensors, Conductivity sensors, Humidity sensors, Potentiometric Biosensors and Proximity sensors. Selection of sensors

#### Unit II

**Importance and Adoption of Smart Sensors, Architecture of Smart Sensors:** Important components, their features, Fabrication methods of Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor

#### Unit III

**Control Systems:** Basics and components, classifications and types of control systems, block diagrams and signal flow graphs. Transfer function, determination of transfer function using block diagram reduction techniques and Mason's Gain formula. Time domain analysis, performance specifications, transient response of first & second order systems, steady state errors and static error constants in unity feedback control systems, response with P, PI and PID controllers.

#### Unit IV

**Applications of sensors and transducers in control systems:** Two tank system, speed control of DC motor, temperature measurement with sensors and transducers with a transmitter, thermistor-controlled fan, flow meter measurement and control system, strain gauge and Wheatstone bridge, scope block with Apple iOS devices, control brightness of Arduino onboard LED from Apple iOS device.

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# Textbooks:

- 1. Patranabi, D. (2003). Sensors and Tranducers. PHI Learning Pvt. Ltd.
- 2. Murty, D. V. S. (2010). Transducers and Instrumentation. PHI Learning Pvt. Ltd.
- 3. Ogata, K. (2010). Modern control engineering (Vol. 5). Upper Saddle River, NJ: Prentice hall.

#### **Reference Books:**

- 1. Doebelin, E. O., & Manik, D. N. (2007). Measurement systems: application and design.
- 2. Bentley, J. P. (2005). Principles of measurement systems. Pearson education.
- 3. Gopal, M. (1993). Modern control system theory. New Age International.



Semester: 5 <sup>th</sup>												
Paper code: IOT355   L   T/P   Cred										ts		
Subject:Sensors and Control Systems Lab021										1		
Marking Scheme:												
1. Teachers Continuous Evaluation: 40 Marks												
2. End term Examination: 60 Marks												
Instructions for Evaluators: Maximum Marks: 60											s: 60	
1. This is the practical component of the corresponding theory paper.												
2. The	2. The practical list shall be notified by the teacher in the first week of the class											
con	commencement under the intimation to the office of the HOD/ Institution in which they											
арр	appear is being offered from the list of practicals below.											
3. Inst	structors can add any other additional experiments over and above the mentioned in the											
exp	experiment list which they think is important.											
4. At least 8 experiments must be performed by the students.												
Course	e Objec	tives:										
1.	To de	monstr	ate app	lication	s of sen	isors an	d transd	lucers ir	n contro	lsystem	ıs.	
2.	To sh	ow the	perforr	nance c	haracte	ristics o	f contro	l systen	ns with	differen	t condit	ions.
<ul> <li>To show the performance characteristics of control systems with different conditions.</li> <li>Course Outcomes:</li> </ul>												
CO1	Analy	ze the	perfo	rmance	charac	teristics	of co	ntrol sy	/stems	with s	pecific	design
	Analyze the performance characteristics of control systems with specific design requirements and design objectives.											
CO2 Develop applications of sensors and transducers in control systems.												
Course Outcomes (CO) to Programme Outcomes (PO)												
Mapping (Scale 1: Low, 2: Medium, 3: High)												
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12
CO1	2	2	2	2	1	-	-	-	-	-	-	1
CO2	2	2	2	2	1	1	1	1	1	1	1	2



### List of Experiments

- 1. (a) To study the characteristics of inductive transducer: LVDT.
  - (b) Measurement of level in a tank using capacitive type level probe.
  - (c) Measurement of strain and load using Strain Gauge.
- 2. (a) To study and verify the characteristics of thermocouple.
  - (b) Measurement of the output voltage corresponding to pressure variation using capacitive and piezoelectric pressure transducers.
    - (c) To plot and analyse the characteristics of Hall Effect transducer.
- (a)To realize transfer functions for first order and second order control system problems using MATLAB.

(b)To plot transient response of first & second order systems using MATLAB/Simulink.

- 4. Plot impulse response, unit step response, unit ramp response of any 2nd order transfer function using MATLAB/Simulink.
- 5. Comparison of open loop & closed loop control in speed control of D.C. motor & to find the transfer function.
- 6. To study the performance of PID Controller on two tank system using MATLAB/Simulink.
- 7. To implement temperature-controlled DC fan system using Thermistor in MATLAB/Simulink.
- 8. Design Active Disturbance Rejection Control for Water-Tank System using MATLAB/ Simulink.
- Temperature control of Continuously Stirred Tank Reactor (CSTR) PID controller using MATLAB/Simulink.
- 10. To setup a measurement system for monitoring surrounding temperature and humidity using Arduino.
- 11. Control Brightness of Arduino Onboard LED from Apple iOS Device using MATLAB/Simulink.
- 12. To implement a mini water management system for indication water levels using Arduino interface.



Semes	ster: 5 <sup>th</sup>											
Paper	code: IC	DT307							L	T/P	Cre	dits
Subje	ct: Com	puter O	rganizati	ion & Ar	chitectu	ire			3	0	3	
Marki	ng Scher	ne:										
1.	Teache	rs Conti	nuous E <sup>,</sup>	valuatio	n: 25 Ma	arks						
2.	End Te	rm Thec	ory Exam	ination:	75 Mark	<s< td=""><td></td><td></td><td></td><td></td><td></td><td></td></s<>						
Instru	ctions fo	or Paper	Setters					Μ	aximum	Marks:	75	
1. Th	ere shou	ıld be 9	questior	ns in the	end teri	m exami	nation q	uestion	paper.			
2. Qu	uestion N	lo. 1 sho	ould be c	compulse	ory and o	cover the	e entire	syllabus	This qu	estion sl	nould ha	ive
	jective c			•••••								
-	part from									•	•	
	ery unit			•			udents n	hay be a	sked to a	attempt	only 1 q	uestion
	om each		•					_		,		
	e questi							-		-	-	
	andard/		•						•			
	e requir <b>se Objec</b>		or (scient	inc) calc	ulators/	log-tabl	es/ data	-tables r	nay be s	pecified	ir requi	ea.
1.	-		the hasi	c conce	nts of co	mputer	oneratio	n				
2.						es along			ing			
3.						ng and pa						
4.						ned arit			ns with c	ligital ha	rdware.	
Cour	se Outco			0				<u> </u>		0		
CO1			e basic c	oncepts	of regis	ter trans	fer lang	uage an	d compu	iter oper	rations.	
	Apply	nd anal	vzovario	us instri	uction fo	ormats fo	or CDU/C		thor wit	h a vario	ty of add	Iroccina
CO2	modes		yze varic					ir o toge			ty of aut	il essilig
			nt types	of Para	llel Com	puter M	odels					
CO3												
CO4	-					th digita	l hardwa	are.				
Course	e Outcor	nes (CO	) to Prog	gramme	Outcom	ies (PO)	В <b>Л</b> -		aala 1. I			<b>7.</b> 11:
<u> </u>	DO01	0002	<b>DO03</b>	D004	DOOL	DOOC				ow, 2: N		
CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	1	1	1	1		1						2
CO1	2	1	1	1							1	3
CO2	3	2	3	2	1	1	1				1	3
CO3	1	1	1	1	<u> </u>	<u> </u>	<u> </u>				<u> </u>	2
04	▲	L T	1 -	1 -								2



#### **Course Overview:**

This course enables the students to understand the principles of computer organization and the basic architectural concepts. It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

#### Unit 1

**Register Transfer Language:** Register transfer language, bus and memory transfer, bus architecture using multiplexer and tri-state buffer, micro-operation: arithmetic, logical, shift micro-operation with hardware implementation, arithmetic logic shift unit.

**Computer Organization and Design**: Instruction codes, general computer registers with common bus system, computer instructions: memory reference, register reference, input-output instructions, timing and control, instruction cycle, input-output configuration, and interrupt cycle. Levels of programming languages: Machine language, Assembly language, High level language.

#### Unit II

**Central processing Unit**: Introduction, general register organization, stack organization, instruction format, addressing modes. Overview of GPU, CPU vs GPU computing difference. **Memory Hierarchy:** Introduction, basics of cache, measuring and improving of cache performance, cache memory: associative mapping, direct mapping, set-associative mapping, cache writing and initialization, virtual memory, common framework for memory hierarchies. Case study of PIV and AMD opteron memory hierarchies.

#### Unit III

**Parallel Computer Models:** The state of computing, classification of parallel computers, multiprocessors and multicomputers, multivector and SIMD computers. Program and Network Properties: conditions of parallelism, data and resource dependences, hardware and software parallelism, program partitioning and scheduling, grain size and latency, program flow mechanisms, control flow versus data flow, data flow Architecture, demand driven mechanisms, comparisons of flow mechanisms.

#### Unit IV

**Pipelining:** Introduction to Flynn's classification, arithmetic pipeline, instruction pipeline, pipeline conflict and hazards, RISC pipeline, vector processing.

**Arithmetic for Computers:** Unsigned, signed 1's, 2's compliment notations, addition, subtraction, multiplication and division (hardware implementation), CPU performance and its factors, evaluating performance of CPU.

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#### Textbooks:

- 1. M. Morris, Mano, "Computer System Architecture", PHI 3rd Edition 2007.
- 2. Kai Hwang, "Advanced computer architecture"; TMH. 2000
- 3. D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002

#### **Reference Books:**

- 1. W. Stallings, "Computer organization and Architecture", PHI, 7th ed, 2005.
- 2. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication. 1998
- 3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI. 2002
- 4. R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003



Semes	ster: 5 <sup>th</sup>											
Paper	code: IC	DT309							L	T/P	Cre	dits
Subje	ct: Macl	nine Lea	rning						3	0	3	
Marki	ng Schei	me:							·			
1.	Teache	ers Conti	nuous Ev	valuatio	n: 25 Ma	arks						
	End Te				75 Mark	KS						
Instru	ctions fo	or Paper	Setters:					Μ	aximum	Marks:	75	
	ere shou		•									
	uestion N			-	•				This qu	estion sl	hould ha	ive
	jective c											
-	ort from				-	-				-	-	
	ery unit om each			-			luents n	hay be a	ѕкей то а	attempt	oniy t d	uestion
	e questi		-				learnin	g outcon	nes of co	ourse/na	ner Th	د
	andard/							-			•	
	e requir		•						•			
	se Objec		. (									
1.	To und	erstand	regressi	on, class	ification	and pre	diction	algorith	ns to cla	ssify dat	ta.	
2.			dge abo									
3.	To ana	lyse feat	ure engi	neering	techniq	ues to fo	ormulate	the solu	utions fo	r the cor	mplex pi	oblems
4.	То арр	ly machi	ine learn	ing tech	niques i	n real w	orld prol	blems.				
Cour	se Outco	omes:										
CO1	Unders	stand ma	achine le	arning t	ools and	l techniq	ues with	n their a <sub>l</sub>	oplicatio	ns.		
	Apply I	machine	learning	g technic	ues for	classifica	ation and	d regress	sion.			
CO2												
CO3			e engine		-							
CO4			sed and				earning b	based so	lutions f	or real-v	vorld pr	oblems.
Course	e Outcor	nes (CO	) to Prog	gramme	Outcom	es (PO)						
							1	apping (S	1	1	-	
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
PO		2	2	2	2	1	1	1	1	1	1	2
CO1	3	3	3	3	3	1	1	1	1	1	1	2
CO2	3	3	3	3	2	1	1	1	1	1	1	1
CO3	3	3	3	3	2	-	-	-	-	-	-	-
CO4	3	3	3	3	2	1	1	1	1	1	1	2

#### **Course Overview:**

This course covers fundamental concepts and methods of computational data analysis, including pattern classification, prediction, visualization, and recent topics in machine learning. The course will give the student the basic ideas and intuition behind modern machine learning methods as well as a bit more formal understanding of how, why, and when they work. The underlying theme in the course is a statistical inference as it provides the foundation for most of the methods covered.



#### UNIT I:

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Introduction to Machine Learning- Basic concepts, developing a learning system, Learning Issues, and challenges. Types of Machine Learning. Feature Selection Mechanisms, Imbalanced Data, Bias in Data, Outlier Detection

#### UNIT II:

Supervised Learning- Linear Regression, Multiple Regression, Logistic Regression, Classification; Classifier Models, K Nearest Neighbor (KNN), Naive Bayes, Decision Trees, Support Vector Machine (SVM), Random Forest

#### UNIT III:

Unsupervised Learning- Dimensionality Reduction; Clustering; K-Means Clustering; C-Means Clustering; Fuzzy C Means Clustering, Association Analysis- Association Rules in Large Databases, Apriori Algorithm, Markov Models: Hidden Markov Models (HMMs).

#### UNIT IV:

Reinforcement Learning- Introduction to Reinforcement Learning, Elements of Reinforcement Learning, Approaches to Reinforcement Learning, Applications of Reinforcement learning. Applications of Machine Learning in different sectors: Medical Diagnostics, Fraud Detection, Email Spam Detection

#### Text Books:

- 1. Tom M. Mitchell, Machine Learning, McGraw-Hill, 2010.
- 2. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.
- 3. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995

#### **Reference Books:**

- 1. Ethem Alpaydin, (2004), Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press
- 2. T. Astie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer (2nd ed.), 2009
- 3. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Spring



Semester: 5 <sup>th</sup>														
Paper c	ode: IO	T357							L	T/P	Credi	ts		
Subject	: Macl	hine Lea	arning l	ab					0	2	1			
Markin	g Schen	ne:												
1.	Teache	rs Conti	nuous	Evaluati	on: 40 I	Marks								
2.	End ter	m Exam	nination	i: 60 Ma	ırks									
Instruct	ions fo	r Evalua	ators:						N	laximur	n Mark	s: 60		
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.					
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week c	of the	class		
com	2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which they													
арр	ear is b	eing off	ered fr	om the	list of p	racticals	s below.							
3. Inst	ructors	can ado	d any of	ther ado	ditional	experin	nents ov	ver and a	above tl	ne ment	ioned i	n the		
exp	eriment	t list wh	ich the	y think i	s impor	tant.								
4. At le	<ul><li>experiment list which they think is important.</li><li>4. At least 8 experiments must be performed by the students.</li></ul>													
Course	e Objec	tives:												
1.	To fo	rmulate	e and ar	nalyse a	lgorithn	n based	on mac	hine lea	rning.					
2.	To de	esign the	e use ca	ases of r	nachine	learnin	g algori	thms as	per the	user re	quirem	ent.		
Course	e Outco	mes:												
CO1	Apply	and d	ifferent	iate ma	chine le	earning	algorith	ms for	regress	ion, clas	sificatio	on and		
	predi	ction p	oblems	5.										
CO2	Imple	ement s	upervis	ed and	unsupe	rvised r	nachine	learnin	g mode	els to an	alyse d	ata for		
	execu	uting fea	ature ei	ngineeri	ng and	feature	selectio	on for re	al-life s	cenarios	5.			
Course	Outcon	nes (CO	) to Pro	gramm	e Outco	omes (P	0)							
							Марр	oing (Sca	le 1: Lo	w, 2: M	edium, S	3: High		
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12		
CO1	3	3	3	3	3	1	1	1	1	1	1	2		
CO2	3	3	3	3	3	1	1	1	1	1	2	1		

#### LIST OF EXPERIMENTS

- 1. Study and Implement Linear Regression.
- 2. Study and Implement Logistic Regression.
- 3. Study and Implement K Nearest Neighbour (KNN).
- 4. Study and Implement classification using SVM.
- 5. Study and Implement Bagging using Random Forests.
- 6. Study and Implement Naive Bayes.



- 7. Study and Implement Decision Trees.
- 8. Study and Implement K-means Clustering to Find Natural Patterns in Data.
- 9. Study and Implement Gaussian Mixture Model Using the Expectation Maximization.
- 10. Study and Implement Classification based on association rules.
- 11. Study and Implement Evaluating ML algorithm with balanced and unbalanced datasets.
- 12. Comparison of Machine learning algorithms based on different-different parameters.



Semes	ter: 5 <sup>th</sup>												
Paper	code: IC	DT311							L	T/P	Cre	dits	
Subjec	t: Prin	ciples of	Entrepr	eneursh	nip Mind	lset			4	0	4		
Marki	ng Scher	ne:											
1.	Teache	rs Conti	nuous Ev	valuatio	n: 25 Ma	arks							
2.	End Te	rm Theo	ry Exam	ination:	75 Mark	ĸs							
Instru	ctions fo	or Paper	Setters:							Maxim	um Mar	ks: 75	
1. Th	ere shou	ıld be 9	questior	is in the	end terr	n exami	nation q	uestion	paper.				
				-	ory and o				This qu	estion sl	nould ha	ive	
-	-				stions. I								
-					t of the I	-				-	-		
				•	ns. How		udents n	hay be a	sked to a	attempt	only 1 q	uestion	
			•		Id be 10				· · · · ·				
					eping in t			-			-		
	standard/ level of the questions to be asked should be at the level of the prescribed textbooks. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.												
	se Objec		r (scient	inc) calc	ulators/	log-tabl	es/ uala	-lables i	nay be s	pecified	ii requi	eu.	
1.			only the	attitude	es, value	s chara	cteristic	s hehav	viour an	d proce		ociated	
					irial & in					-			
					behavio				242.12	1546665		opriace	
2.					of finan		narketin	g for firs	t time e	ntreprer	neurs.		
3.				•	nd apply			-		•			
4.	Create	and wri	te a busi	ness pla	n.	•							
Cours	se Outco	omes:											
CO1	Apply t	he attitu	ides, val	ues, cha	racterist	ics, beha	aviour, a	nd proce	esses ass	ociated	with pos	ssessing	
001	an en	itrepren	eurial a	& inno	vation	mindset	and	engagin	g in s	successf	ul appi	ropriate	
	entrep	reneuria	I and ini	novative	behavio	our.							
CO2	Concep	otualize	the basi	c concep	ots of fina	ance and	d market	ing.					
CO3	Evaluat	te the bu	usiness r	nodel ca	invas an	d apply t	he same	e for pro	duct and	d service	s area.		
CO4	Create	and wri	te a busi	ness pla	n.								
Course				•	Outcom	es (PO)							
							Ma	pping (S	cale 1: L	ow, 2: M	ledium,	3: High)	
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
РО													
CO1	1	2	3	3	1	1	-	1	1	-	-	2	
CO2	2	2	3	3	1	1	-	1	1	-	-	2	
CO3	2	2	3	3	1	1	-	1	2	-	-	2	
CO4	2	2	3	3	2	1	1	1	2	-	-	2	



#### **Course Overview:**

This course gives exposure to the students for the core entrepreneurship concepts. Three real time case studies have been covered to give the students real time understanding of setting up a startup. Business canvas model has been covered under the syllabus followed by the finance and marketing skills for budding entrepreneurs. Students will be able to create and write a business plan after the completion of the course.

#### Unit I

**Introduction to Entrepreneurship and Innovation:** Entrepreneurship: Concepts, entrepreneurship mindset, challenges; Innovation: What is innovation, role of technology, creating new ventures through innovative initiatives; Business opportunities: concepts & techniques for identifying opportunities, writing a problem statement, tools and techniques for idea generation; Introduction to social entrepreneurship.

Study and Analyze at least three case studies of startups in computing (mixture of both successful and failed startups, an Indian startup, startup by a student)

#### Unit II

**Understanding Business Model Canvas:** Introduction to Business Model Canvas; customer segments; value proposition, distribution channels; Customer Relationship, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structure, Preparing a business model canvas of a problem statement

#### Unit III

**Finance and Marketing for early entrepreneurs:** Basic understanding of P&L, Balance sheet and cash flow; Understanding of terms like CAGR, NPV, Angle funding, Venture capital, Debt funding, Equity, private equity, valuation, Break-even analysis, Return on Investment, Working Capital, Cost of Good Sold, Customer Acquisition cost, Customer life time value, profit margins.

**Marketing for budding entrepreneurs:** Understanding customer requirements, Customer Profiling and segmentation, Marketing strategy, 4Ps of Marketing, Network effect.

#### Unit IV

**Creating and writing a Business Plan:** Introduction to different Business Models. Process of Business Planning - Purpose, structure and content, business plan outline, how to write Business plan, Preparing a business plan of a problem statement. Application of Business Model Canvas in creating the business plan. Understand customer needs, design and conduct a survey. Presentation of Business Plan. Process of incorporating a new company in India.

#### Textbooks:

1. "Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers" by Alexander Osterwalder, Yves Pigneur

- 2. "Making Breakthrough Innovation Happen" by Porus Munshi
- 3. Ries Eric (2011), "The lean Start-up: How constant innovation creates radically successful businesses", Penguin Books Limited.

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#### **Reference Books:**

- 1. Blank, Steve (2013), "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", K&S Ranch.
- 2. S. Carter and D. Jones-Evans, "Enterprise and small business- Principal Practice and Policy", Pearson Education (2006)
- 3. T. H. Byers, R. C. Dorf, A. Nelson, "Technology Ventures: From Idea to Enterprise", McGraw Hill (2013)
- 4. Osterwalder, Alex and Pigneur, Yves (2010) "Business Model Generation".
- 5. Kachru, Upendra, "India Land of a Billion Entrepreneurs", Pearson
- 6. Bagchi, Subroto, (2008), "Go Kiss the World: Life Lessons for the Young Professional", Portfolio Penguin
- 7. Bagchi, Subroto, (2012). "MBA At 16: a Teenager's Guide to Business", Penguin Books
- 8. Mitra, Sramana (2008), "Entrepreneur Journeys (Volume 1)", Booksurge Publishin
- 9. Abrams, R. (2006). "Six-week Start-up", Prentice-Hall of India
- 10. Verstraete, T. and Laffitte, E.J. (2011). "A Business Model of Entrepreneurship", Edward Elgar Publishing.
- 11. Johnson, Steven (2011). "Where Good Ideas comes from", Penguin Books Limited.
- 12. Gabor, Michael E. (2013), "Awakening the Entrepreneur Within", Primento.
- 13. Guillebeau, Chris (2012), "The \$100 startup: Fire your Boss, Do what you love and work better to live more", Pan Macmillan
- 14. Kelley, Tom (2011), "The ten faces of innovation, Currency Doubleday"
- 15. Prasad, Rohit (2013), "Start-up sutra: what the angels won't tell you about business and life", Hachette India.



## **SYLLABUS**

(3<sup>rd</sup> Year) for

## BACHELOR OF TECHNOLOGY for

Artificial Intelligence and Data Science Artificial Intelligence and Machine Learning Industrial Internet of Things



# Syllabus of 3<sup>rd</sup> Year, 6<sup>th</sup> semesters Papers for AIML/AIDS



Paper	code: AIDS302/AIML302	L	T/P	Credits
Subjec	t: Digital Image Processing	3	0	3
Markir	ng Scheme		1	
Teache	rs Continuous Evaluation: 25 Marks			
End ter	rm Theory Examination: 75 Marks			
INSTRU	JCTIONS TO PAPER SETTERS:		Maximun	n Marks: 75
2. ( 3. / 4. <sup>-</sup> 5. <sup>-</sup>	There should be 9 questions in the end term examination of Question No. 1 should be compulsory and cover the end objective or short answer type questions. It should be of 2 Apart from Question No. 1, the rest of the paper shall const unit should have two questions. However, students may be each unit. Each question should be 15 marks. The questions are to be framed keeping in view the lestandard/level of the questions to be asked should be at The requirement of (scientific) calculators/log-tables/data <b>e Objectives:</b> To study basic image processing techniques of spatial filtering applications. To understand digital image acquisition tools and base of spatial image acquisition tools and base of the process of spatial image acquisition tools and base of the process of spatial image acquisition tools and base of the process of the proces of the process of the proces of the process of the process	tire syllabus. Th 15 marks. ist of four units be asked to atter earning outcome the level of the a-tables may be ial and frequen	as per the sonpt only 1 es of cour prescribed specified i	syllabus. Every question from se/paper. The textbooks. f required. ns for
3.	To analyze techniques such as image denoising, image neuronality image denoising, image den	age segmentati	on, Image	2
	To design image compression and image segmentat	tion algorithms	5.	
4.				
	e Outcomes:			
	e Outcomes: Understanding of the fundamental concepts of images representation, enhancement, restoration, compresentation, enhancement, restoration, compresentation, compres	• • •	-	-
Cours	Understanding of the fundamental concepts of image representation, enhancement, restoration, compre- Analyze various segmentation techniques for image	ssion, and segree analysis	nentation	-
Cours CO1	Understanding of the fundamental concepts of image representation, enhancement, restoration, compresentation, compresentation	ssion, and segree analysis	nentation	-

Course	Course Outcomes (CO) to Programme Outcomes (PO) Mapping														
	(Scale 1: Low, 2: Medium, 3: High)														
CO/P	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO1	PO1	PO1			
0	1	2	3	4	5	6	7	8	9	0	1	2			
CO1	3	2	-	2	3	-	-	-	3	-	-	2			
CO2	2	1	-	-	3	-	2	-	3	-	-	-			
CO3	2	1	-	2	3	3	2	-	-	-	-	2			
CO4	2	2	-	2	3	3	2	-	-	-	-	3			



#### **Course Overview:**

To introduce the student to various image processing techniques and image fundamentals. To describe the main characteristics of digital images, how they are represented. Mathematical transforms such as such as Fourier, Cosine transforms, Singular value decomposition, 2D Wavelet transform, image enhancement techniques. Image restoration and denoising, segmentation, lossy and lossless data compression algorithms, binary and color image processing.

#### UNIT-I

**INTRODUCTION TO IMAGE PROCESSING:** Introduction to images and its processing, Components of image processing systems, image representations, Image file formats, recent applications of digital image processing, image sampling and quantization, Image Analysis, Intensity transformations, contrast stretching, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian. Need for transform, Fourier, Cosine transforms, 2D Wavelet transform, Different properties of image transform techniques.

#### UNIT II

Concept of image compression, lossless techniques (Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques) and lossy compression techniques (Transform Coding & K-L Transforms, Discrete Cosine Transforms, and BTC), Enhancement in spatial and transform domain, histogram equalization, Directional Smoothing, Median, Geometric mean, Harmonic mean, Homomorphic filtering

#### UNIT III

Image degradation, Type of image blur, Classification of image restoration techniques, image restoration model, Linear and nonlinear restoration techniques, Image denoising, Median filtering. Classification of image segmentation techniques, Boundary detection-based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Thresholding, Iterative thresholding, Otsu's method, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

#### **UNIT IV**

Binarization, Basic Set theory, Binary morphological operations and its properties, Color Image Representation, Converting Between Color Spaces, The Basics of Color Image Processing, Color Transformations, Spatial Filtering of Color Images, Working Directly in RGB Vector Space, Applications of digital image processing: Case studies

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#### **Text Books:**

- 1. Digital Image Processing, R.C. Gonzalez and R.E. Woods, 2nd edition, Pearson Prentice Hall, 2008
- 2. Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989.

#### **Reference Books:**

- 1. Digital Image processing, S Jayaraman, TMH, 2012
- 2. William K. Pratt, *Digital Image Processing*, 3rd Edition, John Wiley, 2001.

#### MOOC:

- 1. https://nptel.ac.in/courses/117/105/117105079/
- 2. https://nptel.ac.in/courses/117/105/117105135/



Semest	er: 6											
Paper o	ode: Al	DS352/	AIML3	52					L	T/P	Cred	its
Subject	: Digita	l Image	Proces	ssing La	ıb				0	2	1	
Markin	g Schen	ne										
Teache	rs Conti	nuous E	valuati	on: 40	Marks							
End ter	m Exam	ination	60 Ma	irks								
INSTRU	CTIONS	TO PA	PER SE	<b>TTERS</b> :						Maximu	ı <mark>m M</mark> ar	ks: 60
		•	•			•	•	ory pape				
	•				•					class co		
					e of the	HOD/ II	nstitutio	n in whie	ch they a	ippear is	being o	ffered
		list of pr					• • • • •		1			
						•	iments o	over and	a above	the men	tioned	in the
	•				is import erforme		studont	te				
	<b>Objecti</b>			ust be p	enome	u by the	studem	15.				
	-											
1	To inti	oduce t	he con	cepts o	f image	proces	sing and	l basic a	nalytica	l metho	ls to be	used
		ge proc										
2	To fan	niliarize	studen	ts with	image e	enhance	ement a	and rest	oration	techniqu	ies, diff	erent
	image	compre	ession t	echniq	ues							
Course	Outcon	nes:										
CO1	Analyz	e techn	iques s	uch as i	mage de	enoisin	g, image	e segme	ntation,	Image e	nhance	ment
		lge dete	•		0		<i>,</i> 0	0	,	0		
CO2		-		quency	domain	filters	on an ir	nage da	ta set.			
Course					ne Outc							
		(	,	-0-		(			le 1: Lov	v, 2: Me	dium, 3	: High)
CO/P	РО	РО	PO	РО	РО	PO	РО	PÒ	РО	PO	PO	PO
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	-	2	2	2	-	-	2	-	-	2
CO2	2	2	1	2	3	3			2		_	3
		1 7	1 1				1		1 1	-		

#### LIST OF EXPERIMENTS:

- 1. Create a program to demonstrate Geometric transformations- Image rotation, scaling, and translation.
- 2. Display of FFT (1-D & 2-D) of an image and apply Two-dimensional Fourier transform to represent the content of an image using the discrete Fourier transform (DFT) and masking with DFT.



- 3. Write a Program of Contrast stretching of a low contrast image, Histogram, and Histogram Equalization and Display of bit planes of an Image.
- 4. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
- 5. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image)
- 6. Implementation of image sharpening filters and Edge Detection using Gradient Filters.
- 7. Implementation of Image Compression by DCT, DPCM, HUFFMAN coding.
- 8. Implementation of image restoring techniques.
- 9. Implementation of Image Intensity slicing technique for image enhancement.
- 10. Study and implement Canny edge detection Algorithm to images and compare it with the existing edge detection algorithms.



Semes	ter: 6 <sup>th</sup>													
Paper	code: A	IDS304T							L	T/P	Cre	dits		
Subjec	t: Fund	amenta	ls of Dee	ep Learn	ing				3	0	3			
Marki	ng Scher	ne:									•			
1.	Teache	rs Conti	nuous Ev	/aluatio	n: 25 Ma	irks								
			ry Exam		75 Mark	s								
Instru	ctions fo	r Paper	Setters:							Maxim	um Mar	ks: 75		
			•					uestion						
					-			syllabus.	This qu	estion sl	nould ha	ive		
-	-		answer t											
•					-	-		st of fou		-				
	-			-			luents n	hay be a	sked to a	attempt		uestion		
	from each unit. Each question should be 10 marks. The questions are to be framed keeping in view the learning outcomes of course/paper. The													
	standard/ level of the questions to be asked should be at the level of the prescribed textbooks.													
	se Objec		•	,	·	0	·		•	•	•			
1.	To und	erstand	the intu	ition and	d mathe	matical p	orinciple	s behinc	l deep le	earning.				
2.								or comp						
3.	-		-	h and cl	nallenge	s of dee	ep learni	ng as co	ompared	l to the	other f	orms of		
		ie learni	-											
4.			ages wit	h variou	is forms	of auto-	encoder	'S						
Cours	se Outco		I. 1.1.						••••					
CO1	Арріу т	ne basic	: building	g DIOCKS	and gen	erai prin	icipies to	or design	ing deep	o learnin	ig algori	tnms.		
CO2	Analyz	e the wo	orking of	Convolu	ution Ne	ural Net	work for	the give	en applio	ation.				
CO3	Implen	nent Aut	oencode	er, Recur	rent Ne	ural Net	work, LS	TM and i	ts variar	nts for re	al life da	ta-sets.		
CO3	Implen	ent con	cents of	Genetic	Adversi	ial Netw	orks and	l text cla	ssificatio	n algori	thms			
			) to Prog						Sincario	in algori	tiinis			
course	- outcor			, anne	outcom		Ma	apping (S	Scale 1: I	Low. 2: N	/ledium	3: High		
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12		
PO														
CO1	3	1	1	1	2	-	-	-	2	1	2	1		
CO2	3	1	1	1	2	1	1	1	2	1	2	2		
CO3	3	1	1	1	2	1	1	1	2	1	2	2		
CO4	3	1	1	1	2	1	1	1	2	1	2	2		

#### **Course Overview:**

The main objective of this course is to develop the understanding of key mathematical principles which are used behind the working of neural networks. Convolution Neural Networks and Recurrent Neural Networks have also been covered in this course. This course also provides the details for usage of Deep Learning for Natural Language Processing.

#### Unit I:

Introduction to Deep Learning, Bayesian Learning, Overview of Shallow Machine Learning, Difference between Deep Learning and Shallow Learning, Linear Classifiers, Loss Function and Optimization Techniques -Gradient Descent and batch optimization.

#### Unit II:

Introduction to Neural Network, Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic Artificial Neural Networks: Single Layer Neural Network, Multilayer Perceptron, Back Propagation through time. Architectural Design Issues.

#### Unit III:

Difficulty of training deep neural networks, Activation Function, Evaluating, Improving and Tuning the ANN. Hyper parameters Vs Parameters, Greedy layer wise training, Recurrent Neural Networks, Long Short-Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.

#### Unit IV:

Convolutional Neural Networks, , Building blocks of CNN, Transfer Learning , Pooling Layers , Convolutional Neural Network Architectures.Well known case studies: LeNet, AlexNet, VGG-16, ResNet, Inception Net.Applications in Vision, Speech, and Audio-Video.

#### **Text Books:**

- 1. Richard O. Duda," Pattern classification, Wiley, 2022
- 2. Adam Gibson and Josh Patterson, "Deep Learning: A Practical approach", 2017
- 3. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.

#### **Reference Books :**

- 1. Charu C. Aggarwal, "Neural Networks and Deep Learning", 2018
- 2. Duda, R.O. and Hart, P.E., Pattern classification. John Wiley & Sons, 2006.

#### **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, SURAJMAL VIHAR-110092



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Semes	ter: 6 <sup>th</sup>											
Paper	code: Al	DS304F	)						L	T/P	Credi	ts
Subjec	t: Fund	amenta	ls of De	eep Lea	rning La	b			0	2	1	
Marki	ng Scher	ne:								·		
1.	Teache	rs Conti	nuous	Evaluati	on: 40 N	Marks						
2.	End ter	m Exam	ninatior	: 60 Ma	ırks							
Instruc	tions fo	r Evalua	ators:						Maxim	um Mar	ks: 60	
1. Thi	s is the	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.			
2. Th	e practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week c	of the	class
cor	nmence	ment u	nder th	ne intim	ation to	the of	fice of t	the HO	D/ Instit	ution in	which	they
ар	bear is b	eing off	ered fr	om the	list of p	racticals	below.					
3. Ins	tructors	can ado	d any of	ther add	ditional	experim	nents ov	er and a	above tl	he ment	ioned i	n the
exp	erimen	t list wh	ich the	y think i	s impor	tant.						
4. At	least 8 e	xperim	ents mi	ist be p	erforme	ed by th	e studer	nts.				
Cours	e Objec	tives:										
3.	Imple	ementat	ion of	deep le	earning	models	in Pytł	non and	train	them w	ith real	-world
	datas			•	0							
4.							letwork	(CNN)	, Recur	rent Ne	ural Ne	etwork
			eep Lea	rning N	LP in Py	thon.						
Cours	e Outco	mes:										
CO1	Desig	n and Ir	npleme	ent Conv	olution	Neural	Networ	k for obj	ject clas	sificatio	n from i	mages
	or vic	leo.										
CO2	Imple	ement A	utoenc	oder, R	ecurren	t Neura	l Netwo	rk, LSTN	Л, its va	riants a	nd Deep	NLP.
Course	Outcor	nes (CO	) to Pro	gramm	e Outco	omes (P	0)					
							Марр	o <b>ing (</b> Sca	ale 1: Lo	w, 2: Me	edium, S	3: High
CO/PC	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
												1012
CO1	2	1	1	1	2	1	1	1	2	1	2	2

#### LIST OF EXPERIMENTS:

- 1. To explore the basic features of Tensorflow and Keras packages in Python
- 2. Implementation of ANN model for regression and classification problem in Python.
- 3. Implementation of Convolution Neural Network for MRI Data Set in Python.
- 4. Implementation of Autoencoders for dimensionality reduction in Python.
- 5. Application of Autoencoders on Image Dataset.



- 6. Improving Autocoder's Performance using convolution layers in Python (MNIST Dataset to be utilized).
- 7. Implementation of RNN model for Stock Price Prediction in Python
- 8. Using LSTM for prediction of future weather of cities in Python
- 9. Implementation of transfer learning using the pre-trained model (MobileNet V2) for image classification in Python.
- 10. 10. Implementation of transfer learning using the pre-trained model (VGG16) on image dataset in Python.
- 11. NLP Analysis of Restaurant Reviews in Python.
- 12. Building a NLP model for Spam Detection using TFIDF (Term Frequency Inverse Document Frequency Vectorizer).



Semes	ter: 6 <sup>th</sup>												
Paper	code: A	IDS306 <sup>-</sup>	Г						L	Т	'/P	Cre	dits
Subjec	t: Big D	ata Ana	alytics						3	0	)	3	
Markin	ng Schei	me											
Teache	ers Cont	inuous	Evalua	tion: 25	5 Marks								
End ter	rm Theo	ory Exar	ninatic	on: 75 N	/larks								
INSTRU	JCTION	S ΤΟ ΡΑ	PER S	ETTERS	:			Ν	/laximu	m Ma	r <b>ks:</b> '	75	
1.	There sl	nould b	e 9 que	estions	in the e	end terr	n exam	ination	questic	on pap	er.		
								the er	-			•	estion
			-				-	ons. It s					
	•							shall co				•	
	•							loweve			•		ed to
		-						stion sh					<i>.</i>
	•						•	view		•			
					level o	f the q	uestion	s to be	asked s	hould	be a	it the	level
	of the p					lators/	log tok	oles/ da	ta tabla		ha	cnoci	find if
	required			scientin	c) calcu	liators/	iog-tat	nes/ ua	la-lable	es may	bes	speci	neu n
	Object												
1.		ntroduc	e the	concep	t of big	data ar	nd its tv	pes.					
2.								work w	ith big	data			
3.		apply di											
4.		<u>··· ·</u>		· · · ·		-	p ecosy	stem a	nd its di	stribut	tion		
Course	Outcor	nes:											
CO1	Unc	lerstand	d the c	oncept	of big c	lata an	d its typ	oes.					
CO2	Ana	lyze dif	ferent	types o	of virtua	lizatior	ns to wo	ork with	big dat	a			
CO3	Арр	ly Map	Reduc	e funda	amenta	ls and c	lifferen	t analyt	ics in bi	ig data			
CO4	Des	ign the	Hadoc	p ecos	ystem a	nd its c	listribut	tion					
Course	Outco	nes (CC	) to P	rogram	me Out	comes	(PO) N	lapping					
									e 1: Lov	<i>N,</i> 2: N	1ediu	um <u>,</u> 3	: High)
CO/P	PO0	PO0	РО	PO0	PO0	PO0	PO0	PO0	PO0	PO1	Ρ	01	PO1
0	1	2	03	4	5	6	7	8	9	0	1		2
CO1	1	1	1	1							1		2
CO2	2	2	2	2	1						1		2
CO3	3	2	2	2	2	1			1		2		3
CO4	3	3	2	2	3	1	1	1	2		2		3



#### **Course Overview:**

Big data analytics is a field of study that focuses on the use of various analytical and statistical methods to extract insights, patterns, and trends from large and complex data sets. The goal of this course is to help businesses and organizations make more informed decisions, improve operational efficiency, and identify new business opportunities.

#### UNIT I:

**Introduction to Big Data-** The Evolution of Data Management, Defining Big Data, Understanding the Waves of Managing Data, building a Successful Big Data Management Architecture, Examining Big Data Types: Structured Data, Unstructured Data. Putting Big Data Together. Brief History of Distributed Computing, Basics of Distributed Computing for big data.

#### UNIT II:

**Exploring the Big Data Stack-** Layer 0: Redundant Physical Infrastructure, Layer 1: Security Infrastructure, Layer 2: Operational Databases, Layer 3: Organizing Data Services and Tools, Layer 4: Analytical Data Warehouses. Big Data Analytics, Big Data Applications.

**Virtualization:** Basics of Virtualization, Server virtualization, Application virtualization, Network virtualization, Processor and memory virtualization, Data and storage virtualization, Managing Virtualization with the Hypervisor, Implementing Virtualization to Work with Big Data.

#### UNIT III:

**Analytics and Big Data-** Basic analytics, Advanced analytics, Operationalized analytics, Monetizing analytics, Text Analytics and Big Data, Social media analytics, Text Analytics Tools for Big Data, Attensity, Clarabridge, OpenText.

**MapReduce Fundamentals**- Understanding the map function, Adding the reduce function. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

#### UNIT IV:

**Exploring Hadoop-** Hadoop & its Features, Hadoop Ecosystem, Hadoop 2.x Core Components, Hadoop Storage: Understanding the Hadoop Distributed File System, Hadoop Processing: MapReduce Framework, Different Hadoop Distributions. Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

**HDFS (Hadoop Distributed File System):** The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

#### [10]

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#### Textbooks:

- 1. Judith S. Hurwitz, Alan F. Nugent, Fern Halper, Marcia A. Kaufman, "Big Data For Dummies", John Wiley & Sons, Inc.(2013)
- 2. Robert D. Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc. (2012)
- 3. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
- 4. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

#### **Reference Books:**

- 1. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill (2012).
- 2. Nathan Marz, James Warren, "Big Data: Principles and best practices of scalable realtime data systems", Manning Publications (2015)
- 3. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, "Learning Spark: Lightning-Fast Big Data Analysis", O. Reilly Media, Inc. (2015).



Semes	ter: 6 <sup>th</sup>											
Paper	code: A	IDS306F	0						L	T/P	Cre	dits
Subjec	t: Big D	ata Ana	alytics	Lab					0	2	1	
Markir	ng Schei	ne										
Teache	ers Cont	inuous l	Evaluat	tion: 40	Marks							
End te	rm Exan	nination	: 60 M	arks								
INSTRU	JCTION	S TO PA	PER SE	TTERS:						Maximu	m Mar	ks: 60
		•		•	of the co	•	•					
	•				•					e class co		
						HOD/ I	nstitutio	on in wh	ich they	appear is	being	offered
	from the	•										
						•	riments	over ar	nd above	the me	ntioned	in the
	•			•	is impo							
	object		nents n	nust be	perform	ed by tr	ie stude	nts.				
1			dimpl	omont	difforon	+ fram	work	tools by	taking	amplo	lata co	-
			•					,		sample o		.5.
2	To illu	istrate a	ind imp	olemen	t the co	ncepts	by taki	ng an ap	oplicatio	n proble	em.	
Course	Outcor	nes:										
CO1	Analy	se the B	ig Data	a using	Map-re	duce pr	rogram	ming in	Hadoop	framew	ork.	
CO2	Apply	concep	ts of bi	ig data a	analytic	s to cor	nduct e	xperime	ents, as v	well as to	o analy	ze and
	interp	ret big	data.	-	-							
Course	Outcor	nes (CO	) to Pr	ogram	me Outo	comes	(PO) M	apping				
		•		C				(Sca	ale 1: Lo	w, 2: Me	edium,	3: High)
CO/P	PO0	PO0	PO	PO0	PO0	PO0	PO0	PO0	PO0	PO1	PO1	PO12
0	1	2	03	4	5	6	7	8	9	0	1	
CO1	2	2	2	1	2		1		1			2
CO2	2	2	2	2	2		1	1	1	1	2	3

#### LIST OF EXPERIMENTS:

- 1. Install Apache Hadoop.
- 2. Develop a map reduce program to calculate the frequency of a given word in a given file.
- 3. Develop a map reduce program to find the maximum temperature in each year.
- 4. Develop a map reduce program to find the grade of students.
- 5. Develop a map reduce program to implement matrix multiplication.
- 6. Develop a map reduce program to find the maximum electrical consumption in each year given electrical consumption for each month in each year.
- 7. Develop a map reduce program to analyze weather data set and print whether the day is shiny or cool day.



- 8. Develop a map reduce program to find the tags associated with each movie by analyzing movie lens data.
- 9. Develop a map reduce program to analyze Uber data set to find the days on which each basement has more trips using the following data set. The uber data set consists of four columns they are:

Dispatching, base, no. date active, vehicle trips.

- 10. Develop a map reduce program to analyze titanic dataset to find the average age of the people (both male and female) who died in the tragedy. How many people survived in each class.
- 11. Develop a program to calculate the maximum recorded temperature year wise for the weather data set in Pig Latin.
- 12. Write queries to sort and aggregate the data in a table using HiveQL.



Semes	ster: 6 <sup>th</sup>													
Paper	code: All	DS308T							L	T/F	P Cre	dits		
Subje	ct: Next (	Generat	ion Da	tabases	5				3	0	3			
Marki	ng Schem	ne												
Teach	ers Contir	าuous Ev	valuati	on: 25 l	Marks									
End te	rm Theor	'y Exami	nation	i: 75 Ma	nrks									
INSTR	UCTIONS	ΤΟ ΡΑΡ	ER SE	<b>FTERS</b> :					Ν	/laximur	n Marks	s: <b>7</b> 5		
	ere should	•					•	•	•					
	estion No			-	-			-	ous. This	questic	on should	d have		
	jective or s			• •								_		
-	art from C				•	•				•				
	it should l ch unit. Ea		-				may be	e asked t	o attem	ot only 1	questio	n from		
		•					he learr	ning outo	omes of	the cou	rse/nane	er. The		
	4. The questions are to be framed keeping in view the learning outcomes of the course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.													
	e requiren		•						•					
	e Objectiv			-	-	-					•			
1	To intro	duce the	e diffe	rent dat	abase r	evolutio	ons.							
2	To analy	ze diffe	rent ty	pes of r	elationa	al and r	on-rela	ational da	atabase	s.				
3	To apply	/ differe	nt type	es of co	nsistenc	y mode	els in M	ongoDB	and Hb	ase.				
4	To fami										languag	es for		
	databas	e revolu	itions.											
Course	e Outcom	nes:												
CO1	Underst	and the	conce	pts of d	atabase	revolu	tions a	nd the ne	eed of ⊦	ladoop e	ecosyste	em.		
CO2	Analyze	differer	nt type	s of rela	ational a	nd non	-relatio	nal data	bases.					
CO3	Apply di	fferent	types o	of consi	stency n	nodels								
CO4	Design o	different	: datab	ases us	ing Spar	'k SQL a	nd Apa	iche Drill						
Course	e Outcom	nes (CO)	to Pro	ogramm	e Outco	omes (P	O) Map	oping						
		-			-			(Sca	ale 1: Lo	w, 2: M	edium, S	3: High		
CO/P	PO01	PO02	РО	PO0	PO05	PO0	PO0	PO08	PO09	PO10	PO11	PO12		
0			03	4		6	7							
CO1	1	1	1	1	2	1						2		
CO2	2	2	2	2	1				1		1	2		
CO3	2	2	2	2	1			1	1		1	2		
CO4	3	2	2	3	2			1	1	1	2	3		

#### **Course Overview:**

The subject gives a detailed overview on the next generation databases introducing the different database revolutions including the Big Data revolution and NoSQL. The students are introduced to various data models for Storage. Languages and programming interfaces like NoSQL, Spark SQL and Apache Drill are also discussed in the subject.



#### UNIT I:

**Database Revolutions**: Early Database Systems, The First Database Revolution, The Second Database Revolution, The Third Database Revolution.

**The Big Data Revolution**: Cloud, Mobile, Social, and Big Data. Google: Pioneer of Big Data. Hadoop: Open-Source Google Stack: Hadoop's Origins, The Power of Hadoop, Hadoop's Architecture, HBase, Hive, Pig. The Hadoop Ecosystem.

Scaling Web 2.0: Sharding, CAP Theorem

#### UNIT II:

**Document Databases:** XML and XML Databases, JSON Document Databases, Data Models in Document Databases, MongoDB

**Graph Databases**: RDBMS Patterns for Graphs, RDF and SPARQL, Property Graphs and Neo4j, Gremlin, Graph Database Internals, Graph Compute Engines

**Column Databases**: Data Warehousing Schemas, The Columnar Alternative, Sybase IQ, C-Store, and Vertica, Column Database Architectures

#### UNIT III:

**Distributed Database Patterns**: Distributed Relational Databases, Nonrelational Distributed Databases, MongoDB Sharding and Replication, HBase, Cassandra.

**Consistency Models**: Types of Consistency, Consistency in MongoDB, HBase Consistency

#### UNIT IV:

**Data Models and Storage:** Review of the Relational Model of Data, Key-value Stores, Data Models in BigTable and HBase, Cassandra, JSON Data Models. Typical Relational Storage Model, Log-structured Merge Trees, Secondary Indexing.

Languages and Programming Interfaces: SQL, NoSQL APIs, Impala, Spark SQL, Couchbase N1QL, Apache Drill.

#### Text Books:

1. Guy Harrison, "Net Generation Databases", Apress 2015

#### **Reference Books:**

- 1. Abraham Silberschatz, Henry F. Korth , S. Sudarshan, "Database System Concepts", McGraw Hill Education, 2013.
- 2. Adam Fowler, "NoSQL For Dummies", Wiley, 2015.

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Semeste	er: 6 <sup>th</sup>											
Paper code: AIDS308P									L	T/P	Credi	ts
Subject: Next Generation Databases Lab									0	2	1	
Marking	g Schem	e										
				n: 40 Ma	irks							
End terr	-			-								
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60												s: 60
1. This is the practical component of the corresponding theory paper.												
2. The practical list shall be notified by the teacher in the first week of the class												
commencement under the intimation to the office of the HOD/ Institution in which they												
appear is being offered from the list of practicals below.												
3. In	3. Instructors can add any other additional experiments over and above the mentioned in											ed in
the experiment list which they think is important.												
4. At least 8 experiments must be performed by the students.												
Course	Objectiv	ves:										
1	To cr	To create NOSQL databases using proper rules.										
2	To im	To implement projection and indexing in databases.										
Course	Outcom	es:										
CO1	Use t	he basic	s of Mc	ngoDB c	omma	ands an	id const	ruct que	eries for	databas	se creati	on
		nteractio		0				•				
CO2				ciples for	NOS	DI data	bases to	o impler	nent da	tabase c	onnecti	vitv
001		Apply database principles for NOSQL databases to implement database connectivity with programming languages.										
Course			-	ramme (		mac (p		ning				
Course	Jutcom	ies (CO)	to Prog	grannine v	Juico	ines (P	O) Map		ale 1: Lo	ow, 2: M	ledium,	3: High
CO/P O	PO01	PO02	PO0 3	PO04	РО 05	PO0 6	PO0 7	PO08	PO09	PO10	PO11	PO12
CO1	2	2	2	1	2	1			1		2	2
CO2	3	3	2	2	2	1		1	2	1	1	3

### List of Experiments:

- Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).
- 2. Demonstrate how to create and drop database in MongoDB.
- 3. Creating the Collection in MongoDB.
- 4. a. Creating collection with options before inserting the documents and drop the collection created.



- b. Insert Documents in MongoDB collections.
- 5. To show limit () ,skip(), sort() methods in MongoDB.
- 6. To implement MongoDB projection.
- 7. MongoDB indexing.
  - a. Create index in MongoDB
  - b. Finding the indexes in a collection
  - c. Drop indexes in a collection
  - d. Drop all the indexes
- 8. Create simple objects and array objects using JSON
- 9. Implement Map reduce operation with suitable example using MongoDB.
- 10. Write a program to implement MongoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.



Semest											
Paper c	ode: AIDS310T	L	T/P	Credits							
Subject	ubject: TIME SERIES ANALYSIS AND FORECASTING303										
	g Scheme										
	s Continuous Evaluation: 25 Marks										
	n Theory Examination: 75 Marks										
	CTIONS TO PAPER SETTERS:			m Marks: 75							
	here should be 9 questions in the end term examination questio										
2. C	uestion No. 1 should be compulsory and cover the entire syllab	us. Th	is ques	tion should							
	ave objective or short answer type questions. It should be of 15										
3. A	part from Question No. 1, the rest of the paper shall consist	of fou	r units	as per the							
S	/llabus. Every unit should have two questions. However, stu	dents	may b	e asked to							
a	ttempt only 1 question from each unit. Each question should be	15 ma	rks.								
4. T	he questions are to be framed keeping in view the learning out	tcomes	s of cou	urse/paper.							
Т	he standard/ level of the questions to be asked should be at the	e level	of the	prescribed							
te	extbooks.										
5. T	he requirement of (scientific) calculators/ log-tables/ data-tak	oles m	ay be	specified if							
re	equired.										
Course	Objectives:										
1.	To learn about important time series models and their applica	tions i	n vario	us fields.							
2.	To use statistical software to estimate the models from real data, and draw conclusions										
	and develop solutions from the estimated models.										
3.	To communicate the statistical analyses of substantial data	sets th	rough	evolution							
				cripianatory							
	text, tables and graphs.			cxplanatory							
4.	text, tables and graphs. To combine and adapt different statistical models to analyze	larger	and m								
4.		larger	and m								
	To combine and adapt different statistical models to analyze	larger	and m								
Course	To combine and adapt different statistical models to analyze data.		and m								
<b>Course</b> CO1	To combine and adapt different statistical models to analyze data. Outcomes:	asting.		ore complex							
<b>Course</b> CO1	To combine and adapt different statistical models to analyze data. Outcomes: Knowledge of basic concepts in time series analysis and foreca	asting.		ore complex							
	To combine and adapt different statistical models to analyze data. Outcomes: Knowledge of basic concepts in time series analysis and foreca Understanding the use of time series models for forecas	asting.		ore complex							

Course Outcomes (CO) to Programme Outcomes (PO) Mapping												
(Scale 1: Low, 2: Medium, 3: High												: High)
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	1	1	1	1	2	1						2
CO2	2	2	2	2	1				1		1	2
CO3	2	2	2	2	1			1	1		1	2
CO4	3	2	2	3	2			1	1	1	2	3



#### **Course Overview:**

The course will provide a basic introduction to modern time series analysis. The course will cover time series regression and exploratory data analysis, ARMA/ARIMA models, model identification/estimation/linear operators. It involves identifying patterns and trends in time-varying data and making forecasts and predictions based on these patterns.

#### UNIT I

**INTRODUCTION OF TIME SERIES ANALYSIS:** Introduction to Time Series and Forecasting, Different types of data, Internal structures of time series. Models for time series analysis, Autocorrelation and Partial autocorrelation. Examples of Time series Nature and uses of forecasting, Forecasting Process, Data for forecasting, Resources for forecasting.

**STATISTICS BACKGROUND FOR FORECASTING:** Time Series Plots, Plotting Smoothed Data, Numerical Description of Time Series Data, Use of Data Transformations and Adjustments, General Approach to Time Series Modeling and Forecasting, Evaluating and Monitoring Forecasting Model Performance.

#### UNIT II

**TIME SERIES REGRESSION MODEL:** Introduction Least Squares Estimation in Linear Regression Models, Statistical Inference in Linear Regression, Prediction of New Observations, Model Adequacy Checking, Variable Selection Methods in Regression, Generalized and Weighted Least Squares, Regression Models for General Time Series Data, Exponential Smoothing, First order and Second order.

#### UNIT III

**AUTOREGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) MODELS:** Autoregressive Moving Average (ARMA) Models, Stationarity and Invertibility of ARMA Models, Checking for Stationarity using Variogram, Detecting Non stationarity, Autoregressive Integrated Moving Average (ARIMA) Models, Forecasting using ARIMA, Seasonal Data, Seasonal ARIMA Models Forecasting using Seasonal ARIMA Models Introduction, Finding the "BEST" Model, Example: Internet Users DataModel Selection Criteria - Impulse Response Function to Study the Differences in Models Comparing Impulse Response Functions for Competing Models.

#### UNIT IV

**MULTIVARIATE TIME SERIES MODELS AND FORECASTING:** Multivariate Time Series Models and Forecasting, Multivariate Stationary Process, Vector ARIMA Models, Vector AR (VAR) Models, Neural Networks and Forecasting Spectral Analysis, Bayesian Methods in Forecasting.

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#### Textbooks:

- 1. Introduction To Time Series Analysis and Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen (2015)
- 2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek Pal Dr. Pks Prakash (2017)
- 3. Time Series Analysis and Forecasting by Example Søren Bisgaard, Murat Kulahci, Technical University of Denmark Copyright © 2011 By John Wiley & Sons, Inc. All Rights Reserved.

#### **Reference Books:**

- 1. Peter J. Brockwell Richard A. Davis Introduction to Time Series and Forecasting Third Edition. (2016).
- 2. Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons Ltd.



Semest	er: 6 <sup>th</sup>											
Paper code: AIDS310P									L	T/P	Credit	S
Subject	ject: Time Series analysis and Forecasting Lab 0 2 1											
Markin	g Schem	е										
	rs Contir			-	1arks							
	m Exami											
	CTIONS		_	_						Maximu	m Mark	s: 60
	his is the	•	•			•	-					
	he practi											
	he intima			e of the	HOD/ In	stitutior	n in whic	h they ap	pear is t	peing off	ered fron	n the
	st of prac											
	nstructor					•	ments o	ver and	above t	the ment	tioned in	the
	xperimer		-		•							
	t least 8		ents mu	ist be pe	rtormed	by the s	tudents.					
	Objectiv											
1		oduce a	-									
2	To und	erstand	the ch	aracteri	stics of	Time se	ries dat	a using o	different	t time se	eries mo	dels.
Course	Outcom	es:										
CO1	Analysi	s of tin	ne seri	ies data	a and le	earn ba	asic con	cepts ir	n time	series r	egressio	n and
	Modeli	ng.										
CO2	Apply c	oncepts	of spe	ctral an	alysis ar	nd space	e-time n	nodels a	nd analy	sis of tir	ne serie	s data.
Course	Outcon		to Pro	gramm		mos (D	0) Man	ning				
Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3: High)												
CO/P	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO1	PO1	РО
0	1	2	3	4	5	6	7	8	9	0	1	12
CO1	2	2	1	3	2					2	2	2
CO2	2	2	3	3	3					2	2	2

### List of Experiments:

- 1. Exploratory analysis of time series data: Explore real world time series data set and visualize the data using various techniques, such as line charts, scatter plots, and time series decomposition.
- 2. Develop a program to understand Time Series Data Cleaning Model and Loading and Handling Times series data.
- 3. Study and differentiate several Pre-processing Techniques in Time Series analyses.
- 4. Write a Program to Check Stationarity of a Time Series data.



- 5. Create a system of Estimating & Eliminating Trend with the following:
  - Aggregation
  - Smoothing
  - Polynomial Fitting
- 6. Develop a program for Smoothing and Exponential smoothing of the Time analysis Data.
- 7. Write a program to check out the Time series Linear and non-linear trends.
- 8. Build an ARIMA model for a given time series data set, including identifying the order of differencing, selecting the appropriate AR and MA parameters, and evaluating the model's performance using various metrics, such as AIC, BIC, and MSE.
- 9. Write a program to demonstrate seasonal autoregressive integrated moving average model (SARIMA)
- 10. Create a system to demonstrate dependence Techniques using
  - Multivariate Analysis of Variance and Covariance
  - Canonical Correlation Analysis
- 11. Write a program to demonstrate factor analysis and cluster analysis
- 12. Forecasting: Create predictions and forecasts for a given time series data set using various techniques, such as ARIMA forecasting, exponential smoothing, and state space models and evaluate the accuracy of their forecasts using various metrics, such as MAPE, MAE, and RMSE.
- 13. Time series regression: Build a time series regression model that includes one or more explanatory variables and use it to make predictions and forecasts. Interpret the coefficients and assess the goodness of fit of the model using various metrics, such as R-squared and adjusted R-squared.



Semes	er: 6 <sup>th</sup>			
Paper	code: AIDS312T	L	T/P	Credits
Subjec	: Social Network Analytics	3	0	3
Markir	g Scheme			
Teache	rs Continuous Evaluation: 25 Marks			
End ter	m Theory Examination: 75 Marks			
INSTRU	ICTIONS TO PAPER SETTERS:	Ma	ximum	Marks: 75
2. ( 3. / 4 5	There should be 9 questions in the end term examination question pa Question No. 1 should be compulsory and cover the entire syllabus. Objective or short answer type questions. It should be of 15 marks. Apart from Question No. 1, the rest of the paper shall consist of fou Every unit should have two questions. However, students may be question from each unit. Each question should be 15 marks. The questions are to be framed keeping in view the learning outco tandard/ level of the questions to be asked should be at the level of the requirement of (scientific) calculators/ log-tables/ data-tables ma <b>Objectives:</b> To Understand the components and entities of the social netw To analyze social media data to comprehend user sentime	This q r units asked mes o the pre y be sp vork	as per t to attend f course escribed becified i	the syllabus. Impt only 1 /paper. The textbooks. f required.
	essential information appropriately.			
3.	Model and visualize the social network			
4.	Detect and analyze the communities in social networks			
Course	Outcomes:			
CO1	Understand the key concepts and theories of social network a	nalysis	5.	
CO2	Analyze social network data: Students should be able to collect social network data using various tools and software packages, and R			
CO3	Design a system to assimilate information available on the web Network Application			
CO4	Apply social network analysis to real-world problems in va strategies and recommendations based on their findings.	rious	fields a	nd develop

Course (	Dutcome	s (CO) to	Progra	amme O	utcome	s (PO) N	1apping					
								(	Scale 1:	Low, 2: N	/ledium,	3: High)
CO/PO	PO01	PO02	PO0	PO04	PO05	PO0	PO07	PO08	PO09	PO10	PO11	PO12
			3			6						
CO1	2	1	2	-	-	1	-	-	-	-	1	-
CO2	2	1	2	1	3	1	-	1	1	1	1	1
CO3	2	1	2	1	-	1	-	1	-	1	1	-
CO4	2	1	2	1	2	2	1	1	1	1	1	1



#### **Course Overview:**

This course explores the use of social network analysis to understand the growing connectivity and complexity in the world around us on different scales-ranging from small groups to the World Wide Web. It examines how we create social, economic, and technological networks, and how these networks enable and constrain our attitudes and behavior. The course will discuss how social network concepts, theories, and visual-analytic methods are being used to map, measure, understand, and design a wide range of phenomena such as social networking sites, recommender systems, trust and reputation systems, search engines.

#### UNIT-I

**Fundamentals of Social Network Analysis:** Social Network Perspective, Fundamentals concepts in Network Analysis: Sociogram, Sociometry. Social Network Data: Types of Networks: One-Mode, Two-Mode, Affiliation, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Notations for Social Network Data: Graphs, Directed, Singed, Valued graphs, Multigraph, Relations and Matrices.

#### UNIT-II

**Centrality and Prestige:** Prominence: Actor-Centrality, Prestige, Group-Centrality, Prestige, Non directional Relations-Degree, Closeness, Betweenness, Eigen Vector Centrality, Directional Relations-Centrality, Prestige.

**Structural Balance and Transitivity:** Structural Balance: Signed Non directional, Signed Directional Relations, Checking for Balance, Index for Balance, Clusterability-Theorems, Clustering Coefficient and Transitivity.

#### UNIT-III

**Cohesive Subgroups:** Social Group and Subgroup-Notation, Subgroups Based on Complete Mutuality: Clique, Reachability and Diameter: n-cliques, n-clans and n-clubs, Subgroups Based on Nodal Degree: k-plexes, k-cores, Measures of Subgroup Cohesion, Community detection using Subgroups and Betweenness.

Roles and Positions: Structural Equivalence: Definition, Social Roles and, Positional Analysis, Measuring Structural Equivalence, Representation of Network Positions, Block Models-Introduction, Network Positions and roles-Introduction

#### UNIT-IV

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**Dyadic and Triadic Methods**: Dyads: Definitions, Dyad Census, Index, Simple Distributions, Triads: Random Models and Substantive Hypotheses, Triad Census, Distribution of a Triad Census- Mean and Variance, Testing Structural Hypotheses.

**Models in Social Network:** Small world network- Watt Strogatz networks - statistical models for social networks - network evaluation model - Preferential attachment - power law - Random Model : Erdos -Renyi model - Barabasi Albert model - Epidemic model - Case study: Text and opinion Analysis

# Textbooks:

- Wasserman Stanley, and Katherine Faust, Social Network Analysis: Methods and Applications, Structural Analysis in the Social Sciences. Cambridge University Press, 2012 Online Edition.
- 2. Albert-László Barabási, Network Science, Cambridge University Press, 1st edition, 2016.

# **Reference Books:**

- 1. John Scott, "Social Network Analysis", Sage Publications Ltd., Fourth Edition, 2017.
- 2. David Knoke & Song Yang, "Social Network Analysis", Sage Publishing, Third Edition, 2020





Semeste	r: 6 <sup>th</sup>											
Paper co	de: Al	DS312P							L	T/P	Cre	dits
Subject:	Social	Netwo	rk Ana	alytics L	ab				0	2	1	
Marking												
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Course C	-											
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4						_	blome	on coci	ial netw	ork and	analy	za tha
4		nunitie					Diems		a netw		allaly	ze the
Course C			5 11 300		WULK3.							
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CO2	-				•		-			modela	nd hui	ld Social
002		ork Ap								modere		
Course (					ne Outo	comes	(PO) M	apping				
			,	-0.4.11			(. =) 140	•••	e 1: Low	. 2: Med	lium. 3	: High)
CO/P	PO	РО	PO	РО	PO	РО	PO	PO	PO	PO	PO	PO
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	2	2	3	1	-	1	-	1	1	-
CO2	2	2	2	2	3	2	1	1	1	1	1	1

# LIST OF EXPERIMENTS:

- 1. Study and demonstrate to find the basic properties of a Graph/Social Network.
- 2. Demonstrate the calculation of Centrality measures.
- 3. Demonstrate the ranking of web pages in a web graph.
- 4. Find divisions in a Social Network.
- 5. Implement Community Detection algorithms on a Social Network.



- 6. Demonstrate modeling of Social Networks.
- 7. Visualize a multidimensional Social Network.
- 8. Applications of Classification and Clustering on a Social Network.
- 9. Design and implement a Sentiment Analyzer.
- 10. Design and implement a Social Network.



Semest	er: 6 <sup>th</sup>											
Paper o	ode: A	IDS314	T/AIM	L316T					L	T/P	C	edits
Subject	: Quar	ntum Co	omput	ing					4	0		4
Markin	g Scher	ne										
Teache	rs Cont	inuous	Evalua	ation: 2	25 Mark	S						
End ter	m Theo	ory Exa	minati	on: 75	Marks							
I	NSTRU	CTIONS	TO PA	<b>APER SI</b>	ETTERS:				Maxi	mum N	1arks: 6	0
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					•	•			entire sy		•	
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		-	•						ould be			
	-					-	-		e learni	-		
						of the c	questio	ns to be	e asked s	should	be at th	ne level
		rescribe						, .				
	-		nt of (	scientii	ric) calci	ulators	/ log-ta	bles/ da	ata-tabl	es may	be spe	cified if
	equired											
Course			الم ما	. ما م م ام م	+	م م م م	ما + ام م					
1.					to und	derstan	ia the	quantu	im com	puting	and q	uantum
2		nation i			ithma a	nd com	noro of	ffactive				aarithm
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5.		•		-	lement i					phenon	nena s	such as
4.	-	-				-		-		catod	annlica	tions of
4.		um cor		• •	erations	s lo u	evelop	more	sopnisti	cateu	аррпса	LIONS OF
Course			nputin	<u>چ</u> .								
Course												
CO1	Analy	se the k	pehavio	or of ba	asic qua	ntum a	algorith	ms.				
CO2	Imple	ment si	imple d	quantu	m algor	ithms a	and info	ormatio	n chann	els in th	ne quan	tum
COZ	circuit	t model	l.									
CO3	Simul	ate a si	mple a	uantur	m error-	correc	ting cod	de.				
COS												
CO4	Gain i	nsights	into q	uantur	n securi	ty.						
Course	e Outco	mes (C	O) to F	Program	nme Ou	itcome	es (PO)	Mappin	g			
								(Scal	le 1: Lov	v, 2: Me	edium,	3: High)
CO/P	РО	PO	PO	РО	РО	РО	РО	РО	РО	РО	РО	PO1
0	01	02	03	04	05	06	07	08	09	10	11	2
CO1	2	1	2	-	-	1	-	-	-	-	1	-
CO2	2	1	2	1	3	1	-	1	1	1	1	1
CO3	2	1	2	1	-	1	-	1	-	1	1	-
CO4	2	1	2	1	2	2	1	1	1	1	1	1



#### **Course Overview:**

The course will help students not only in specialising in the existing and changing technologies but also in various fields of R&D and electronic manufacturing. Since Quantum computers can solve computational problems faster than classical computers, Quantum Computing will help you surge ahead in your career. Quantum Computing course will help you solve problems above a specific size and complexity.

#### **UNIT I: Introduction: Quantum Measurements**

Introduction to Quantum Mechanics and Quantum Computing, Applications and Future of Quantum computing, Quantum Gates and Circuits. Optical approaches to Quantum Computing. Limits of approaches

# UNIT II: Quantum Basics and Principles

Quantum Basics and Principles: No cloning theorem & Quantum Teleportation, Bell's inequality and its implications, Quantum Algorithms & Circuits. Quantum Measurements Density Matrices, Fragility of quantum information: Decoherence, Quantum Superposition, and Entanglement

#### **UNIT III: Algorithms**

Algorithms: Deutsch and Deutsch–Jozsa algorithms, Grover's Search Algorithm, Quantum Fourier Transform, Shore's Factorization Algorithm. Quantum Computing Models: NMR Quantum Computing, Spintronics, Linear Optical MODEL, Nonlinear

# UNIT IV: Performance, Security and Scalability

Performance, Security and Scalability: Quantum Error Correction: Fault tolerance; Quantum Cryptography, Implementing Quantum Computing: issues of fidelity; Scalability in quantum computing.

#### Text Books:

- 1. Eric R. Johnston, Nic Harrigan, Mercedes and Gimeno-Segovia "Programming Quantum Computers: Essential Algorithms and Code Samples, SHROFF/ O'Reilly.
- 2. V.K Sahni, Quantum Computing (with CD), TATA McGraw-Hill.

# **Reference Books:**

- 1. Chris Bernhardt, Quantum Computing for Everyone (The MIT Press).
- 2. Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Information", Cambridge (2002).
- 3. Riley Tipton Perry, "Quantum Computing from the Ground Up", World Scientific Publishing Ltd (2012).
- 4. Scott Aaronson, "Quantum Computing since Democritus", Cambridge (2013).
- 5. P. Kok, B. Lovett, "Introduction to Optical Quantum Information Processing", Cambridge.

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Semest	er: 6 <sup>th</sup>												
Paper o	ode: Al	DS316	Γ/ΑΙΜ	L318T					L	T,	/P	Cre	edits
Subject	t: Cogn	itive Co	mputi	ng					4	0		4	
Markin	g Scher	ne											
1.	Teache	rs Cont	inuous	Evalua	ation: 25	5 Mark	S						
					on: 75 N	/larks							
INSTRU	ICTIONS	S ТО РА	PER S	ETTERS	5:				Ν	/laxim	um	Marl	ks: 60
1. 1	There sh	nould be	e 9 que	estions	in the e	end ter	m exan	nination	questio	n pape	er.		
					•	•			-		•	uesti	on should
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	•												is per the
		-				•						у ре	asked to
	-	-	-				-		ould be			ome	es of the
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	•				er addit	ional e	xperim	ents ove	er and a	bove t	the	men	tioned in
				•	ey think		-		-				
6. 1	he req	uireme	nt of (	scienti	fic) calc	ulators	s/ log-t	ables/ d	lata-tab	les ma	ay b	e sp	ecified if
r	equired	ł.											
Course	Object	ives:											
1	Identi	fy how <sup>·</sup>	the co	ncept o	of cognit	tive cor	mputin	g evolve	d.				
2	Analyz	ze the	workir	ng of k	nardwar	e and	softwa	ire tech	nologie	s behi	nd	the	cognitive
	compi	-											
3	-					-				Process	sing	and	Big Data
								ng soluti					
4		-	use ca	ses and	applica	ations of	of cogn	tive cor	nputing	•			
	Outcor												
CO1	To ide	ntify ho	ow the	conce	ot of co	gnitive	compu	ting evo	lved.				
CO2	To ana	alyze th	e elem	ients tł	nat mak	e up a	cognitiv	/e comp	uting sy	stem.			
CO3	To cor	nceptua	lize ho	ow Arti	ficial Int	elligen	ice, Nat	ural Lar	nguage l	Process	sing	and	Big Data
					-		•	ng soluti					
CO4	To im	olemen	t the c	ognitiv	e mode	ls that	apply t	o differe	ent real-	life sce	enar	ios.	
Course	e Outco	mes (C	O) to P	rogran	nme Ou	tcome	s (PO) I	Mapping (S		ow. 2.	Me	dium	n, 3: High)
CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	-	20	PO12
0	01	02	03	04	05	06	07	08	09	10	1	1	
CO1	2	1	2	-	-	-	-	-	-	-	1		-
CO2	2	1	2	1	3	-	-	-	1	1	1		1
CO3	2	1	2	1	-	-	-	-	-	1	1		-
CO4	2	1	2	1	2	-	-	-	1	1	1		1



#### **Course Overview:**

This course has been designed to make students understand cognitive computing's underlying technologies. This course covers knowledge representation techniques and natural language processing algorithms and dynamic learning approaches based on accumulated evidence rather than reprogramming. Number of case studies have also been covered as part of this course to help the students go through step-by-step design and testing of cognitive systems. The IBM's Watson cognitive platform has also been covered in the syllabus.

#### Unit I

Introduction: Foundations of cognitive computing, Elements of cognitive system, Two systems of judgement and choice, Understanding complex relationship between systems, Design principles for cognitive systems, NLP in support of cognitive systems, Applying NLP to business problems.

#### Unit II

Relationship between big data and cognitive computing: Dealing with human generated data, Analytical data warehousing, Data in motion and streaming data, Integration of big data with traditional data, Knowledge representation models.

#### Unit III

Advanced analytics to cognitive computing: Key capabilities in advanced computing, Using advanced analytics to create value, Impact of open source tools on advanced analytics, Role of cloud and distributed computing in cognitive computing: Cloud computing models, Delivery models of cloud, Managing workloads, Security and governance, Data integration and management in cloud.

# Unit IV

Business implications of cognitive computing, IBM's watson as a cognitive system, Process of building a cognitive application, Emerging cognitive areas and future applications, Case Studies: Cognitive healthcare application and smarter cities: cognitive computing in government.

# Textbooks:

- 1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley, 2015.
- 2. Rob High and Tanmay Bakshi, Cognitive Computing with IBM Watson: Build Smart Applications Using Artificial Intelligence as a Service (1 ed.), 2019.

# **Reference Books:**

- 1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind (3 ed.), Cambridge University Press, 2020. ISBN 978-1108440349.
- 2. Adnan Masood and Adnan Hashmi, Cognitive Computing Recipes
- 3. Artificial Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, Foreword by Matt Winkler, Apress

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Semest	er: 6 <sup>th</sup>											
Paper c	ode: Al	DS318T	/AIML	320T					L	T/P	Cred	its
Subject	: Biom	edical D	Data Ar	nalysis					4	0	4	
Markin	g Schen	ne										
Teache	rs Conti	nuous E	Evaluat	ion: 25	Marks							
	m Theo	,										
	CTIONS		_	_						Maximu	ım Mar	ks: 60
2. C h 3. A s a 4. T c t 5. II t 6. T	have obj Apart fro yllabus. The que tourse/p he prese nstructo he expe	n No. 1 s ective of Dom Que Every only 1 of estions Daper. T cribed t prs can a eriment uiremer	should or shor estion I unit sh questic are to he star extboo add an list wh	be com t answe No. 1, t nould h on from o be fr ndard/ oks. y other ich the	ipulsory er type o he rest ave two each un ramed level of additio y think i	and co questio of the o ques nit. Eac keeping the que nal exp is impo	over the ns. It sh paper s tions. H h quest g in vio estions erimen rtant.	entire s ould be shall con lowever ion sho ew the to be as ts over a	syllabus. of 15 n nsist of r, stude uld be 1 learnir sked sho and abo	This qu	its as po be ask omes c at the le	er the ed to of the evel of ed in
	Objecti											
1	To fam	niliarize	studer	nts with	Fundar	mental	s of Bior	nedical	Image I	Processi	ng	
2	To use	image	proces	sing teo	chnique	s in dif	ferent b	iomedi	cal appli	ications		
3	To ana	lyze Mi	ulti-Sca	le and	Multi-O	rientat	ion Me	dical Im	age			
4	To ap applica		ature	Extracti	on and	l Selec	tion fo	r Decis	ion Ma	iking in	biome	dical
Course	Outcon	nes:										
CO1	Under	stand th	ne fund	dament	als of bi	iomedi	cal data	analyti	CS			
CO2	Analyz	e image	e proce	essing te	echniqu	es in di	fferent	biomec	lical app	lication	S	
CO3	Apply	Texture	e Featu	res in b	iomedio	cal appl	ications	5				
CO4	Design	decisio	on mak	ing bas	ed solut	tions fo	or medic	al diagr	nosis			
Course	Outcor	mes (CC	D) to Pi	rogram	me Out	comes	(PO) M		e 1: Low	, 2: Mec	lium, 3:	High)
CO/P	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1		1	-	1	-	1	-	-	2	1	-	2
CO2	1	2	1	1	1	1	2	1	2	2	2	2
CO3	2	2	1	1	1	1	2	1	2	2	2	2
CO4	2	2	2	2	2	2	2	2	3	2	3	3



**Prerequisite**: Fundamentals of Machine Learning and Data Mining Concepts.

### **Course Overview:**

The aim of Biomedical Data Analysis is to equip students with the necessary skills and knowledge to analyze and interpret complex biomedical data. The course aims to provide students with a solid understanding of the different types of biomedical data and the methods and techniques used for their analysis.

#### UNIT I:

**Fundamentals of Biomedical Image Processing:** Introduction, Medical Image Formation, Image Enhancement, Image Data Visualization, Visual Feature Extraction, Segmentation, Classification, Quantitative Measurements and Interpretation, Image Management

**Fusion of PET and MRI for Hybrid Imaging:** Positron Emission Tomography, Magnetic Resonance Imaging, Hybrid PET Fusion System

#### UNIT II:

**Cardiac 4D Ultrasound Imaging:** The Role of Ultrasound in Clinical Cardiology, Principles of Ultrasound Image Formation, Limitations of 2D Cardiac Ultrasound, Approaches Towards 3D Cardiac Ultrasound, Validation of 3D Cardiac Ultrasound Methodologies, Remaining Challenges in 4D Cardiac Ultrasound.

**Morphological Image Processing Applied in Biomedicine:** Introduction, Binary Morphology, Gray-Scale Operations, Watershed Segmentation, Segmentation of Diffusion MRI

# UNIT III:

**Texture in Biomedical Images:** Characterizing the Texture of Swatches, Simultaneous Texture Segmentation, Examples of the Use of Texture Features in Biomedical Applications.

**Multi-Scale and Multi-Orientation Medical Image Analysis:** The Necessity of Scale, Differential Invariants, Second Order Image Structure and Features, Third Order Image Structure: T-Junctions, Adaptive Blurring and Geometry-Driven Diffusion, Edge Focusing, Orientation Analysis.

# UNIT IV:

**Feature Extraction and Selection for Decision Making:** Introduction, Image Representation, Image Features and Distance Functions, Feature Selection, Association Rule Mining. Case Study: Improving Computer-Aided Diagnosis by Association Rule Mining.

**Melanoma Diagnosis:** The Cutaneous Melanoma, State of the Art in CM Diagnosis, Dermoscopy Image Analysis, Commercial Systems, Evaluation Issues.

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# Text Books:

- 1. Thomas M. Deserno, "Biomedical Image Processing", ei Springer.
- 2. G.R. Sinha, B.C. Patel, "Medical Image Processing: Concepts and Applications", PHI, 2014.
- 3. Christo\_El\_Morr, Hossam\_Ali-Hassan, "Analytics in Healthcare A Practical Introduction", Springer Briefs in Health Care Management and Economics.

# **Reference Books:**

- 1. Peter White, "Data-Handling in Biomedical Science", Cambridge University Press.
- 2. Peter Langkafel (Ed.), "Big Data in Medical Science and Healthcare Management", De Gruyter.
- 3. Kerstin Denecke, "Health Web Science: Social Media Data for Healthcare", Springer.



Semest	er: 6 <sup>th</sup>			
Paper c	ode: AIDS320T/AIML322T	L	T/P	Credits
Subject	: AI & Sustainable Computing	4	0	4
Markin	g Scheme	•		
Teache	s Continuous Evaluation: 25 Marks			
End ter	n Theory Examination: 75 Marks			
INSTRU	CTIONS TO PAPER SETTERS:	N	laximu	m Marks: 60
1. T	here should be 9 questions in the end term examination que	estion	paper.	
2. C	uestion No. 1 should be compulsory and cover the entire syll	abus. T	This que	stion should
h	ave objective or short answer type questions. It should be o	f 15 m	arks.	
	part from Question No. 1, the rest of the paper shall consi			•
	yllabus. Every unit should have two questions. However, s		-	
	ttempt only 1 question from each unit. Each question should			
	he questions are to be framed keeping in view the le	-		
	ourse/paper. The standard/ level of the questions to be aske	d shoi	lid be a	t the level of
	ne prescribed textbooks.	d a hav	a tha m	antionad in
	nstructors can add any other additional experiments over and ne experiment list which they think is important.	vous i	e the m	entioned in
	he requirement of (scientific) calculators/ log-tables/ data-t	ablas	may bo	specified if
	equired.	abies		specified if
	Objectives:			
1	To understand how to distill a real-world challenge as	an ar	tificial	intelligence
-	problem, involving explicit representation and learning of			-
	models; reasoning about such models; and using such models;	•		
	action selection, and interaction with humans.			0,
2	To design, analyze, implement, and use state-of-the-art a	AI and	l machi	ne learning
	techniques for dealing with real-world data, including data in	nvolvir	ng visior	n, language,
	perception, and uncertainty.			
3	To recognize the social impact of artificial intelligen	ce an	d the	underlying
	responsibility to consider the ethical, privacy, moral, a	nd leg	gal imp	lications of
	artificial intelligence technologies.			
4	To inculcate the responsibilities to use AI and ethical decision	ons al	bout the	e tools they
	designed.			
	Outcomes:			
CO1	Understand the significance of artificial intelligence in the s			
CO2	Analyze the social and cultural aspects and implications of a			
CO3	Attain knowledge about the potential transformative e	effects	of the	e emerging
	technologies	<u> </u>		
CO4	Gain insights about the role of artificial intelligence in differ	ent ve	rticals.	



Course	e Outco	mes (CO	D) to F	rogran	nme Ou	tcome	s (PO) N					. 11:ab)
CO/P	PO	PO	PO	PO	PO	PO	PO	(Scal	le 1: Lov <b>PO</b>	v, 2: ivie <b>PO</b>	aium, 3 <b>PO</b>	: Hign) <b>PO</b>
-								_				
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1		1	-	1	-	1	-	-	2	1	-	1
CO2	1	2	1	1	1	1	2	1	2	2	2	1
CO3	2	2	1	1	1	1	2	1	2	2	2	2
CO4	2	2	2	2	2	2	2	2	3	2	3	2

#### **Course Overview:**

The course will help students in exploring the relationship between Artificial Intelligence and Humanity on an overall premise. It reflects upon how the world is changing with the advent and exponential increase of Artificial Intelligence in all verticals of society. This course will assist you in students in attaining wisdom regarding the potential effects of the emerging technologies in Artificial Intelligence. Role of Artificial Intelligence in business domain, governance and marketing shall be explored in this course.

#### UNIT I:

AI & Society: Relation of AI with Knowledge, Culture and Communication. Implications of AI: Cultural, Social, Cognitive, Economic, Ethical and Philosophical. Societal and cultural impacts of AI, New Media Technologies: Design, Use, Management, Policy of Information and Communication. Impact of AI: Impact of AI on governance, Impact of AI on information security, Impact of AI in the corporate sector and community welfare. AI in information technologies, humanities, social sciences, arts, and sciences.

#### UNIT II:

Potential and Transformative Impacts: Critical consequences of AI, Latest technological innovations. Applications of emerging technologies in day-to-day life. Societal dimension of research: benefits, impacts, and implications on society. AI and research ethics. Forces influencing AI: trust, biases, privacy, reliability, responsibility, and competence.

#### UNIT III:

Encashing AI: AI for Business, AI in the Organization Structure, AI-based data infrastructure, Impact of recommenders on markets Applications in Finance: Fraud Detection and Stock Market Prediction, Market adoption, and barriers. AI & Gaming Industry. AI Strategy and Governance: AI Strategy and Governance Agenda, AI-Driven Business Transformation. Developing a Portfolio of AI Projects, Lowering Barriers to AI Use



# UNIT IV:

Green IT and sustainability, ecological footprint of IT, and the issues of lifecycle, sustainability, life cycle assessment and code of conducts; energy measurement and other useful metrics for Green IT, Usage of software tools and hardware to measure and estimate energy consumption; **Sustainable software:** Ecological design, applying good practices to write energy efficient software; energy footprint of data centers and cloud computing, standards and good practices for energy efficiency in servers,

#### Text Books:

- 1. AI for People and Business, by Alex Castrounis, 2019, O'Reilly Media, Inc.
- 2. Green Computing: Tools and Techniques for Saving Energy, Money, and Resources, Bud E. Smith, Auerbach Publications
- 3. 2084: Artificial Intelligence, the Future of Humanity, and the God Question: Artificial Intelligence and the Future of Humanity, 2020, by John C. Lennox, Zondervan

#### **Reference Books:**

- 1. The Age of AI: And Our Human Future (B PB) Paperback Import, 4 August 2022 by <u>Daniel</u> <u>Huttenlocher</u>, <u>III Schmidt, Eric</u>, <u>Henry A Kissinger</u>
- 2. Green Internet of Things and Machine Learning, Roshani Raut, Sandeep Kautish, Zdzislaw Polkowski, Anil Kumar, Chuan-Ming Liu, John Wiley & Sons, 10-Jan-2022.



	ter: 6 <sup>th</sup>												
Paper	code: A	DS322T	/AIML3	324T					L	T/F	Р	Cred	its
Subjec	t: Virtu	al and A	Augmen	ted Rea	lity				4	0		4	
Markir	ng Scher	ne											
1.	Teacher	rs Contin	uous Eva	aluation:	25 Mar	ks							
2.	End terr	m Theory	y Examin	ation: 7	5 Marks								
-	UCTION		-	-				Maxim	-	-			
2. (   3. /	There sh Questio have ob Apart fr syllabus attempt	n No. 1 jective o om Que . Every	should or short estion N unit sh	be comp answer Io. 1, th Iould ha	pulsory type qu ne rest ave two	and covuestions of the population	ver the e a It shou paper shou ons. Ho	entire so uld be o nall con owever,	yllabu f 15 r sist c stud	is. Th mark of foi lents	his qu ks. ur un s may	its as p	er the
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	e Objec												
1.	Under	stand h	low the	e desigr	n of VR	techno	ology re	-lates t	o hu	man	nerc	eption	and
	cognit	ion							0 110	man	i pere	00000	
2.		s applic	ations o	of VR to									
2.	Discus design Learn experi	s applic the fur ments u	ndamen Ising VR	tal aspe	the con ects of	duct of designi	scientifing and	c resea	rch, t nentir	raini ng ri	ng, an gorou	id indus is empi	trial rical
	Discus design Learn experi	s applic the fur	ndamen Ising VR	tal aspe	the con ects of	duct of designi	scientifing and	c resea	rch, t nentir	raini ng ri	ng, an gorou	id indus is empi	trial rical
3. 4.	Discus design Learn experi Learn techni	s applic the fur ments u about m ques foi	ndamen Ising VR Nultimoo	tal aspe  dal virtu	the con ects of al displa	duct of designin	scientifing and	c reseat implem	rch, t nentir	raini ng ri	ng, an gorou	id indus is empi	trial rical
3. 4.	Discus design Learn experi Learn	s applic the fur ments u about m ques foi	ndamen Ising VR Nultimoo	tal aspe  dal virtu	the con ects of al displa	duct of designin	scientifing and	c reseat implem	rch, t nentir	raini ng ri	ng, an gorou	id indus is empi	trial rical
3. 4. Cours	Discus design Learn experi Learn techni <b>e Outco</b>	s applic the fur ments u about m ques foi	ndamen Ising VR nultimoo r evalua	tal aspe  dal virtu ting goo	the con ects of al displa od and b	duct of designin ays for c pad virtu	scientifing and conveyir	c resear implem ng and p faces.	rch, t nentir prese	rainii ng rij nting	ng, an gorou g infor	id indus is empi	trial rical
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3. 4. Cours CO1 CO2	Discus design Learn Learn techni <b>e Outco</b> Under Desigr hardw Analyz	s applic the fur ments u about m ques for mes: standin ning and vare.	ndamen using VR nultimoo r evalua g the fu I develo evaluat nd VR to	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i	the con ects of al displa od and b ntal con and VR usabilit real-wo	duct of designin ays for c bad virtu cepts an cepts an applica ay and e rld prob	scientifi ng and conveyir ual inter nd techr itions us	c resear implem ng and p faces. nologies sing app ness of	rch, t nentir prese s of A propri	nting R and ate s	ng, an gorou g infor d VR. softwa R appl	id indus is empi mation are and ications	trial rical and
3. 4. Cours CO1 CO2 CO3	Discus design Learn Learn techni <b>e Outco</b> Under Desigr hardw Analyz	s applic the fur ments u about m ques for omes: omes: ostandin ning and vare. zing and	ndamen using VR nultimoo r evalua g the fu I develo evaluat nd VR to	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i	the con ects of al displa od and b ntal con and VR usabilit real-wo	duct of designin ays for c bad virtu cepts an cepts an applica ay and e rld prob	scientifi ng and conveyir ual inter nd techr itions us	c resear implem ng and p faces. nologies sing app ness of	rch, t nentir prese s of A propri	rainin ng ri nting R and ate s nd VF	ng, an gorou g infor d VR. softwa R appl	id indus is empi mation are and ications	trial rical and
3. 4. Cours CO1 CO2 CO3 CO4	Discus design Learn experi Learn techni <b>e Outco</b> Under Desigr hardw Analyz Applyi Health	s applic the fur ments u about m ques for mes: standin ning and vare. zing and ng AR a ncare, er	ndamen using VR nultimoo r evalua g the fu develo evaluat nd VR to ntertain	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i ment, a	the con ects of al displa od and k ntal con and VR usabilit real-wo nd trair	duct of designin ays for c bad virtu cepts an cepts ar applica ay and e rld prob ning.	scientifi ng and conveyir ual inter nd techr tions us ffective	c resear implem ng and p faces. nologies sing app ness of differen	rch, t nentir prese s of A propri AR ar nt fie	raining ng rip nting ate s nd VF	ng, an gorou g infor d VR. softwa R appl uch as	id indus is empi mation are and ications is educat	trial rical and
3. 4. Cours CO1 CO2 CO3 CO4 CO/	Discus design Learn techni e Outco Under Desigr hardw Analyz Applyi Health PO0	s applic the fur ments u about m ques for mes: standin ning and vare. zing and ng AR a ncare, er PO0	ndamen using VR nultimoo r evalua g the fu l develo evaluat nd VR to ntertain <b>PO0</b>	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i ment, a <b>PO0</b>	the con ects of al displa od and b ntal con and VR usabilit real-wo nd trair <b>PO0</b>	duct of designin ays for c bad virtu cepts ar cepts ar applica ty and e rld prob hing. <b>PO0</b>	scientifi ng and conveyir ual inter nd techr itions us ffective lems in	c resear implem ng and p faces. nologies sing app ness of differen	rch, t nentir preser s of A propri AR ar nt fie	raining ng rip nting ate s nd VF	ng, an gorou g infor d VR. softwa R appl uch as <b>PO1</b>	id indus is empi mation are and ications s educat	trial rical and 5. tion, <b>PO1</b>
3. 4. Cours CO1 CO2 CO3 CO4 CO4 CO/ PO	Discus design Learn techni <b>e Outco</b> Under Desigr hardw Analyz Applyi Health <b>PO0</b> <b>1</b>	s applic the fur ments u about m ques for omes: standin ring and vare. zing and vare. zing and page a poo 2	ndamen using VR nultimoo r evalua g the fu develo evaluat nd VR to ntertain <b>PO0</b> <b>3</b>	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i ment, a <b>POO</b> 4	the con ects of al displa od and k ntal con and VR usabilit real-wo nd trair <b>PO0</b> <b>5</b>	duct of designin ays for c bad virtu cepts an cepts an ce	scientifi ng and conveyir ual inter nd techr itions us ffective lems in <b>PO0</b> <b>7</b>	c resear implem ng and p faces. nologies sing app ness of differen	rch, t nentir preser s of A propri AR ar nt fie	raining ng rip nting ate s nd VF	ng, an gorou g infor d VR. softwa R appl uch as <b>PO1</b>	id indus is empi mation are and ications s educat	trial rical and 5. tion, <b>PO1</b>
3. 4. Cours CO1 CO2 CO3 CO4 CO4 CO/ PO CO1	Discus design Learn techni <b>e Outco</b> Under Desigr hardw Analyz Applyi Health <b>PO0</b> <b>1</b> 2	s applic the fur ments u about m ques for omes: standin ring and vare. zing and vare. zing and pare, er PO0 2 2	ndamen Ising VR Nultimoo r evalua g the fu I develo evaluat nd VR to ntertain <b>PO0</b> <b>3</b> 2	tal aspe dal virtu ting goo ndamer ping AR ting the o solve i ment, a <b>PO0</b> <b>4</b> 2	the con ects of al displa od and k ntal con and VR usabilit real-wo nd trair <b>PO0</b> <b>5</b> 3	duct of designin ays for c bad virtu cepts an cepts an ce	scientifi ng and conveyir ual inter nd techr itions us ffective lems in <b>PO0</b> <b>7</b> 3	c resear implem ng and p faces. nologies sing app ness of differen	rch, t nentir preser s of A propri AR ar nt fie	raining ng rip nting ate s nd VF	ng, an gorou g infor d VR. softwa R appl uch as <b>PO1</b>	id indus is empi mation are and ications s educat	trial rical and 5. tion,



# **Course Overview:**

The aim of the course is to provide students with the necessary skills and knowledge to understand, design, develop, and apply AR and VR technologies in various fields. This Course aims to introduce students to the fundamental concepts and technologies of AR and VR, including the hardware and software used to create and experience these immersive environments.

#### UNIT I

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality - Primary Features and Present Development on Virtual Reality - Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker - Sensor - Digital Glove - Movement Capture - Videobased Input - 3D Menus & 3DScanner – Output - Visual /Auditory / Haptic Devices.

#### UNIT II

Visual Computation in Virtual Reality: Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large-Scale Environments & Real Time Rendering.

#### UNIT III

Interactive Techniques in Virtual Reality: Body Track - Hand Gesture - 3D Manus - Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega - MultiGen - Virtools.

**Application of VR in Digital Entertainment:** VR Technology in Film & TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

#### **UNIT IV**

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

#### Text Books

- 1. Burdea, G. C., P. Coffet., "Virtual Reality Technology", Second Edition, Wiley-IEEE Press, 2003/2006.
- 2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.

#### **Reference Books**

1. Alan Craig, William Sherman, Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.



Semest	er: 6 <sup>th</sup>											
Paper c	ode: Al	ML308T	/AIDS	324T					L	Т/І	P C	redits
Subject	: Netw	ork Scie	ence						3	0		3
Marking	g Schen	ne										
Teacher	s Conti	nuous E	valuat	ion: 25	Marks							
End teri	n Theo	ry Exam	inatior	า: 75 M	arks							
INSTRU	CTIONS	TO PA	PER SE	TTERS:						Maxir	num Ma	arks: 75
1. T	here sh	ould be	9 que	stions i	n the en	d term	examin	ation qu	uestion p	paper		
2. C	uestior	n No. 1	should	l be coi	mpulsor	y and o	over th	e entire	e syllabu	s. This	questior	should
	-								of 15 ma			
	•											syllabus.
				•						asked to	attemp	t only 1
					questio						,	
	•				•	-		-				per. The
			of the	e quest	ions to	be ask	ked sho	uld be	at the	evel of	the pre	escribed
	extbook		t of (	colontif		lators	/ 109 +0	bloc/d	ata tabl		ha cha	aified if
	equired			scientii	ic) calci	liators	log-la	bles/ u		es may	be spe	cified if
Course												
1.			nd tho	undarlı	ving heh	aviour	and pro	nortios	ofvariou	is types	ofnotw	orks with
1.		nelp of i				avioui	and pro	perties		is types	Unietw	
2		•					ما: م <del>د</del> دام			+ + + + + + + + + + + + + + + + + + + +		ida araa
2.				science	principie	es to pr	edict th	e dynan	nics and	the top	biogy a v	vide area
		al netw										
3.				-		-		d attack	toleran	ce of co	omplex	networks
			-		cading f							
4.	То а	nalyze r	networ	k epide	mics to	quantif	y and fo	precast t	he sprea	ad of inf	ectious	diseases.
Course	Outcon	nes:										
CO1	Iden	tify the	e govei	rning n	nathema	itical p	rinciple	s behin	d the a	rchitect	ure of i	networks
	eme	rging in	variou	is doma	ins of so	cience,	nature	and tecl	nnology.			
CO2	Арр	y the k	nowled	dge of	network	scienc	e to cla	assify va	rious ty	pes of ı	network	s to gain
	impo	ortant ir	nferend	ces.								
CO3	Арр	y releva	ant me	easures	to clas	sify the	e struct	ure of r	network	s and s	hows ho	w these
	mea	sures ca	an diffe	erentiat	e betwe	en diff	erent ty	pes of r	andom a	and real	-world n	etworks.
CO4	Ana	yse the	netwo	rk data	associa	ted wit	, h inforn	nation t	hat char	nges ove	er time.	
Course	Outco	mes (CC	D) to P	rogram	me Out	comes	(PO) Ma	apping				
		1			1		1	· ·	1	,	1	n, 3: High)
CO/P	РО	РО	РО	РО	PO	РО	РО	РО	PO	РО	PO	PO12
0	01	02	03	04	05	06	07	08	09	10	11	
CO1	2	2	-	1	1	2	2	-	1	1	1	1
CO2	1	1	-	1	2	2	1	-	1	2	1	2
	2	3	1	2	2	1	2	-	1	1	2	l 7
CO3 CO4	3	3	1	2	2	2	1	-	1	2	2	2



#### **Course Overview:**

Network science course covers the topology and dynamics of complex networks, aiming to better understand the behaviour and properties of the underlying systems. In this course, algorithmic, computational, and statistical methods of network science, as well as its diverse applications are also covered. Concept implementation using NetworkX in Python is also the integral part of the syllabus. Various case studies have also been covered to understand the impact of networks and also to model epidemic and its prediction by studying the network.

#### UNIT I:

Introduction, Vulnerabilities due to Interconnectivity, Networks and Complex Systems, Emergence of Network Science, Characteristics of Network Science, Societal and Scientific Impact of Networks, Case Studies of Various Real-World Networks and their societal/scientific impact. Graph Theory: Bridges of Konigsberg, Networks and Graphs, Degree Distribution, Network Representations, Representing Networks in NetworkX, Networks: Path Length, and Components. Drawing Directed/Undirected graphs with Weighted/Unweighted Edges in NetworkX.

#### UNIT II:

Random Networks: Introduction, Random Network Model, Number of Links, Degree Distribution, Small World and Computing Clustering Coefficient in NetworkX. The Scale Free Property: Introduction, Power Laws and Scale Free Networks, Hubs, Universality, Ultra Small Property, Degree Exponent, Generating Networks with Arbitrary Degree Distribution. Generating random network in NetworkX.

#### UNIT III:

The Barabasi-Albert Model: Introduction, Growth and Preferential Attachment, Degree Dynamics, Degree Distribution, Measuring Preferential Attachment, Non-Linear Preferential Attachment, Diameter and Clustering Coefficient, Evolving Networks: Introduction, Bianconi-Barabasi Model, Measuring Fitness, Bose-Einstein Condensation, Degree Correlations: Assortativity and Disassortativity, Measuring Degree Correlations, Structural Cutoffs, Correlation in Real Networks, Generating Correlation Networks.

#### UNIT IV:

Network Robustness: Percolation Theory, Robustness of Scale Free Networks, Attack Tolerance, Modelling Cascading Failures and Building Robustness, Identifying Network Robustness using NetworkX, Communities, Spreading Phenomena: Introduction, Epidemic Modeling, Contact Networks, Immunization and Epidemic Prediction. Creating Partitions and Identifying the Modularities of Partitions, Implementation of SIS Spreading Model.

#### **Text Books:**

- 1. Menczer, Filippo, Santo Fortunato, and Clayton A. Davis. A First Course in Network Science. Cambridge University Press, 2020.
- 2. A-L. Barabási , Network Science , available online, 2015.

#### **Reference Books:**

1. M.E.J. Newman, Networks - An introduction, Oxford Univ Press, 2010.

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Semest	er: 6 <sup>th</sup>			
Paper c	ode: AIML308P/AIDS324P	L	T/P	Credits
Subject	Network Science Lab		2	1
	g Scheme			
Teacher	s Continuous Evaluation: 40 Marks			
	n Examination: 60 Marks			
	CTIONS TO PAPER SETTERS:			m Marks: 60
	his is the practical component of the corresponding theory	• •		
2. T	he practical list shall be notified by the teacher in the	e first	week o	f the class
C	ommencement under the intimation to the office of the	HOD/	Institutio	on in which
tl	ney appear is being offered from the list of practicals below	۷.		
3. Ir	structors can add any other additional experiments over a	and ab	ove the	mentioned
ir	the experiment list which they think is important.			
4. A	t least 8 experiments must be performed by the students.			
Course	Objectives:			
1	To understand the underlying behaviour and proper	ties o	f variou	s types of
	networks with the help of mathematical tools.			
2	To apply network science principles to predict the dyna	amics	and the	topology a
	wide area of real networks.			,
Course	Dutcomes:			
CO1	Apply relevant measures to classify the structure of r	etwor	ks and s	shows how
	these measures can differentiate between different ty			
	world networks.	-		
CO2	Analyse the network data associated with information the	nat cha	anges ov	er time.

Course	Outco	mes (CC	) to P	rogram	me Out	comes	(PO) M	lapping							
	(Scale 1: Low, 2: Medium, 3: High)														
CO/P															
0	01	02	03	04	05	06	07	08	09	10	11	12			
CO1	2	3	1	2	2	1	2	-	1	1	2	2			
CO2	3	3	1	2	2	2	1	1	1	2	2	2			



# LIST OF EXPERIMENTS:

- 1. Understanding NetworkX API basics.
- Performing network analysis of directed graphs (Weighted/Unweighted) using NetworkX in Python
- 3. Performing network analysis of undirected graphs ((Weighted/Unweighted)) using NetworkX in Python.
- 4. Computing degree centrality for a node in a network.
- 5. Generating subset of network using NetworkX.
- 6. Drawing network using matplot libraries and measuring degree of assortativity.
- 7. Generating networks with arbitrary degree distribution using NetworkX.
- 8. Finding shortest path from single node to all distant nodes using NetworkX.
- 9. Computing clustering coefficients of different nodes using NetworkX.
- 10. Computing clustering coefficients of different networks using NetworkX.
- 11. Implementing the model for spreading dynamics using NetworkX.



Semest	er: 6 <sup>th</sup>											
Paper o	ode: Al	DS3261		L328T					L	T/P	Cr	edits
Subject	: Block	chain T	echno	logy					3	0		3
Markin												
Teache	rs Conti	nuous	Evalua	tion: 25	5 Marks							
End ter	m Theo	ry Exan	ninatio	n: 75 N	/larks							
INSTR	JCTION	S TO P/	APER S	ETTERS	S:					Maxim	um Ma	rks: 75
1. T	here sh	ould be	e 9 que	estions	in the e	end ter	m exam	nination	questic	on pape	r.	
2. 0	Question	n No. 1	. shou	ld be c	ompuls	ory an	id cove	r the e	ntire sy	llabus.	This qu	uestion
s	hould h	ave ob	jective	or sho	rt answ	er type	e questi	ons. It s	should b	e of 15	marks.	
3. A	Apart fro	om Que	estion	No. 1 <i>,</i> t	the rest	of the	paper	shall co	onsist of	four u	nits as p	per the
	-	-				•			er, stude		-	ked to
			•				•		ould be			
	•					•	-		e learni	-		
	-	-			level o	f the q	uestior	is to be	asked s	should b	be at th	e level
	of the pr					1 .						•••••
							•		er and a	bove th	ie ment	loned
	n the ex	•			•		•		ta-table	c may k		fied if
	equired			Clentin	c) calcu	ators	iog-tat	nes/ ua	la-lable	s may k	speci	neu n
Course												
<u>1.</u>	· · ·		tho f	undam	ontals	of blo	ckchain	and a	hle to	ovnlain	crypto	graphic
1.					chain te					слріані	crypto	graphic
2.		-						kens a	nalvse	the blo	nck det:	ails and
2.					actions		, , , , , , , , , , , , , , , , , , , ,	incino, e	linaryse			
3.							e vario	us type	s of Blo	ckchair	netwo	orks and
		nsus alg										
4.		dy and	,		olidity.							
Course												
CO1	To stu	udy th	e con	cept o	f mone	ey, fur	ndamen	tals of	f blockd	hain a	nd to	explain
	crypto	, graphio	c conce	epts un	derlying	g block	chain te	echnolo	gy.			•
CO2	To lea	rn and	apply t	he cen	tral con	icept o	f the bl	ockchai	n ecosy	stem ar	nd PoW	, and to
	study	the adv	anced	concep	ots of Et	thereu	m					
CO3	To stu	dy Ren	nix, ho	w to de	esign an	d build	l smart	contra	cts and o	examin	e variou	us types
	of Blo	ckchain	netwo	orks an	d conse	nsus a	lgorithr	ns				
CO4	To lea	rn and	apply t	he con	cept of	Solidit	y (langı	lage us	ed in Etł	nereum	)	
Course	Outco	mes (C	D) to P	rogram	nme Ou	tcome	s (PO) I	Mappin	g			
		•		U			. ,		e 1: Low	, 2: Me	dium, 3	: High)
CO/P	РО	РО	РО	РО	РО	PO	РО	PO	PO	РО	PO	PO
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	3	2	-	-	1	1	1	1	1	1	2
CO2	2	2	-	3	3	-	-	-	-	-	-	2
CO3	2	2	2	3	3	-	1	-	1	-	-	-
CO4	2	2	-	3	3	-	-	-	-	-	1	-



#### **Course Overview:**

The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. This course includes the fundamental design and architectural primitives of Blockchain, consensus protocols, types of the Blockchain system and the security aspects, methods to deploy smart contracts on different platforms, along with various use cases from different application domains in real life.

#### UNIT I

Background leading blockchain, Shortcoming of current transaction system, The emergence of Blockchain, Bitcoin blockchain, Blockchain Architecture, Conceptualization, Blockchain components, Cryptocurrencies, Characteristics of cryptocurrencies, Alt coins, Crypto wallets, Creation of Blocks, Wallet Transactions, Transaction details in a Block, Merkle Tree, Hash functions, pseudo random numbers, public key cryptosystem, Generation of keys, Digital signatures.

#### UNIT II

Blockchain types-Public Blockchain, Private Blockchain, Federated Blockchain, Ethereum blockchain, Go Ethereum, Gas, Gas price, Gas Limit, ETH, MetaMask, Public Test Networks, set up a Ethereum node using Geth, Mining in Blockchain, Double spending, Consensus algorithms: Proof of Work, Proof of Stake, Attacks on Bitcoin (Sybil Attacks, 51% Attack, etc.), Byzantine fault, Node failure.

#### Unit III

Byzantine General Problem, BFT (Byzantine fault tolerance), PBFT (Practical Byzantine fault tolerance), Delegated Proof of Stack, Paxos Consensus algorithm, Raft Algorithm, Solo Miner, Pool Miners, Deployment of Smart contracts in Blockchain, Remix, Compilation of smart contracts, Deployment environments, JavaScript Environment

#### UNIT IV

Solidity: Data types in solidity, Operators, State variables, Global Variables, Local variables. Solidity arrays, Solidity functions, Structs in solidity, Inheritance, Special variables, Solidity mapping, Function overloading, Personal Blockchain network, Ganache, Contract deployment to Ganache network, Modifiers in solidity, Events, Emerging applications of Blockchain.

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# **Text Books:**

- 1. Bettina Warburg, Bill Wanger and Tom Serres, Basics of Blockchain (1 ed.), Independently published, 2019. ISBN 978-1089919445.
- 2. Holbrook and Joseph, Architecting enterprise blockchain solutions (1 ed.), John Wiley & Sons, 2020. ISBN 978- 00000000.
- 3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

# **Reference Books:**

- 1. Bashir and Imran, Mastering blockchain: "Distributed ledger technology, decentralization, and smart contracts explained (1 ed.), Packt Publishing Ltd, 2018. ISBN 978- 1111111.
- 2. Andreas M. Antonopoulos. 2017. Mastering Bitcoin: Unlocking Digital Crypto-Currencies (2nd. ed.). O'Reilly Media, Inc.



Semest	ter: 6 <sup>th</sup>											
Paper o	code: Al	DS326F	/AIML	328P					L	T/P	Credi	ts
Subject	t: Block	chain T	echnol	ogy Lak	כ				0	2	1	
Markin	g Schen	ne							•		•	
	rs Conti				Marks							
	m Exam											
INSTRU	JCTIONS	5 ТО РА	PER SE	TTERS:						Maximu	ım Mar	ks: 60
2. 1 6 3. 1 1 4. <i>1</i>	The pra commer appear i nstructo the expe At least <b>Objecti</b> To stu To stu	ctical li ncemen s being ors can a eriment 8 exper ves: dy Rem derstand dy insta	st sha t under offered add an list wh iments ix, how d the co illation	I be n the int d from t y other ich the must b y to des oncept of Gan	otified imation the list o addition y think i oe perfo ign and of Solid ache su	by the to the of pract nal exp s impo rmed b build s ity (lan it and c	e teach office o cicals be eriment rtant. by the st mart co guage u deploy v	er in tl f the HC elow. ts over a cudents ontracts used in f various a	y paper. ne first DD/ Insti and abov on vario Ethereur applicati	week of tution in ve the m ous platt m) ions of E	n which nention forms Blockcha	they ed in
			rgume	nts in a	structu	ired, lo	gical an	d comp	elling m	anner.		
	Outcon			• •								
CO1					and bu							
CO2	To ma	ke use o	of Solid	ity, wo	rk with	ethers	and stu	dy abou	it Metar	nask		
Course	e Outco	mes (CC	D) to Pi	rogram	me Out	comes	(PO) M	••••	e 1: Low	<i>ı,</i> 2: Me	dium <u>,</u> 3	: High
CO/P	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	2	3	3	-	1	-	1	-	-	2
CO2	2	2	-	3	3	-	-	-	-	-	1	1

# LIST OF EXPERIMENTS:

- 1. Study and implementation of hash functions and digital signatures
- 2. Conversion of Byte Code to Op-Code using etherscan.io
- 3. Deployment of Solidity Smart Contracts and Viewing Transaction Status on etherscan
- 4. Working with Remix IDE and Execution of Solidity Code



- 5. Execution of Smart Contracts on Goerli Testnet after getting Test ETHERS from Faucet
- 6. Creating a New Cryptocurrency and Importing in Metamask
- 7. Transferring new cryptocurrency to other accounts
- 8. Installation of Ganache Suite and Deployment of Smart Contracts on Ganache
- 9. Using Web3 GUI to interface Ganache and importing methods of smart contracts
- 10. Study of Metaverse and NFT in Blockchain
- 11. Setup of Testnets and Integration with Metamask



Semest	ter: 6 <sup>th</sup>											
Paper o	code: A	IDS328	T/AIM	L330T					L	T/P	Cred	lits
Subject	t: Cloue	d Comp	uting						3	0	3	
Markin	g Scher	ne							ľ			
Teache	rs Conti	nuous E	valuati	on: 25	Marks							
End ter	m Theo	ry Exam	ination	: 75 Ma	arks							
INSTRU	JCTION	S TO PA	PER SI	ETTERS	:			Ma	ximum	Marks: 6	50	
1. 1	There sh	ould be	9 ques	stions ir	n the en	d term	examin	ation qu	uestion p	aper.		
					•					. This qu	estion	should
	-								of 15 ma			
										four uni		
										ay be ask	ed to a	ttempt
						•		d be 15				
	-					-		-		es of the o evel of t		
	extbool		everor	the qu	estions	to be a	skeu si		at the i		le pres	scribeu
-		-	add anv	other :	addition	alexne	rimente	s over ar	nd above	the men	tioned	in the
					nk is im			, over ut		the men	loncu	the
	•			•				oles/ da	ta-tables	may be	speci	fied if
	equired		,		,	,	U			,	•	
Course	Object	ives:										
1	This c	ourse in	ntrodu	ces abo	ut the c	loud e	nvironr	nent.				
2	Buildi	ng softv	vare sy	stems	and cor	nponer	nts that	scale to	o million	s of user	s in m	odern
	intern	et.										
3	Cloud	concep	ots cap	abilitie	s across	s the va	arious d	cloud se	ervice m	odels ind	cluding	; laaS,
	PaaS,	SaaS, a	and de	evelopi	ng clou	id-base	d softv	ware ap	oplicatio	ns on t	op of	cloud
	platfo	rms.										
4	This c	ourse a	lso int	roduce	s about	the da	ata inte	ensive c	omputin	g and st	udies	about
	differe	ent clou	id appl	ication	s.							
Course	Outcor	nes:										
CO1					cepts a	nd tern	ninolog	ies in cl	oud con	nputing,	paralle	el and
		outed co		<u> </u>								
CO2			the kr	nowled	ge in vi	rtualiza	ition ar	nd differ	rent tech	nnology	examp	les of
		lization										
CO3										d Aneka		•
CO4										ogramm	ing.	
Course	Outcor	nes (CO	)) to Pr	ogram	me Out	comes	(PO) N	<b>lapping</b> (Scale)		, 2: Med	ium, 3	: High)
CO/P	РО	РО	РО	РО	РО	РО	РО	РО	PO	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	3	2	-	-	1	1	1	1	1	1	2
CO2	2	2	-	3	3	-	-	-	-	-	-	2
CO3	2	2	2	3	3	-	1	-	1	-	-	-
	1	1	1	1	1		1	1				



#### **Course Overview:**

The Cloud Computing Fundamentals course provides an in-depth understanding of the key concepts, technologies, and best practices involved in cloud computing. This course is designed to equip students with the knowledge and skills required to leverage cloud computing for various business applications.

#### UNIT I:

#### Introduction

Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies. **Principles of Parallel and Distributed Computing -** Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing

#### UNIT II:

#### Virtualization

Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

#### UNIT III:

#### **Cloud Computing Architecture**

Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges **Cloud Application Platform:** Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management High-Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming.

#### UNIT IV:

# Data Intensive Computing:

Map-Reduce Programming: What is Data-Intensive Computing? Technologies for Data-Intensive Computing. **Cloud Applications**: Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Business and Consumer Applications, Multiplayer Online Gaming.

# **Text/Reference Books:**

- 1. Mastering Cloud Computing: by Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, McGraw Hill Education.
- 2. Cloud Computing: by Rajkumar Buyya, TMH

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Semest	er: 6 <sup>th</sup>											
Paper o	ode: Al	DS328F	P/AIM	L330P					L	T/P	Cred	its
Subject	: Cloud	l Comp	uting l	ab					0	2	1	
Markin	g Scher	ne										
Teache					) Marks							
	m Exam				•					Maxim	um Ma	rks: 60
2. T c 3. I	inder th offered f nstructo experime At least 8 <b>Object</b> i	tical list e intima rom the rs can a ent list w experir <b>ives:</b>	shall be ation to list of dd any which th nents r	e notifie o the o practica other a ney thin must be	d by the ffice of Is below additiona k is impo	teache the HO /. al exper ortant. ned by t	r in the f D/ Insti iments the stud	first wee tution in over and ents.	k of the n which d above	class cor they ap the men	oear is	being
2			-		ition teo ud comp		gies suc	h as hy	perviso	rs, virtua	al mach	ines,
Course						0						
CO1	Deploy	y and m	anage	virtual	machir	nes and	l contai	ners on	a cloud	l platfor	m.	
CO2	Config	ure and	l mana	ige clou	ud stora	ige, net	twork, a	and sec	urity sei	vices.		
Course	e Outco	mes (CO	D) to P	rogran	nme Ou	itcome	s (PO) I		-	2: Med	ium, 3:	High)
CO/P	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	2	2	3	-	-	-	-	1	-	-
CO2	2	2	2	2	1	1	1	-	1	1	1	2

# LIST OF EXPERIMENTS:

- 1. Install virtualbox/vmware workstation 45 5 install a c compiler in the virtual machine and execute a sample program
- 2. Create type 2 virtualization in vmware. Allocate memory and storage space as per requirement. Install guest os on that vmware.



- 3. Adding a new virtual disk to a virtual machine. Convert basic disc to dynamic disc and vice versa
  - a. Shrink and extend virtual disk
  - b. Create, manage, configure and schedule snapshots
  - c. Create spanned, mirrored and striped volume
  - d. Create raid 5 volume
- 4. Sharing and data transfer between the virtual machines
- 5. Create type 2 virtualization on esxi 6.5 server
- 6. Create a vlan in cisco packet tracer
- 7. Create a vpn from one virtual machine to another virtual and pass data secure way
- 8. Find procedure to set up the one node hadoop cluster
- 9. Simulate a cloud scenario using cloudsim and run a scheduling algorithm that is not present in cloudsim.
- 10. Data analytics in the cloud: Perform data analytics and processing in a cloud environment using services such as AWS EMR, Google Cloud Dataproc, or Azure Hdinsight.
- 11. Implement cloud security controls such as encryption, access management, and network security using cloud-native services.



Semes	ter: 6 <sup>th</sup>			
Paper	code: AIDS330T/AIML332T	L	T/P	Credits
Subjec	: Human Computer Interaction	4	0	4
Markin	g Scheme		1	•
Teache	rs Continuous Evaluation: 25 Marks			
End ter	m Theory Examination: 75 Marks			
INSTRU	ICTIONS TO PAPER SETTERS:	Max	imum M	Marks: 60
2. ( 3. / 4. 5.	There should be 9 questions in the end term examination question Question No. 1 should be compulsory and cover the entire syllal objective or short answer type questions. It should be of 15 mark Apart from Question No. 1, the rest of the paper shall consist of Every unit should have two questions. However, students mark question from each unit. Each question should be 15 marks. The questions are to be framed keeping in view the learning o standard/ level of the questions to be asked should be at the leve The requirement of (scientific) calculators/ log-tables/ data-table <b>Objectives:</b>	ous. This (s. four uni y be ask utcomes el of the s may be	question ts as pe ed to at of cours prescrib	r the syllabus. tempt only 1 se/paper. The ed textbooks.
1.	To learn basics concepts of Human Computer Interaction			
2.	To design the features of an interactive system- u perspective.	sability	from	the human
3.	To develop various HCI models and techniques.			
4.	To apply different data gathering and analysis techniques	•		
Course	Outcomes:			
CO1	Apply core theories, models and framework from the field	d of HCI		
CO2	Gather, Analyze and Interpret the data			
CO3	Design, Develop and Evaluate user interface			
	Create Interactive Prototypes			

Course	Outco	mes (CC	) to P	rogram	me Out	comes	(PO) M	lapping						
	(Scale 1: Low, 2: Medium, 3: High)													
CO/P	РО	PO	РО	PO	РО	РО	РО	РО	PO	РО	РО	РО		
0	01	02	03	04	05	06	07	08	09	10	11	12		
CO1	1	-	-	-	-	1	1	1	1	-	-	1		
CO2	1	3	-	2	-	1	1	1	1	-	-	1		
CO3	1	-	3	-	1	1	1	1	1	1	1	1		
CO4	1	2	3	2	2	1	1	1	1	1	1	1		

Prerequisites: Critical Reasoning and Problem solving, Web designing



#### **Course Overview:**

This course will focus on how we can design human-centered systems that people find useful and usable. This course provides an introduction to designing, prototyping, and evaluating user interfaces. It will involve understanding the foundation elements of human computer interaction, understanding the design process and various design issues, performing contextual inquiry and task analysis, using sketching and prototyping tools, fundamentals of visual design, usability engineering, usability evaluation.

#### Unit I

Introduction to basic concepts of Human Computer Interaction, Understanding Design Issues, User Needs and User Experience (UX), Process of Interaction Design, Usability goals, User Experience Goals, Principles of Usability Design Conceptualizing Interaction, Conceptual Models, Framework, Cognitive models, Interaction Types, Paradigm for Interaction.

#### Unit II

Social Interaction, Understanding Stakeholder Requirements, Emotional Interactions, Cognitive Models, Design Principles, Design frameworks, Design processes

#### Unit III

Interface Types, Natural User Interface (UI), Data Gathering Issues, Data Recording, Interviews, Questionnaires, Observation, Choosing and Combining Data Gathering Techniques. Quantitative and Qualitative Data Analysis, Tools to support Data Analysis, Interpret and Presenting the Finding Approaches for collecting and analyzing data, Visualizing and Exploring Data, Ethical Design Concerns.

# Unit IV:

Introduction to Design Requirements, Establish Requirements, Data Gathering for Requirements, Task Analysis, Task Decomposition, Comparison between Task Analysis Techniques, Prototyping, Tools for Interaction Designs, Evaluation Techniques, Usability Testing, Create Interactive Prototypes using proto.io, Case Studies on Usability and User experience.

# Text Books:

- 1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction∥, 3rd Edition, Pearson Education, 2004.
- 2. H. Sharp, Y. Rogers and J. Preece Interaction Design Beyond Human-Computer Interaction, 3<sup>rd</sup> Edition, John Wiley & Sons.

# **Reference Books:**

- 1. J. M. Caroll (ed.), HCI Models, Theories and Frameworks: Towards a Multidisciplinary Science (Interactive Technologies), Morgan Kauffman 2003.
- 2. C. Stephanidis (ed.), User Interface for All: Concepts, Methods and Tools, Lawrence Erlbaum Associates, 2001.
- 3. B. Shneiderman, Designing the User Interface, Addison Wesely, 2000.
- 4. S. Bhattacharya, Human-Computer Interaction, MC Graw Hill India, 2019.

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Semest	er: 6 <sup>th</sup>											
	ode: AID	) S332T/	AIML3	36T					L	T/P	Cr	edits
Subject	: Mobile	e Applic	ation D	evelop	ment				3	0		3
Markin	g Schem	e		-						•		
Teacher	rs Contin	iuous Ev	aluatio	n: 25 N	larks							
End ter	m Theor	y Exami	nation:	75 Mar	ks							
INS	TRUCTIC	ONS TO	PAPER	SETTER	S:				Μ	laximun	n Marks	: 75
2. C o 3. A E 4. T 5. Ir e	here sho Question bjective part fror very uni uestion f he quest tandard/ nstructor xperime he requi	No. 1 sh or short m Quest t should from ead ions are level of s can ad nt list wh	nould be answer ion No. I have th unit. to be f the que dd any nich the	e compu r type qu 1, the two qu Each qu ramed k estions t other a cy think	ulsory ar uestions rest of t estions. estion s ceeping i to be asl dditiona is impor	nd cove . It shou he pape Howev hould b in view ked shou al exper tant.	r the en Ild be of er shall o er, stud e 15 ma the learn uld be at iments o	tire sylla 15 mark consist o ents ma rks. ning out the leve over and	abus. Thi ks. of four ur ay be as comes of el of the d above	s question hits as p ked to a f the cou prescrib the men	er the sy attempt urse/pap ed textb ntioned	yllabus. only 1 er. The ooks. in the
	Objectiv						· ·				· · ·	
1.	Under					•	plicatio	n develo	opment,	includir	ng the d	lifferent
2.			-	-	-		-		imonly jective-0			ile app
3.	-	nent mo ations, a		-			authent	ication,	social m	nedia in	tegratio	n, push
4.		op skills al and r	-				ervices i	into mo	bile appl	lications	to enal	ole data
Course	Outcom	es:			•							
CO1		stand th ms, frar				-	plicatio	n develo	opment,	includir	ng the d	lifferent
CO2		-		-			n the fie	eld of mo	obile app	olication	develo	pment.
CO3		nent co unicatio					•••		uch as	data sto	orage, r	network
CO4	Design		evelop	mobile	applica	ations	for spec	cific pla	tforms (	Androic	l or iOS	5) using
Course	Outcom	nes (CO)	to Pro	gramm	e Outco	omes (P	O) Map		ale 1: Lov	w, 2: Me	edium, 3	: High)
CO/P	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	PO0	, PO1	PO1	PO1
0	1	2	3	4	5	6	7	8	9	0	1	2
CO1	2	3	2	-	-	1	1	1	1	1	1	2
CO2	2	2	-	3	3	-	-	-	-	-	-	2
CO3	2	2	2	3	3	-	1	-	1	-	-	-
CO4	2	2	-	3	3	-	-	-	-	-	1	-



#### **Course Overview:**

The Mobile Application Development course provides comprehensive knowledge and practical skills required to design, develop, and deploy mobile applications for various platforms, such as Android and iOS. This course covers the entire mobile app development lifecycle, including user interface design, programming languages, frameworks, data storage, integration with web services, testing, and deployment.

#### UNIT – I

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

#### UNIT – II

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

#### UNIT – III

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

#### UNIT – IV

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

#### **TEXT BOOKS:**

1. T1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

# **REFERENCE BOOKS:**

- 1. R1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
- 2. R2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
- 3. R3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

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Semest	er: 6 <sup>th</sup>											
Paper o	ode: Al	DS332P	/AIML	336P					L	T/P	Credit	s
Subject	: Mobi	le Appli	cation	Develo	pment	Lab			0	2	1	
Markin	g Schen	ne							•	•		
Teache	rs Conti	nuous E	Valuat	ion: 40	Marks							
	m Exam											
INSTRU	ICTIONS	5 ТО РА	PER SE	TTERS:						Maximu	m Mark	s: 60
2. 1 c a 3. 1 t 4. 4	The pra comment oppear is nstructor he expe ta least a <b>Objecti</b> To pro applica applica	ctical li icement s being ors can a eriment 8 experi ves: ovide h ations for oly the ation de	st sha t under offered add and list wh iments nands-o or vario concep	I be n the int from t y other ich the must b on exp ous plat	iotified imation the list c addition y think i oe perfo erience forms. techniq	by the to the of pract nal expo s impor rmed b in de jues lea	teach office o icals be eriment tant. y the st signing, arned ir	er in the HC low. ts over a udents. develo	y paper. he first DD/ Insti and abor oping, a eoretica app dev	tution in ve the m and tes il aspec	n which the mentione ting model to the mentione ting model to the mention of the	they ed in obile
Course	Outcon	ologies.										
CO1	Integra			licatior	ns with v	veb ser	vices an	id APIs t	o enhan	ice func	tionality	and
CO2	-		•		• •				e efficie atabase		-	
Course	Outcor	mes (CC	) to Pr	ogram	me Outo	comes	(PO) Ma		le 1: Lov	<u>v, 2: Me</u>	dium, 3:	High
CO/P	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	PO
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	2	3	3	-	1	-	1	-	-	2
CO2	2	2	_	3	3	_	_	_	_	_	1	1

# LIST OF EXPERIMENTS:

- 1. Design a simple user interface for a mobile application using a design tool or framework like Sketch, Adobe XD, or Flutter.
- 2. Hello World Application: Create a basic "Hello World" application for a mobile platform of your choice (Android or iOS) using the respective development environment.



- 3. Implement data storage functionality in your mobile application using local storage options like SQLite database or shared preferences.
- 4. Develop a mobile application that interacts with a RESTful API to fetch and display data from a remote server.
- 5. Integrate sensors such as accelerometer, gyroscope, or GPS into your mobile application to capture and utilize sensor data.
- 6. Add multimedia functionality to your mobile application, such as capturing photos/videos, playing audio files, or integrating with social media sharing.
- 7. Implement user authentication and authorization features in your mobile application, allowing users to register, log in, and access personalized content.
- 8. Incorporate push notifications into your mobile application, enabling the delivery of realtime alerts or messages to users.
- 9. Develop a mobile application that utilizes location services to provide location-based information, such as finding nearby places or tracking user movements.
- 10. Mobile App Testing and Debugging: Learn and apply various testing techniques, including unit testing, integration testing, and debugging, to ensure the quality and stability of your mobile application.



Subject: Cryptography and Data Privacy40Marking Scheme401. Teachers Continuous Evaluation: 25 Marks2. End term Theory Examination: 75 MarksINSTRUCTIONS TO PAPER SETTERS:Maximum Marks: 601. There should be 9 questions in the end term examination question paper.2. Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.4. The questions are to be framed keeping in view the learning outcomes of the cout The standard/ level of the questions to be asked should be at the level of the textbooks.5. Instructors can add any other additional experiments over and above the mention	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>Marking Scheme         <ol> <li>Teachers Continuous Evaluation: 25 Marks</li> <li>End term Theory Examination: 75 Marks</li> </ol> </li> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>There should be 9 questions in the end term examination question paper.</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> </ol> <li>The questions are to be framed keeping in view the learning outcomes of the cour The standard/ level of the questions to be asked should be at the level of the textbooks.</li> </li></ol> <li>Instructors can add any other additional experiments over and above the mention</li>	stion should the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>Teachers Continuous Evaluation: 25 Marks</li> <li>End term Theory Examination: 75 Marks</li> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>There should be 9 questions in the end term examination question paper.</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> </ol> </li> <li>The questions are to be framed keeping in view the learning outcomes of the cour The standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mentio</li> </ol>	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>2. End term Theory Examination: 75 Marks</li> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>There should be 9 questions in the end term examination question paper.</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> </ol> </li> <li>The questions are to be framed keeping in view the learning outcomes of the court the standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mention</li> </ol>	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>There should be 9 questions in the end term examination question paper.</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atte question from each unit. Each question should be 15 marks.</li> </ol> </li> <li>The questions are to be framed keeping in view the learning outcomes of the courthe standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mention</li> </ol>	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>There should be 9 questions in the end term examination question paper.</li> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> <li>The questions are to be framed keeping in view the learning outcomes of the court the standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mentio</li> </ol>	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>Question No. 1 should be compulsory and cover the entire syllabus. This quest have objective or short answer type questions. It should be of 15 marks.</li> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> <li>The questions are to be framed keeping in view the learning outcomes of the court the standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mention</li> </ol>	the syllabus. empt only 1 urse/paper. e prescribed										
<ul> <li>have objective or short answer type questions. It should be of 15 marks.</li> <li>3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> <li>4. The questions are to be framed keeping in view the learning outcomes of the court the standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>5. Instructors can add any other additional experiments over and above the mention</li> </ul>	the syllabus. empt only 1 urse/paper. e prescribed										
<ol> <li>Apart from Question No. 1, the rest of the paper shall consist of four units as per th Every unit should have two questions. However, students may be asked to atte question from each unit. Each question should be 15 marks.</li> <li>The questions are to be framed keeping in view the learning outcomes of the cou The standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>Instructors can add any other additional experiments over and above the mentio</li> </ol>	empt only 1 urse/paper. e prescribed										
<ul> <li>Every unit should have two questions. However, students may be asked to atter question from each unit. Each question should be 15 marks.</li> <li>4. The questions are to be framed keeping in view the learning outcomes of the cour The standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>5. Instructors can add any other additional experiments over and above the mention</li> </ul>	empt only 1 urse/paper. e prescribed										
<ul> <li>question from each unit. Each question should be 15 marks.</li> <li>4. The questions are to be framed keeping in view the learning outcomes of the court of the standard/ level of the questions to be asked should be at the level of the textbooks.</li> <li>5. Instructors can add any other additional experiments over and above the mention</li> </ul>	urse/paper. e prescribed										
<ul><li>The standard/ level of the questions to be asked should be at the level of the textbooks.</li><li>5. Instructors can add any other additional experiments over and above the mention</li></ul>	e prescribed										
textbooks. 5. Instructors can add any other additional experiments over and above the mentio											
5. Instructors can add any other additional experiments over and above the mentio	oned in the										
	oned in the										
	xperiment list which they think is important. he requirement of (scientific) calculators/ log-tables/ data-tables may be specified if										
required.	·										
Course Objectives:											
1 To understand the fundamentals of cryptography											
2 To acquire knowledge on standard algorithms used to provide confid	identiality.										
Integrity and authentication.											
<b>3</b> To analyze concepts, issues, principles of security related properties and	d validate										
using different models.											
4 To apply knowledge of a range of computer security technologies as well techniques to achieve differential privacy for linear queries.	as Design										
Course Outcomes:											
	hanisms										
<b>CO2</b> Analyse various Symmetrical and Asymmetrical encryption algorithms a usage to achieve security mechanisms.	and their										
<b>CO3</b> Apply the concept of Data integrity, Authentication, Digital Signatures.											
CO4 Investigate several differential privacy algorithms and design algorithms t	to protect										
systems from malicious software and their related threats.											
Course Outcomes (CO) to Programme Outcomes (PO) Mapping											
(Scale 1: Low, 2: Medium	n, 3: High)										
CO/P PO											
O 01 02 03 04 05 06 07 08 09 10 11	1 12										
CO1         2         2         -         1         1	1										
CO2       2       2       -       1       1           CO3       2       2       -       2       2       1       1       1	1 1 2										
	1 2 1 2										



#### UNIT - I

**Security Concepts:** Introduction, The need for security and Data Privacy, Security approaches, Principles of security, Types of Security attacks, Security services and mechanisms, A model for Network Security, Social Aspects of Privacy, Legal Aspects of Privacy and Privacy Regulations, Database Security, Statistical Database security, Inference Control, Hippocratic databases.

**Cryptography Concepts and Techniques:** Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

#### UNIT - II

**Symmetric key Ciphers:** Block Cipher principles, DES, AES, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

**Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange.

#### UNIT - III

**Cryptographic Hash Functions:** Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

**Key Management and Distribution**: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

#### UNIT-IV

**Anonymization**: Linkage and re-identification attacks, k-anonymity, I-diversity, t-closeness, implementing anonymization, Anonymizing complex data, Privacy and anonymity in mobile environments, Database as a service, Privacy in Cloud infrastructure

**Differential Privacy (DP):** Formalism and interpretation of DP, Fundamental DP mechanisms and properties, Interactive and non-interactive DP, DP for complex data Local Differential Privacy (LDP)

#### TEXT BOOKS:

- 1. Cryptography and Network Security Principles and Practice: William Stallings, Pearson Education, 6th Edition
- 2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
- 3. C. Dwork and A. Roth, The Algorithmic Foundations of Differential Privacy, now Publishers, 2014.

#### **REFERENCE BOOKS:**

- 1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
- 2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
- 3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.

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4. Charu C. Aggarwal, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2008.



# AIML 6<sup>th</sup> Semester



Semest	er: 6 <sup>th</sup>			
Paper c	ode: AIML304T	L	T/P	Credits
Subject	: Advances in Deep Learning	3	0	3
Markin	g Scheme		•	
Teache	s Continuous Evaluation: 25 Marks			
	n Theory Examination: 75 Marks			
INSTRU	CTIONS TO PAPER SETTERS:	Maximu	ım Mar	ks: 60
2. 4	There should be 9 questions in the end term examination question Question No. 1 should be compulsory and cover the entire syllable objective or short answer type questions. It should be of 15 marks Apart from Question No. 1, the rest of the paper shall consist of f Every unit should have two questions. However, students may question from each unit. Each question should be 15 marks. The questions are to be framed keeping in view the learning out standard/ level of the questions to be asked should be at the level The requirement of (scientific) calculators/ log-tables/ data-tables <b>Objectives:</b>	us. This our uni be ask comes of the	questio ts as pe ed to a of cour prescrib	r the syllabus. ttempt only 1 se/paper. The ed textbooks.
1.	To learn advanced concepts in deep learning.			
2.	To understand different methods of optimization in deep learni	ng.		
3.	To learn practical tips in training deep learning models.			
4.	To know research methods in the field of deep learning.			
Course	Outcomes:			
CO1	Describe the advanced concepts in deep learning.			
CO2	Explain different methods of optimization in deep learning.			
CO3	Define practical tips in training deep learning models.			
CO4	State research methods in the field of deep learning.			

Course	Outco	mes (CC	) to P	rogram	me Out	comes	(PO) N	lapping				
								(Scale	e 1: Low	, 2: Med	dium, 3:	High)
CO/P	РО	РО	PO	PO	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	2	-	1	1							1
CO2	2	2	-	1	1							1
CO3	2	2	-	2	2					1	1	2
CO4	3	1	3	1	2	1				1	1	2

#### **Course overview:**

Deep Learning is the most popular branch of machine learning which uses neural network-based models for solving problems in a number of domains. Therefore, it is important that after understanding the fundamental concepts of deep learning in 'Deep Learning - I', more advanced concepts are taught so that students could apply them in problem solving to solve problems



effectively.

## UNIT I

Reviewing Deep Learning Concepts, NN, Regularization, Batch Normalization, Weight Initialization Strategies, Learning vs Optimization, Effective training in Deep Net ,Early Stopping, Normalization(Batch,Instance,Group), Batch Gradient Descent (GD), GD with momentum).

## UNIT 2

Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Image Denoising, Semantic Segmentation, Object Detection etc. Neural Attention Models, Neural Machine Translation. Performance Metrics, Baseline Methods, Data Requirements, Hyperparameter Tuning: Manual vs Automatic, Grid vs Random.

## UNIT 3

Improved Optimization: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization).

## UNIT 4

Deep Generative Models: Generative Adversarial Networks (GANs). Generating Images with Various Auto Encoders, Generative Adversial Networks (GAN), The Generator, The Discriminator, The Adversial Network, Training GAN. Introduction to Natural Language Processing (NLP), Text Classification and Deep Learning. Case study: Action recognition, shape recognition, visual instance recognition, emotion recognition.

## **Text Books**

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville,"Deep Learning" MIT Press, 2016. **Reference Books** 

2. Duda, R.O. and Hart, P.E., 2006. Pattern classification. John Wiley & Sons.



Semes	ster: 6 <sup>th</sup>			
Paper	code: AIML304P	L	T/P	Credits
Subjec	ct: Advances in Deep Learning Lab	0	2	1
Marki	ng Scheme	I		
Teache	ers Continuous Evaluation: 40 Marks			
End te	erm Examination: 60 Marks			
INSTR	UCTIONS TO PAPER SETTERS:	Maximu	m Marks	5: 60
	This is the practical component of the corresponding the The practical list shall be notified by the teacher in the under the intimation to the office of the HOD/ Institution from the list of practicals below. Instructors can add any other additional experiments experiment list which they think is important. At least 8 experiments must be performed by the stude of <b>Objectives:</b> To design and implement deep learning models for classification, object detection, natural language pro- To evaluate the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of deep learning models for the stude of the performance of the perfo	first week of the on in which they approved and above the ents.	bpear is l he men sks, incl ch recog	being offered tioned in the uding image
Course	e Outcomes:			
CO1	Implement deep learning models for a variety of task detection, natural language processing, and speech r		e classific	ation, object
CO2	Apply deep learning algorithms to a real-world prob report on the expected accuracy that can be achieve	lem, optimize the		

Course	Outco	mes (CC	D) to P	rogram	me Out	tcomes	(PO) N	lapping	5			
								(Scal	e 1: Low	, 2: Me	dium, 3	: High
CO/P	РО	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1												
CO2												

## LIST OF EXPERIMENTS:

- 1. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
- 2. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.
- 3. Design a neural Network for classifying news wires (Multi class classification) using Reuters



dataset.

- 4. Design a neural network for predicting house prices using Boston Housing Price dataset.
- 5. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
- 6. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
- 7. Use a pre-trained convolution neural network (VGG16) for image classification.
- 8. Implement one hot encoding of words or characters.
- 9. Implement word embeddings for IMDB dataset.
- 10. Implement a Recurrent Neural Network for IMDB movie review classification problem.
- 11. Image classification: Building a deep learning model that can classify images into different categories, such as animals, cars, or buildings.
- 12. Object detection: Developing a model that can identify and locate objects in an image, such as cars, pedestrians, or traffic signs.
- 13. Generative models: Creating a deep learning model that can generate new content, such as images, music, or text, based on examples provided during training.



Paper	code: AIML306T	L	T/P	Credits
Subjec	t: Machine Learning for Intelligent Communication & Systems	3	0	3
Marki	ng Scheme			
1.	Teachers Continuous Evaluation: 25 Marks			
2.	End term Theory Examination: 75 Marks			
INSTR	UCTIONS TO PAPER SETTERS: Maximum Mai	r <b>ks: 60</b>		
1.	There should be 9 questions in the end term examination question p	aper		
2.	Question No. 1 should be compulsory and cover the entire syllabus.	This qu	uestion	should have
	objective or short answer type questions. It should be of 15 marks.			
3.	Apart from Question No. 1, the rest of the paper shall consist of four	r units	as per t	the syllabus.
	Every unit should have two questions. However, students may be	e asked	to atte	empt only 1
	question from each unit. Each question should be 15 marks.			
4.	The questions are to be framed keeping in view the learning outco			
	standard/ level of the questions to be asked should be at the level of	-		
5.	The requirement of (scientific) calculators/ log-tables/ data-tables ma	ay be sp	pecified	if required.
Course	Objectives:			
1	To apply the area of machine learning in the context of communication	ations I	earning	5
2	To plan automatic modulation classification.			
3	To apply iterative channel decoding			
4	To Familiar with real-world case studies and examples of machin	e learr	ing app	lications in
	communication			
Course	Outcomes:			
CO1	Apply the area of machine learning in the context of communication	ons Lea	rning	
CO2	Plan automatic modulation classification			
CO3	Investigate iterative channel decoding			

Course	Outcon	nes (CO	) to Pi	ogram	me Out	comes	(PO) M	lapping				
(Scale 1: Low, 2: Medium, 3: High												High)
CO/P	PO	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	2	-	-	3	-	-	2	-	-	-	-	2
CO2	2	-	3	-	-	2	-	-	-	1	-	-
CO3	-	2	2	3	-		-	-	-	-	1	-
CO4	2	2	3	2	2	2	-	-	-	-	-	2

#### **Course Overview:**

This course helps the student to have basic idea of machine learning techniques to various signal processing requirements for communications including channel estimation, automatic modulation classification and iterative channel decoding.



#### UNIT I:

Channel estimation and prediction: Adaptive transmission systems, The Impact of Outdated CSI, Classical Channel Prediction, Neural Network Based Prediction Schemes, Flat fading SISO Prediction, Channel-Gain Prediction with Real-Valued and Complex-Valued RNN, Channel Envelope Prediction, Frequency-Selective SISO Prediction, Performance and Complexity, Computational Complexity.

#### UNIT-II:

Automatic Modulation Classification: Signal Models for modulation classification, Likelihood based classifiers, Distribution Test-based classifiers, Modulation classification Features, Machine Learning models for Modulation classification.

#### UNIT III:

Channel Encoding and Decoding: Overview of Channel coding and Deep Learning, DNN for Channel coding and to Decoding Directly.

#### UNIT IV:

DNNs for joint equalization and Channel Decoding, CNNs for Decoding, Decoding by Eliminating Correlated Channel Noise, BP-CNN Decoding.

#### Text Books:

- 1. Zhechen Zhu and Ashoke K. Nandi, (2015), Automatic Modulation Classification: Principles, Algorithms and Applications, Wiley.
- 2. Luo, F. L., (2020), Machine Learning for Future Wireless Communications, Wiley.

#### **Reference Books:**

1. He, R., and Ding Z., (2019), Application of Machine Learning in Wireless Communications, The Institution of Engineering and Technology, IET.

#### Self-study:

- 1. Jagannatham, A. K., Principles of Communication II, NPTEL Course Material, Department of Electrical Engineering, Indian Institute of Technology Kanpur, https://nptel.ac.in/courses/108104098/
- 2. Machine Learning for Communications Emerging Technologies Initiative, IEEE https://mlc.committees.comsoc.org/research-library/

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	ode: AIML306P	L	T/P	Credits
Subject Lab	: Machine Learning for Intelligent Communication & Systems	0	2	1
Markin	g Scheme		ł	
Teache	rs Continuous Evaluation: 40 Marks			
End ter	m Examination: 60 Marks			
INSTRU	ICTIONS TO PAPER SETTERS: N	/laxim	um Mar	ks: 60
2. 3. 4. Course	This is the practical component of the corresponding theory paper The practical list shall be notified by the teacher in the first week o under the intimation to the office of the HOD/ Institution in which t from the list of practicals below. Instructors can add any other additional experiments over and al experiment list which they think is important. At least 8 experiments must be performed by the students. <b>Objectives:</b>	of the o	opear is l	peing offered
1	To analyze the communication system with machine learning alg			
	To Familiar with the software tools and programming languages in communication.	used	for mac	nine learning
2				
	Outcomes:			
	Outcomes: Examine and study real-world case studies and examples of ma in communication, including chatbots, virtual assistants, and per		-	• •

Course	Outco	mes (CC	)) to P	rogram	me Out	tcomes	; (PO) N	1apping	5			
								(Scal	e 1: Low	<i>ı,</i> 2: Me	dium, 3	: High
CO/P	РО	РО	РО	PO	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	-	2	2	3	-	-	-	-	1	2	1	2
CO2	2	2	3	2	2	2	-	-	-	2	-	2

#### List of Experiments:

- 1. **Predictive maintenance in communication systems:** Develop and evaluate a machine learning algorithm that predicts maintenance requirements of communication systems based on data such as temperature, humidity, and usage patterns.
- 2. **Traffic prediction in wireless networks:** Develop and test a machine learning algorithm that predicts network traffic volume based on past network usage patterns and other relevant factors, such as time of day and weather.



- 3. **Fraud detection in financial transactions:** Develop and test a machine learning algorithm that detects fraudulent financial transactions, such as credit card fraud, based on transaction history and other relevant factors.
- 4. **Machine learning for beamforming in wireless communication:** Develop and evaluate a machine learning algorithm that optimizes beamforming in wireless communication systems, in order to improve signal quality and reduce interference.
- 5. **Machine learning for network optimization:** Develop and test a machine learning algorithm that optimizes network parameters, such as routing and congestion control, to improve network performance and reliability.
- 6. **Anomaly detection in network traffic:** Students could develop and test an anomaly detection algorithm that uses machine learning techniques to identify unusual network traffic patterns that may indicate security threats or network faults.
- 7. **Machine learning for resource allocation in IoT networks:** Develop and evaluate a machine learning algorithm that optimizes resource allocation, such as bandwidth or power, in an IoT network to maximize overall system performance.



Semest	er: 6 <sup>th</sup>			
Paper c	ode: AIML310T	L	T/P	Credits
Subject	: Modeling complex Systems using Machine Learning	3	0	3
Markin	g Scheme	•		·
Teache	rs Continuous Evaluation: 25 Marks			
	m Theory Examination: 75 Marks			
	CTIONS TO PAPER SETTERS:		um Marl	ks: 60
	There should be 9 questions in the end term examination quest	• •		
	Question No. 1 should be compulsory and cover the entire syllab		questio	n should have
	objective or short answer type questions. It should be of 15 mar			
	Apart from Question No. 1, the rest of the paper shall consist of		•	•
	Every unit should have two questions. However, students mar question from each unit. Each question should be 15 marks.	y be ask	ed to a	ttempt only 1
	The questions are to be framed keeping in view the learning of	utcome	of the	sourse/paper
	The standard/ level of the questions to be asked should be a			
	extbooks.			
	nstructors can add any other additional experiments over and	above t	he ment	tioned in the
	experiment list which they think is important.			
6	The requirement of (scientific) calculators/ log-tables/ data	-tables	may be	specified if
	equired.			
Course	Objectives:			
1	Understand the nature and facets of "complex systems".			
2	Become familiar with data science tools and computational m	odels ap	plicable	for complex
	systems			
3	Apply data science tools and techniques to real-life "complex			
4	Understand the concepts of time- series analysis and agents in	n modeli	ng desig	ns
Course	Outcomes:			
CO1	To understand basic concepts of Machine learning techniqu	es and	learn ab	out complex
	models			
CO2	To study simulation of various models			
CO3	To learn about embedded system and real-time system mode			
CO4	To understand and deploy Time series data and its statistics ar	nd to lea	rn vario	us categories
	of agent-based models			

Course	Outcom	es (CO)	) to Pro	gramme	e Outco	mes (PO	D) Map	ping				
								(Sca	le 1: Lov	<i>א</i> , 2: Me	edium, 3	: High)
CO/P	PO0	РО	PO0	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	1	02	3	04	05	06	07	08	09	10	11	12
CO1	3	-	-	3	-	-	2	-	-	-	-	2
CO2	2	-	3	-	-	2	-	-	-	1	-	-
CO3	-	2	2	3	-		-	-	-	-	1	-
CO4	2	3	3	2	2	2	-	-	-	-	-	2

#### **Course Overview:**



The course focuses on the application of machine learning techniques to model complex systems in various fields such as science, engineering, economics, and social sciences. The course covers a range of topics, including the fundamentals of complex systems, different modeling approaches such as agent-based modeling, network modeling, and system dynamics modeling, and the application of machine learning algorithms to these modeling approaches.

### UNIT I

Definition of a complex system- Complex systems in engineering- Complex systems in nature & society. Modelling of complex systems-Introduction to dynamical system theory- standard models in dynamical systems-transitions in dynamical systems-bifurcations- Maps and flows- Chaos-Routes to chaos.

## UNIT II

Modeling Complex Systems: Introduction, list processing in simulation, approaches to stering lists in a computer linked storage allocation Simulation examples using any simulation language: Single-server Queuing simulation with time-shared computer model, job-shop model, and event-list manipulation.

## UNIT III

Embedded System Modeling: Embedded systems and system level design, models of computation, specification languages, hardware/software code design, system partitioning, application specific processors and memory, low power design Real-Time system modeling, Fixed Priority scheduling, Dynamic Priority Scheduling Data Communication Network modeling, IP network intradomain (e.g. OSPF, RIP) routing simulation.

## UNIT IV

Introduction to time series data analysis, basic definitions and construction, frequency and time domain, stationary time series, autocovariance function, autoregression, GARCH model, time-series with memory: R/S analysis and hurst exponent, detrended fluctuation analysis, random matrix theory and its applications, Introduction to Agent-based modeling, types of agent-based model.

## **Text Books:**

- 1. Newman, Mark, Albert-László Barabási, and Duncan J. Watts. The structure and dynamics of networks. Princeton university press, 2006.
- 2. Hamilton, James Douglas. Time series analysis. Princeton university press, 2020.
- 3. Econophysics: An Introduction. Sitabhra Sinha, Arnab Chatterjee, Anirban Chakraborti, Bikas K. Chakrabarti. Wiley, 2010.
- 4. Introduction to the Modelling and Analysis of Complex Systems, Hiroki Sayama, Binghamton University, SUNY, ISBN: 978-1-942341-08-6 (print edition), 2015.

## **Reference Books:**

1. A First Course in Network Science. Filippo Menczer, and Santo Fortunato, Cambridge University Press, 2020.

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- 2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, Wiley, 2015.
- 3. Time series analysis: forecasting and control. Box, George EP, Gwilym M. Jenkins, Gregory C. Reinsel, and Greta M. Ljung, John Wiley & Sons, 2015.
- 4. N. Boccora, Modelling of Complex Systems, 2nd Edition, Springer 2010



Semes	ter: 6 <sup>th</sup>			
Paper	code: AIML310P	L	T/P	Credits
Subjec	t: Modeling complex Systems using Machine Learning Lab	0	2	1
Marki	ng Scheme	1		
Teache	ers Continuous Evaluation: 40 Marks			
End te	rm Examination: 60 Marks			
INSTR	UCTIONS TO PAPER SETTERS:	Maxim	um Mark	ks: 60
2. 3. 4. Course	This is the practical component of the corresponding theory pa The practical list shall be notified by the teacher in the first were under the intimation to the office of the HOD/ Institution in whi from the list of practicals below. Instructors can add any other additional experiments over an experiment list which they think is important. At least 8 experiments must be performed by the students. e Objectives:	ek of the o ch they a d above t	ppear is l	being offered
1	To familiar students with the software tools and programmin	ng languag	ges used	for modeling
2	complex systems           To gain hands-on experience in applying machine learning a modeling.	algorithm	s to com	plex systems
Course	Outcomes:			
CO1	Interpret and communicate the results of complex systems clear and understandable manner.	modeling	g to stake	eholders in a
CO2	Apply machine learning algorithms and techniques to model using real-world data sets	and simu	late com	plex systems

Course	Course Outcomes (CO) to Programme Outcomes (PO) Mapping													
	(Scale 1: Low, 2: Medium, 3: High													
CO/P														
0	01	02	03	04	05	06	07	08	09	10	11	12		
CO1														
CO2														

## LIST OF EXPERIMENTS:

- 1. : Develop a machine learning model to predict a specific outcome or behavior in a complex system based on historical data. For example, predicting stock market prices or weather patterns.
- 2. Build a model to detect anomalies or outliers in complex systems. This could involve identifying unusual behavior in network traffic, detecting fraudulent transactions, or identifying defective products in a manufacturing process.



- 3. Use machine learning techniques to forecast future values in time series data of a complex system. This can be applied to predict demand for products, electricity consumption, or stock market trends.
- 4. Design a recommendation system that suggests relevant items or content to users based on their preferences and behaviors. This could involve recommending movies, products, or news articles in a complex system.
- 5. Apply clustering algorithms to group similar instances or entities within a complex system. This can be used for customer segmentation, market analysis, or identifying patterns in biological data.
- 6. Build a generative model that can simulate complex systems based on learned patterns and parameters. This could involve generating realistic images, synthesizing music, or creating virtual characters.
- 7. Utilize reinforcement learning techniques to develop an intelligent agent that learns to make decisions and control a complex system. For example, training an autonomous robot to navigate in a dynamic environment.
- 8. Text and Language Processing: Develop models for natural language understanding and processing in complex systems. This can include sentiment analysis, text classification, or machine translation.
- 9. Network Analysis: Apply machine learning algorithms to analyze and model complex networks, such as social networks, transportation networks, or biological networks.
- 10. Deep Learning for Image Analysis: Use deep learning architectures to analyze and interpret complex visual data.



Semes	ter: 6 <sup>th</sup>				
Paper	code: AIML312T		L	T/P	Credits
Subjec	t: Nature Inspired Computing		3	0	3
Markir	ng Scheme			•	
Teache	ers Continuous Evaluation: 25 Marks				
End ter	rm Theory Examination: 75 Marks				
INSTRU	JCTIONS TO PAPER SETTERS:	Maximum M	arks:	60	
2. 3. 4. 5. 6.	There should be 9 questions in the end term e Question No. 1 should be compulsory and cov objective or short answer type questions. It sh Apart from Question No. 1, the rest of the pap Every unit should have two questions. Howe question from each unit. Each question should The questions are to be framed keeping in view standard/ level of the questions to be asked sh Instructors can add any other additional experiment experiment list which they think is important. The requirement of (scientific) calculators/ log	er the entire syllabus ould be of 15 marks. per shall consist of for ever, students may be be 15 marks. If the learning outcom nould be at the level of eriments over and ab	s. This our un oe ask nes of of the pove t	questio its as pe ed to at the cour prescrib he ment	r the syllabus ttempt only se/paper. The bed textbooks tioned in the
1	• <b>Objectives:</b> To understand the fundamentals of nature i	nspired techniques			
2	To study the Swarm Intelligence and Immun				
3	To apply nature inspired process that can be	1 9 1		V	
4	Develop swarm intelligence algorithms to so			<i>.</i>	
	e Outcomes:				
CO1	Understand nature inspired algorithms, its s	trength, weakness. a	nd sui	itability	
CO2	Make use of nature-inspired algorithms to d				
CO3	Determine the appropriate parameter settir work well.				
CO4	Evaluate performance of Nature inspired optimized manner	algorithm in conte	ext of	problei	n solving in

Course Outcomes (CO) to Programme Outcomes (PO) Mapping														
	(Scale 1: Low, 2: Medium, 3: High)													
CO/P														
0	01	02	03	04	05	06	07	08	09	10	11	12		
CO1	3	-	-	3	-	-	2	-	-	-	-	2		
CO2	2	2	3	1	-	2	-	-	-	1	-	-		
CO3	2	2	3	3	-		-	-	-	-	1	1		
CO4	2	3	3	2	2	2	-	-	-	-	-	2		



#### **Course Overview:**

The Course focuses on introducing the principles and applications of computational algorithms that are inspired by natural processes and phenomena. These algorithms draw inspiration from biological systems, physical processes, and social interactions in nature to solve complex optimization, decision-making, and prediction problems.

#### UNIT I

**Introduction:** From Nature-to-Nature Computing, Philosophy, Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributive Interactivity, Adaptation Feedback-Self-Organization-Complexity, Emergence and, Bottom-up Vs Top-Down-Determination, Chaos and Fractals.

#### UNIT II

**Computing Inspired by Nature:** Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm – Genetic Algorithms, Reproduction - Crossover, Mutation, Evolutionary Programming Genetic Programming

#### UNIT III

**Swarm Intelligence:** Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Kno wledge, Particle Swarm Optimization (PSO)

**DNA Computing:** Motivation, DNA Molecule Adleman's experiment, Test tube programming language, Universal DNA Computers, PAM Model, Splicing Systems, Scope of DNA Computing, From Classical to DNA Computing.

#### UNIT IV

**Immuno Computing:** Introduction- Immune System, Physiology and main components Pattern Recognition and Binding, Immune Network Theory- Danger Theory, Evaluation Interaction Immune Algorithms, Introduction – Genetic algorithms, Bone Marrow Models, Forest's Algorithm Artificial Immune Networks.

#### Text Books

- 1. Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", Cha pma n & Hall/ CRC, Ta ylor and Francis Group, 2007.
- 2. Floreano D. and Mattiussi C., "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", MIT Press, Cambridge, MA, 2008.
- 3. Albert Y. Zomaya, "Handbook of Nature-Inspired and Innovative Computing", Springer, 2006.
- 4. Marco Dorrigo, Thomas Stutzle," Ant Colony Optimization", PHI, 2005



Seme	ster: 6 <sup>th</sup>			
Paper	code: AIML312P	L	T/P	Credits
Subje	ct: Nature Inspired Computing Lab	0	2	1
Marki	ing Scheme			
Teach	ers Continuous Evaluation: 40 Marks			
End te	erm Examination: 60 Marks			
INSTR	SUCTIONS TO PAPER SETTERS:	Maxim	um Mark	ks: 60
2. 3. 4.	This is the practical component of the corresponding the The practical list shall be notified by the teacher in the fi under the intimation to the office of the HOD/ Institution from the list of practicals below. Instructors can add any other additional experiments of experiment list which they think is important. At least 8 experiments must be performed by the studen e Objectives: Develop basic knowledge of Nature Inspired Computin	irst week of the n in which they a over and above t nts.	ppear is l	being offered
T	principle.	ng rechniques a	na their	working
	Generate the possible ways of solution to a certain re	al world problen	n using N	lature
2	Inspired Computing Techniques			
	Inspired Computing Techniques e Outcomes:			
		ns in terms of Ini	tializatio	n, Processing

Course	Course Outcomes (CO) to Programme Outcomes (PO) Mapping													
	(Scale 1: Low, 2: Medium, 3: High)													
CO/P														
0	01	02	03	04	05	06	07	08	09	10	11	12		
CO1	3	3	2	2	2	2		-	1	-	-	2		
CO2	3	3	3	3	3	2		-	2	-	-	2		

## LIST OF EXPERIMENTS:

- 1. Programs based on Concept of Optimization
- 2. Programs based on Concept of Meta heuristics
- 3. Implementing reproduction techniques such as crossover and mutation.
- 4. Programs showing Implementation of GA
- 5. Programs using Problem solving approach of GA



- 6. Programs showing Implementation of ACO algorithm
- 7. Programs using Problem solving approach of ACO algorithm
- 8. Programs showing Implementation of PSO algorithm
- 9. Programs using Problem solving approach of PSO algorithm
- 10. Programs showing Implementation of Honey-bee algorithm
- 11. Programs using Problem solving approach of Honey-bee algorithm
- 12. Programs showing Implementation of Bat algorithm
- 13. Programs using Problem solving approach of Bat algorithm
- 14. Programs showing Implementation of Harmony Search
- 15. Programs using Problem solving approach of Harmony Search
- 16. Implementing basic DNA computing algorithms such as Adleman's experiment and test tube programming language.



Semes	ter: 6 <sup>th</sup>			
Paper of	code: AIML 314T	L	T/P	Credits
Subjec	: Artificial Intelligence for Game Designing	3	0	3
Markin	g Scheme	•		·
Teache	rs Continuous Evaluation: 25 Marks			
End ter	m Theory Examination: 75 Marks			
INSTRU	ICTIONS TO PAPER SETTERS:	Maxim	um Mar	ks: 60
2. 3. 4. 5.	There should be 9 questions in the end term examination questio Question No. 1 should be compulsory and cover the entire syllab objective or short answer type questions. It should be of 15 marks Apart from Question No. 1, the rest of the paper shall consist of f Every unit should have two questions. However, students may question from each unit. Each question should be 15 marks. The questions are to be framed keeping in view the learning outco standard/ level of the questions to be asked should be at the level The requirement of (scientific) calculators/ log-tables/ data-tables <b>Objectives:</b>	us. Thi our un be ask mes of of the	s question its as pe ed to an the cour prescrib	r the syllabus. ttempt only 1 se/paper. The red textbooks.
1	To understand the basic concepts of game designing.			
2	To analyse character movement algorithms and customize car n	novem	ents.	
3	To understand the functioning of path finding and decision-n development.	naking	algorith	ms for game
4	To evaluate different game usability and user experience techni	ques		
Course	Outcomes:			
CO1	Critically evaluate game designing concepts, elements, and char	acters.		
CO2	Analyze character game movement algorithms and customize vehicle System.	car mo	vement	using Unity's
CO3	Differentiate the implementation of path finding algorithms us and simulate crowded city.	ing Wa	ypoint a	nd Navmesh
CO4	Evaluate effectiveness of game design using standard models lil	ke MEE	GA+	

Course Outcomes (CO) to Programme Outcomes (PO) Mapping														
(Scale 1: Low, 2: Medium, 3: High)														
CO/P														
0														
CO1	1	2	-	2	-	1	1	-	-	1	-	2		
CO2	1	2	1	1	3	1	1	-	-	2	-	2		
CO3	2	2	2	2	3	2	1	-	-	1	1	2		
CO4	2	3	3	2	3	2	1	1	2	2	1	2		

#### **Course Overview:**



This course enables students to learn game development. Movement Algorithms, Path Finding Algorithms and Decision-Making Algorithms have been covered in the course. Evaluation of existing and new games using standard methods in UI/UX have also been covered. Students will be able to apply all the covered game design concepts and develop a beta version of the game.

## Unit I

Introduction to games: types of games, importance of game design. Introduction to latest game engines such as Unity (C#), Unreal (C++, Blueprints), Godot (GDscript). Understanding different modules of the games – depending on different game types e.g puzzle game – level designing, player journey/behavior, ui/ux, game physics, game rules, game mechanics, audio. Scenes - game objects and transforms; Entities, components.

#### Unit II

Game physics- Rigid bodies and forces, Colliders, Joints. 2D,3D and Isometric 2D Level Design and Practice. Movements – Player movements (AI) (Using Unity's Navmesh).

#### Unit III

Understanding game cameras – Perspective, Orthographic, Player interactions and game mechanics (AI) (for puzzle games and RPGs). Applying animations and animation events, UI/UX in game design (Menu design, player statistics, HUD – heads up display, GAP, MEEGA+), Adding audio and sound effects

#### Unit IV

Game Polishing – particle effects and reactive environments. Playtesting - Game evaluation (Usability and User experience) and analytics. Al algorithms for game development.

#### Textbooks:

1. Felicia, Patrick. Unity 5 from Proficiency to Mastery: Artificial Intelligence: Implement challenging AI for FPS and RPG Games.

#### **Reference Books:**

- 1. Anders Drachen, Pejman Mirza-Babaei, and Lennart Nacke, Games User Research, Oxford University Press, 2018.
- 2. Colleen Macklin and John Sharp, Games, Design and Play: A Detailed Approach to Iterative Game Design, 2016.

#### Website References

- 1. https://www.gamedev.net/articles/programming/artificial-intelligence/the-total-beginners-guide-to-game-ai-r4942/
- 2. <u>https://www.geeksforgeeks.org/game-playing-in-artificial-intelligence/</u>

#### Important video links:

- 1. Getting started
- 2. Making Subway surf



Semes	ter: 6 <sup>th</sup>			
Paper	code: AIML 314P	L	T/P	Credits
Subjec	t: Artificial Intelligence for Game Designing Lab	0	2	1
Markir	ng Scheme		I	
Teache	rs Continuous Evaluation: 40 Marks			
End te	m Examination: 60 Marks			
INSTRU	JCTIONS TO PAPER SETTERS:	Maxim	um Marl	ks: 60
1.	This is the practical component of the corresponding the the corresponding the the corresponding the the test of t	neory paper	·.	
2.	The practical list shall be notified by the teacher i	n the first	week d	of the class
	commencement under the intimation to the office of			
	they appear is being offered from the list of practicals	below.		
3.	Instructors can add any other additional experiments	over and ab	ove the	mentioned
	in the experiment list which they think is important.			
4.	At least 8 experiments must be performed by the stud	ents.		
Cours	e Objectives:			
1	To analyse character movement algorithms and custo	omize car m	oveme	nts.
2	To understand the functioning of path finding and o	lecision-ma	king alg	orithms for
	game development.		0 0	
Cours	outcomes:			
CO1	Analyze character game movement algorithms and o	customize c	ar move	ement using
	Unity's Vehicle System.			
CO2	Differentiate the implementation of path finding a	gorithms u	sing Wa	aypoint and
	Navmesh and simulate crowded city.			

Course	Course Outcomes (CO) to Programme Outcomes (PO) Mapping													
	(Scale 1: Low, 2: Medium, 3: High													
CO/P														
0	01	02	03	04	05	06	07	08	09	10	11	12		
CO1	2	2	2	2	2	2	1	-	1	-	-	-		
CO2	3	3	3	3	3	2	2	-	2	-	-	-		

## LIST OF EXPERIMENTS:

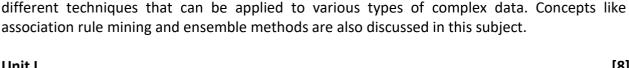
- Introduction to latest game engines such as Unity (C#), Unreal (C++, Blueprints), Godot (GDscript)
- 2. Installation of Unity
- 3. Working with interface of Unity



- 4. Creation of scenes and game objects using Unity
- 5. Applying transformations of game objects and deactivation of game objects using Unity.
- 6. Working with Constraints in Unity.
- 7. Develop 2D game projects in Unity using sprites, Tilemaps and 2D physics system.
- 8. Embedding various graphic features of Unity in game development.
- 9. Working with Buit-in 3D Physics features: Character control, Rigid body physics, Collision, Joints and Multi-scene physics.
- 10. Using scripting used to embed graphical effects, control the physical behaviour of objects and implement a custom AI system for characters in the game.
- 11. Working with Unity's Vehicle Module Feature.
- 12. Creating a multiplayer game using Network Manager in LAN mode and using Network Manager in Matchmaker mode.
- 13. Converting a single-player game to Unity Multiplayer.
- 14. Implementation of Crowd simulation project using Unity.



Seme	ester: 6 <sup>th</sup>												
Pape	r code: A	IML3261	Г						L	T/P	Cre	dits	
Subje	ect: Data	Mining							3	0	3		
Mark	king Sche	me:							·				
1	. Teache	ers Conti	nuous Ev	valuation	n: 25 Ma	irks							
	. End Te				75 Mark	(S							
Instr	uctions fo	or Paper	Setters:					Μ	aximum	Marks:	75		
1. T	here shou	uld be 9	question	is in the	end terr	n exami	nation q	uestion	paper.				
2. C	Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 10 marks.												
0	bjective o	or short a	answer t	ype que	stions. It	t should	be of 10	marks.					
	part from				-	-				=	-		
	very unit			•			udents n	hay be a	sked to a	attempt	only 1 q	uestion	
	rom each		•					_		,			
	he questi							-			-		
	tandard/		•						•				
	he requir <b>rse Obje</b> o		r (scient	inc) calc	ulators/	іод-тарі	es/ data	-tables r	nay be s	pecified	ir requi	ea.	
1.			differer	t types	of data	and usin	o data r	re-proc	ossing ta	chnique	s annlic	ahle on	
	the da		unierei	it types	or uata		ig uata p	ne-pioc	essing to	cinique	s applic		
2.			rious cla	ssificatio	n and cl	ustering	technia	ues on r	eal worl	d datase	ets.		
3.			nining te					-					
4.			erent as			•			ng techn	iques.			
Cou	rse Outco					0	•		0	•			
CO1	Interp	et the l	basic col	ncepts c	of data i	mining t	echniqu	es to id	entify in	nterestir	ig and r	elevant	
	. patteri	ns.											
CO2	Apply	and perf	orm pre-	-process	ing step	s to prep	oare the	data an	d get ins	ights int	o the da	taset.	
		1:00			1		• • •			•			
CO3			ent assoc	lation ru	lies ider	ntified us	sing asso	Delation	rule min	ing or se	equence	mining	
	-	l life data					المناع اممر				بمامي ما ح	a <b>t</b> u <i>u</i> a a a	
CO4	Design	and Dev	velop mo	aeis usir	ig classif	ication a	and clust	ering teo	unniques	s on com	piex dat	a types.	
Cour	se Outcoi	mes (CO	) to Prog	ramme	Outcom	es (PO)							
			,			( /	Ma	apping (S	Scale 1:	Low, 2: N	/ledium,	3: High	
CO/	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
PO													
CO1	2	1	2	-	3	-	-	1	-	-	-	-	
CO2	2	2	2	3	-	-	-	-	1	-	-	-	
CO3	2	-		2	3	-	1	-	-	1	-	-	
CO4	2	2		3	3	-	-	-	-		1	2	



The subject gives a detailed overview on data mining as a process starting from pre-processing the dataset to classification/clustering techniques on the data. The students are introduced to

Unit I Data Mining Basics- What is Data Mining, Kinds of Patterns to be Mined, Tasks of Data Mining, Data Mining Applications- The Business Context of Data Mining, Data Mining as a Research Tool, Data Mining for Marketing, Benefits of data mining.

Data Pre-processing- Review of Data Pre-processing: Types of Data, Data Quality, Measurement and Data Collection Issues, Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature Creation, Data Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity.

#### Unit II

Classification- Types of classifiers, Rule based classifiers, Model Selection, Model Evaluation, Artificial Neural Networks: Activation Functions (Sigmoid, Tanh, ReLU, Leaky ReLU, Selu), Perceptron, Multilayer Feed-Forward Neural Network, Backpropagation, Semi-supervised classification, Active Learning, Ensemble Methods: Methods for Constructing an Ensemble Classifier, Bias-Variance Decomposition, Bagging, Boosting, GBM, XGBoost, Stacking, Random Forest. Metrics for Evaluating Classification Performance: Holdout method, Cross Validation, Bootstrap

Handling Class Imbalance Problem: Evaluating Performance with Class Imbalance, Finding an Optimal Score Threshold, Multiclass Problem.

#### Unit III

Association Rule Mining- Mining Frequent Patterns, Associations and correlations, Market Basket Analysis, Apriori algorithm, Support Counting, Improving the efficiency of Apriori, Rule generation in Apriori algorithm, FP growth algorithm, Eclat algorithm, Mining Various kinds of Association Rules, Maximal Frequent Itemsets, Closed Itemsets, Evaluation of Association Patterns. Handling Categorical Attributes, Handling Continuous Attributes.

Sequential Patterns- Sequential Pattern Discovery, GSP algorithm, SPADE algorithm, Timing Constraints.

#### Unit IV

**Cluster detection-** Different Types of Clusters, Hierarchical Methods: Agglomerative and Divisive Clustering, Density based Clustering: DBSCAN algorithm, Comparing K-means and DBSCAN, Self-Organizing Maps (SOM), Cluster Evaluation. Outlier Analysis, Outlier Detection Methods. Mining Complex Data Types.

Avoiding False Discoveries- Significance Testing, Hypothesis Testing, Multiple Hypothesis Testing, Pitfalls in Statistical Testing

## **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

## **Course Overview:**

[8]

[12]

[10]

## [10]



## Textbooks:

- 3. Tan Pang- Ning, Steinbach M., Viach, Kumar V., "Introduction to Data Mining", Second Edition, Pearson, 2013.
- 4. Han J., Kamber M. and Pei J., "Data Mining Concepts and Techniques", Second Edition, Hart Court India P. Ltd., Elsevier Publications, 2001.

#### **Reference Books:**

- 1. Zaki M.J., Meira W., "Data Mining and Machine Learning: Fundamental Concepts and Algorithms", Second Edition, Cambridge University Press, 2020
- 2. Witten, E. Frank, M. Hall, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Publishers, 2011.



Semest	er: 6 <sup>th</sup>											
Paper c	ode: Al	ML326	Р						L	T/P	Credi	ts
Subject	: Data	Mining	g Lab						0	2	1	
Markin	g Schen	ne:										
1.	Teache	rs Conti	nuous	Evaluati	on: 40 I	Marks						
2.	End ter	m Exam	ninatior	i: 60 Ma	irks							
Instruct	tions fo	r Evalua	ators:						Maximu	ım Mar	ks: 60	
1. This	is the p	oractica	l comp	onent o	f the co	rrespon	ding the	eory pap	ber.			
2. The	practi	cal list	shall	be not	ified b	y the	teacher	in the	e first	week c	of the	class
com	nmence	ment u	nder th	ne intim	ation to	o the of	fice of t	he HO	D/ Instit	ution in	which	they
арр	ear is b	eing off	ered fr	om the	list of p	racticals	below.					
3. Inst	ructors	can ado	d any of	ther add	ditional	experim	nents ov	er and a	above th	ne ment	ioned in	n the
exp	eriment	t list wh	ich the	y think i	is impor	tant.						
4. At le	east 8 e	xperim	ents mi	ust be p	erforme	ed by th	e studer	nts.				
Course	e Objec	tives:										
1.	То ре	erform p	oreproc	essing c	on real v	vorld da	tasets.					
2.	To de	velop n	nodels	using di	fferent	data mi	ning tec	hniques	on com	nplex da	tasets.	
Course	Outco	mes:										
CO1	Analy	ze and	apply p	re-proc	essing t	echniqu	es to pr	epare a	nd proc	ess real	life dat	asets.
CO2	Imple	ement d	lifferen	t cluster	ing or c	lassifica	tion tec	hniques	s for var	ying set	s of pro	blems.
Course	Outcon	nes (CO	) to Pro	ogramm	e Outco	omes (P	0)					
							Mappi	<b>ng (</b> Scal	le 1: Lov	v, 2: Me	dium, 3	: High)
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12
CO1	2	1	-	2	3	-	1	-	-	1	-	-
CO2	2	2	-	3	3	-	-	-	-	-	1	2

## List of Experiments

- 1. Introduction and installation of WEKA tool.
- 2. Perform data pre-processing including cleaning, integration and transformation on ARFF files using WEKA.
- 3. Apply association rule mining on ARFF files using WEKA.
- 4. Implementation of Neural Network technique on ARFF files using WEKA.
- 5. Implementation of Bagging and Boosting techniques on ARFF files using WEKA.



- 6. Apply the concept of Voting ensemble method to ARFF files and compare the results with single classifiers.
- 7. Implementation of Visualization technique on ARFF files using WEKA.
- 8. Implementation of Clustering technique on ARFF files using WEKA.
- 9. Study of DBMINER tool.
- Apply pre-processing and classification/regression techniques on a real-world dataset.
   Evaluate the performance of classification techniques using different parameters.



Semest	er: 6 <sup>th</sup>											
Paper o	ode: Al	ML3341	Γ						L	Т/Р	Credit	s
Subject	t: Introd	duction	to Rob	otics					4	0	4	
Markin	g Schen	ne								•	•	
Teache	rs Conti	nuous E	valuat	ion: 25	Marks							
End ter	m Theo	ry Exam	inatio	า: 75 M	arks							
	ICTIONS										m Mark	s: 60
2. C 3. A E c 4. T S 5. I	There sho Question Objective Apart fro Every uni question The quest tandard, nstructor experime The requi	No. 1 sh or short m Quest it should from eac tions are / level of rs can ac ent list w	nould b answe ion No d have ch unit. to be f the qu dd any hich th	e compu r type q . 1, the two qua Each qua ramed k restions other a ey think	ulsory ar uestions rest of tl estions. uestion s eeping i to be as dditiona is impor	nd cover 5. It shown he pape Howeve should b n view t ked sho I experi rtant.	the ent uld be of r shall co er, stude be 15 ma he learn uld be a ments c	ire syllat 15 marl onsist of ents mar rks. ing outco t the lev over and	bus. This four un y be ask omes of el of the above t	question its as pe ed to at the cour prescrib he ment	r the syll ttempt o se/pape red textb tioned in	abus. only 1 r. The ooks. o the
	Objecti		•							· ·	· ·	
1		of stud rmore t									its gripp 1	ers.
2	Ability jacobia		lents t	o utiliz	e the d	ifferen	tial mo <sup>.</sup>	tion and	d veloci	ties of	robot u	sing
3	-	of stue nian me		to use	the dy	namic	analysi	s of for	ces usi	ng Lagr	angian	and
4	Ability	of stud	ents to	impler	ment th	e onlin	e and of	ffline pr	ogramn	ning of ı	robots.	
Course	Outcon	nes:										
CO1		nt will b nderstar								ng with	its grip	oers
CO2	Studer jacobia		e able	to utili	ize the	differei	ntial mo	otion an	d veloc	ities of	robot u	sing
CO3		nt will k mian me		e to use	e the d	ynamic	analys	is of fo	rces usi	ing Lagr	rangian	and
CO4	Studer	nt will b	e able	to impl	ement t	he onli	ne and	offline <sub>l</sub>	orogram	nming o	f robots	
Course	e Outcoi	mes (CC	) to Pi	rogram	me Out	comes	(PO) M	••••	e 1: Low	<i>ı,</i> 2: Me	dium, 3:	High)
CO/P	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО	РО
0	01	02	03	04	05	06	07	08	09	10	11	12
CO1	3	3	3	3	3	2	1	-	1	3	1	2
CO2	3	3	3	3	3	1	1	-	2	3	1	2
CO3	3	3	3	3	3	1	1	-	3	3	2	3
CO4	3	3	3	3	3	3	2	-	3	3	2	3
	-	-	l –	-	l –	-	-				<u> </u>	-



**Course Overview:** The course provides a comprehensive introduction to the principles, technologies, and applications of robotics. This course covers the fundamental concepts, components, and algorithms used in robotics, as well as the design, development, and control of robotic systems. Students will gain hands-on experience with robot hardware and software, and explore various robotic applications across different industries.

#### UNIT I

**Fundamentals of Robot Technology:** Robot definition, automation and robotics, Robot anatomy, Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission

**End effectors:** Mechanical and other types of grippers, Tools as end effectors, Robot and effector interface, Gripper selection and design.

**Sensors and actuators used in robotics**: Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots

#### UNIT II

**Kinematics of Robots:** Transformation Matrices, Inverse transformation matrices, Forward and Inverse kinematic equation for position and orientation, Denavit-Hartenberg representation of robot, inverse kinematic solution for articulated robot, Numericals.

**Differential Motions and velocities:** Jacobian, Differential motions of a frame, Differential motion between frames, Calculation of the Jacobian, Inverse Jacobian, Numericals.

## UNIT III

**Dynamic analysis of Force:** Lagrangian and Newtonian mechanics, Dynamic equations form multiple –DOF Robots, Static force analysis of Robots, Transformation of forces and moments between coordinate frames, Numericals.

**Trajectory Planning:** Basics of Trajectory planning, Joint space trajectory planning, Cartesian Space trajectories, Numericals.

## UNIT IV

**Robot Programming languages & systems:** Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

**Off-line programming systems:** Introduction, central issues in on-line and offline programming, Programming examples.

**Application of robots:** Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

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## [10]

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## Text Books:

- 1. Saha, S. K. (2014). *Introduction to robotics*. Tata McGraw-Hill Education.
- 2. Mittal, R. K., & Nagrath, I. J. (2003). *Robotics and control*. Tata McGraw-Hill.
- 3. Fu, K. S., Gonzalez, R., & Lee, C. G. (1987). *Robotics: Control Sensing. Vis.* Tata McGraw-Hill Education.
- 4. Niku, S. B. (2001). *Introduction to robotics: analysis, systems, applications* (Vol. 7). New Jersey: Prentice hall.

#### **Reference Books:**

- 1. Spong, M. W., & Vidyasagar, M. (2008). *Robot dynamics and control*. John Wiley & Sons.
- 2. Choset, H., Lynch, K. M., Hutchinson, S., Kantor, G. A., & Burgard, W. (2005). *Principles of robot motion: theory, algorithms, and implementations*. MIT press.
- 3. Bhaumik, A. (2018). From AI to robotics: mobile, social, and sentient robots. CRC Press.



# Syllabus of 3<sup>rd</sup> Year, 6<sup>th</sup> semesters Papers for IIOT



Paper co	r: 6 <sup>th</sup>											
	Paper code: IOT302							1	. 1	Г/Р	Credit	S
Subject: Digital Image Processing								3	3 (	0	3	
Marking	Scheme											
1.	Teachers	S Continu	ous Evalua	ation: 2	5 Marks	5						
2.	End term	n Theory	Examinati	on: 75 N	Marks							
INSTRUC	TIONS TO	PAPER SE	TTERS:					ſ	Maximu	um Ma	arks: 7	5
<ol> <li>Qui ob</li> <li>Ap</li> <li>Ap</li> <li>Eve qui</li> <li>Th</li> <li>sta</li> <li>Th</li> </ol>	-	1 should short ans ould have n each u ns are to vel of the nent of (s basic im	d be comp wer type ( No. 1, the re two qu nit. Each q be framed questions	ulsory a question rest of estions uestion keepir to be a calculate	and cov ns. It sh the pap . Howe should ng in vie nsked sh ors/ log	er the o ould be per sha ver, stu be 15 be 15 ew the nould be -tables,	entire syl of 15 m ll consist udents m marks. learning e at the lo / data-tal	labus. Th arks. of four u nay be a outcome evel of th bles may	is ques inits as sked to es of co be preso be spe	per th atter urse/p cribed cified i	ne sylla npt on paper. textboo f requi	bus. ly 1 The oks. red.
	applicatio											
2. 3.			ital image									
5.	-		ques such	as ima	ge aen	oising, I	image se	gmentat	ion, im	age er	inance	nent
4.		and edge detection. To design image compression and image segmentation algorithms.										
	-	-			inage st	-9						
	Outcomes: Understanding of the fundamental concepts of image processing, including image representation, enhancement, restoration, compression, and segmentation.											
CO1		tation, er	nhanceme	nt, rest	oration	, compr	ession, a	nd segm	-		ding ir	nage
CO2		tation, er various se	nhanceme gmentatio	nt, reste on tech	oration, niques f	, compr for imag	ession, a ge analys	nd segm is	entatio		ding ir	nage
CO2 CO3	Outline t	tation, er various se he variou	nhanceme egmentations feature	nt, resto on techi extracti	oration, niques f on tech	, compr for imag niques	ession, a ge analys for image	nd segm is e analysis	entatio		ding ir	nage
CO2 CO3 CO4	Outline t Design in	tation, en various se he variou nage com	nhanceme egmentations feature opression a	nt, resto on techo extracti and ima	oration, niques f on tech ge segn	, compr for imag niques nentatio	ession, a ge analys for image on algori	nd segm is e analysis thms.	entatio	n.		nage
CO2 CO3 CO4 Course O	Outline t Design in utcomes (C	tation, er various se he variou nage com <b>O) to Pro</b>	nhanceme gmentations feature pression a gramme O	nt, resto on techi extracti and ima utcomes	oration, niques f on tech ge segn <b>(PO) M</b>	, compr for imag niques nentation apping	ession, a ge analys for image on algori (Scal	nd segm is e analysis thms. e 1: Low,	entatio	n. um, 3: I	High <b>)</b>	
CO2 CO3 CO4	Outline t Design in	tation, er various se he variou nage com <b>O) to Pro</b>	nhanceme egmentations feature opression a	nt, resto on techo extracti and ima	oration, niques f on tech ge segn	, compr for imag niques nentation apping	ession, a ge analys for image on algori	nd segm is e analysis thms.	entatio 5 2: Medin <b>PO0</b>	n.	High <b>)</b>	PO
CO2 CO3 CO4 Course O	Outline t Design in utcomes (C	tation, er various se he variou nage com <b>O) to Pro</b>	nhanceme gmentations feature pression a gramme O	nt, resto on techi extracti and ima utcomes	oration, niques f on tech ge segn <b>(PO) M</b>	, compr for imag niques nentation apping	ession, a ge analys for image on algori (Scal	nd segm is e analysis thms. e 1: Low,	entatio	n. um, 3: I	High)	
CO2 CO3 CO4 Course O CO/PO	Outline to Design in utcomes (C PO01	tation, er various se he variou nage com nage com <b>O) to Pro</b> g <b>PO02</b>	nhanceme gmentations feature pression a gramme O PO03	nt, resto on techi extracti and ima utcomes PO04	oration, niques f on tech ge segn s (PO) M PO05	, compr for imag niques nentation apping PO06	ession, a ge analys for image on algori (Scal <b>PO07</b>	nd segm is e analysis thms. e 1: Low, <b>PO08</b>	entatio 2: Medin PO0 9	n. um, 3: <b>PO10</b>	High)	PO
CO2 CO3 CO4 Course O CO/PO	Outline t Design in utcomes (C PO01 2	tation, er various se he variou nage com nage com <b>CO) to Prog</b> <b>PO02</b> 2	nhanceme egmentations feature pression a gramme O PO03 2	nt, resto on techi extracti and ima utcomes PO04 2	oration, niques f on tech ge segn s (PO) M PO05 2	, compr for imag niques nentation <b>apping</b> <b>PO06</b> 2	ession, a ge analys for image on algori (Scal <b>PO07</b> 1	nd segm is e analysis thms. e 1: Low, <b>PO08</b>	entatio 2: Media PO0 9 1	n. um, 3: PO10	High)	PO



#### **Course Overview:**

To introduce the student to various image processing techniques and image fundamentals. To describes the main characteristics of digital images, how they are represented. Mathematical transforms such as such as Fourier, Cosine transforms, Singular value decomposition, 2D Wavelet transform, image enhancement techniques. Image restoration and denoising, segmentation, lossy and lossless data compression algorithms, binary and color image processing.

#### Unit I

**INTRODUCTION TO IMAGE PROCESSING:** Introduction to images and its processing, Components of image processing systems, image representations, Image file formats, recent applications of digital image processing, image sampling and quantization, Image Analysis, Intensity transformations, contrast stretching, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian. Need for transform, Fourier, Cosine transforms, 2D Wavelet transform, Different properties of image transform techniques.

#### Unit II

Concept of image compression, lossless techniques (Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques) and lossy compression techniques (Transform Coding & K-L Transforms, Discrete Cosine Transforms, and BTC), Enhancement in spatial and transform domain, histogram equalization, Directional Smoothing, Median, Geometric mean, Harmonic mean, Homomorphic filtering

#### Unit III

Image degradation, Type of image blur, Classification of image restoration techniques, image restoration model, Linear and nonlinear restoration techniques, Image denoising, Median filtering. Classification of image segmentation techniques, Boundary detection-based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Thresholding, Iterative thresholding, Otsu's method, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

#### Unit IV

**Binarization:** Basic Set theory, Binary morphological operations and its properties, Color Image Representation, Converting Between Color Spaces, The Basics of Color Image Processing, Color Transformations, Spatial Filtering of Color Images, Working Directly in RGB Vector Space, Applications of digital image processing: Case studies

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#### **Text Books**

- 1. Digital Image Processing, R.C. Gonzalez and R.E. Woods, 2nd edition, Pearson Prentice Hall, 2008
- 2. Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989.

#### **Reference Books**

- 1. Digital Image processing, S Jayaraman, TMH, 2012
- 2. William K. Pratt, *Digital Image Processing*, 3rd Edition, John Wiley, 2001.

#### моос

- 1. https://nptel.ac.in/courses/117/105/117105079/
- 2. https://nptel.ac.in/courses/117/105/117105135/



				= /p	
Paper code: IOT352P			L	T/P	Credits
Subject: Digital Imag	e Processing Lab		0	2	1
Marking Scheme:					
1. Teachers Cont	tinuous Evaluation: 40 Marks				
2. End term Exar	mination: 60 Marks				
Instructions for Evalu	lators:	Ma	ximu	ım Marl	ks: 60
1. This is the practic	al component of the correspo	onding theory paper.	•		
2. The practical lis	t shall be notified by the	teacher in the fi	irst v	week o	f the class
commencement	under the intimation to the	office of the HOD/ I	nstit	ution in	which they
appear is being of	ffered from the list of practica	als below.			
3. Instructors can ac	d any other additional exper	iments over and abc	ove th	ne ment	ioned in the
experiment list w	hich they think is important.				
4. At least 8 experim	nents must be performed by t	the students.			
Course Objectives:					
	the concerts of income and	assing and basic ana	lvtica	l metho	
<b>1.</b> To introduce	e the concepts of image proce	zssilig allu basic alla			ds to be use
1. To introduce in image pro			.,		ds to be use
in image pro	ocessing.				
in image pro <b>2.</b> To familiariz					
in image pro <b>2.</b> To familiariz	ocessing. e students with image enhar				
in image pro 2. To familiariz image comp Course Outcomes:	ocessing. e students with image enhar	ncement and restora	ation	techniq	ues, differer
in image pro 2. To familiariz image comp Course Outcomes:	ocessing. e students with image enhar pression techniques hniques such as image denois	ncement and restora	ation	techniq	ues, differer
in image pro2.To familiariz image compCourse Outcomes:C01Analyze tech and edge de	ocessing. e students with image enhar pression techniques hniques such as image denois	ncement and restora	ation	techniq	ues, differer

CO/P O	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	2	2	2	2	1	-	-	-	-	-	-	1
CO2	2	2	2	2	1	1	1	1	1	1	1	2

#### LIST OF EXPERIMENTS:

- 1. Create a program to demonstrate Geometric transformations- Image rotation, scaling, and translation.
- 2. Display of FFT (1-D & 2-D) of an image and apply Two-dimensional Fourier transform to represent the content of an image using the discrete Fourier transform (DFT) and masking with DFT.
- 3. Write a Program of Contrast stretching of a low contrast image, Histogram, and Histogram Equalization and Display of bit planes of an Image.



- 4. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
- 5. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image)
- 6. Implementation of image sharpening filters and Edge Detection using Gradient Filters.
- 7. Implementation of Image Compression by DCT, DPCM, HUFFMAN coding.
- 8. Implementation of image restoring techniques.
- 9. Implementation of Image Intensity slicing technique for image enhancement.
- 10. Study and implement Canny edge detection Algorithm to images and compare it with the existing edge detection algorithms.



Semeste	r: 6 <sup>th</sup>											
Paper co	de: IOT	304T							L	T,	/P Cr	edits
Subject:	Wirele	ess Sense	or Netv	vorks					3	0	3	
Marking	Scheme	9										
1. T	eachers	Continu	ious Ev	aluatior	n: 25 Ma	irks						
<b>2.</b> E	nd term	Theory	Examiı	nation: 7	75 Mark	S						
INSTRUC		Ο ΡΑΡΕ	R SETT	ERS:						Maxim	um Ma	rks: 75
2. Qu	uestion ojective	No. 1 sh or short	ould be answe	e compu r type q	ulsory an uestions	nd cover s. It shou	r the en uld be o	on questi tire sylla f 15 mar	bus. Thi ks.	s quest		
Ev qu	eryunit lestion f	should rom eac	have t h unit.	wo que Each qu	estions. Jestion s	Howeve should b	er, stud oe 15 ma		y be asl	ked to	attempt	only 1
sta	andard/ ie requii	level of rement of	the qu	estions	to be as	ked sho	uld be a	arning o at the lev lata-tabl	el of the	e prescr	ibed tex	tbooks.
1.		derstand	basic	concept	s of wire	eless ser	nsor net	works.				
2.		rn about		· · ·								
3.	To und	derstand	l the m	iddlewa	re archi	tecture	and net	work ma	anageme	ent mod	lels for V	VSN.
4.	To stu	dy Appli	cations	and De	ployme	nt of Wi	ireless S	ensor Ne	etworks			
Course	Outcom	les:										
CO1	Under	stand th	ie WSN	concep	ts, chall	enges a	nd appli	ications				
CO2				•		-		he operation	ating en	vironme	ent	
	-					-		-				iges and
CO3		issues	•			01				0		0
CO4	Learn	the Mid	dlewar	e archit	ecture 8	k Netwo	rk Mana	agement	for WSI	N		
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	-	-	2	2	2	-	1	1	-	-	1	1
CO2	-	2	2	2	2	-	1	-	-	-	1	1
CO3	-	2	2	2	2	-	1	-	-	-	1	1
CO4	1	1	2	2	2	1	1	1	-	-	1	1

# **Course Overview:**

This course provides students with an opportunity to learn the fundamentals behind the design of wireless sensor networks. A primary focus of this course is to give students hands-on programming experience with various sensors and sensing platforms. Wireless sensor networks further contribute to the widespread use of distributed sensor systems. The miniaturization of computing and sensing technologies enables the development of tiny, low-power, and inexpensive sensors, actuators, and controllers. Further, embedded computing systems (i.e., systems that typically interact closely with the physical world and that are designed to perform only a limited number of dedicated functions) continue to find application in an increasing number of areas.



Technology: Sensor Node Technology.

Introduction: Introduction to Wireless Sensor Network (WSN), Sensor Network Architectural Elements, Challenges and Hurdles, Applications of WSN. Review of Sensor and Transmission

Communication Protocols: MAC Protocols: Fundamentals of MAC Protocols, MAC Protocols for WSN, BMAC Protocol, IEEE 802.15.4 standard and ZigBee. Routing Protocols: Data Dissemination and Gathering, Routing Challenges and Design Issues, Routing Strategies in WSN.

Unit III

Transport Control Protocols: Traditional Transport Control Protocols, Design Issues in Transport Protocols, WSN Middleware Principles, Middleware Architecture.

# Unit IV

[10] Network Management for WSN: Network Management Requirements, Traditional Network Management Models, Network Management Design Issues.

# **Text Books**

- 1. Kazem, Sohraby, Daniel Minoli, Taieb Zanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
- 2. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9).

# **Reference Books**

- 1. Raghavendra, Cauligi S, Sivalingam, Krishna M., Zanti Taieb, "Wireless Sensor Network", Springer 1st Ed. 2004 (ISBN: 978-4020-7883-5).
- 2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Network", Elsevier, 1st Ed. 2004 (ISBN: 13-978-1-55860-914-3).
- 3. B. Krishnamachari, "Networking Wireless Sensors", Cambridge University Press.
- 4. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag.

# **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

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# Unit I

Unit II



Semes	ter: 6 <sup>th</sup>											
Paper	code: l	OT304F	)						L	T/F	P Crec	lits
Subjec	t: Wire	eless Se	nsor N	letwor	k Lab				0	2	1	
	ng Sche											
						0 Mark	S					
	End te				Marks							
Instru	ctions f	or Evalı	uators	:						Maxi	mum Ma	arks: 60
1. Th	is is the	practic	al con	nponen	t of the	corresp	onding	theory p	oaper.			
2. Th	e prac	tical lis	st sha	ll be i	notified	by th	e teach	ner in t	the first	: week	of the	class
									OD/ Inst	titution	in which	n they
•	•	•				•	cals belo					
			-			-		over an	id above	the me	ntioned	in the
				•	•	portant.						
			nents	must be	e perfor	med by	the stu	dents.				
Cours	se Obje	ctives:										
1.	. To de	esign va	arious	topolog	gies of V	Vireless	networ	ks.				
2.	. To de	emonst	rate tł	ne phys	ical and	MAC la	iyer pro	tocols o	f Wireles	ss netwo	orks.	
Cours	se Outc	omes:										
CO1	Ana	vze tec	hniqu	es such	as imag	e denoi	sing, im	age seg	mentatio	on, Imag	e enhan	cement
		, edge de	•		L L	•	0,	0 0		, 0		
CO2		-			ncy don	nain filte	ers on a	n image	data set	•		
Course		-		-	-		) Mappi		Scale 1: L		ledium, 3	3: High <b>)</b>
CO/P	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
0												
CO1	2	2	2	2	3	-	-	-	-	1	-	-
CO2	2	2	2	2	2	1	1	1	2	1	1	2

# LIST OF EXPERIMENTS

# (Wireless Sensor Network Lab)

- 1. Create a sample wireless topology using Simulation Tool using NS2/NS3/MATLAB.
- 2. Create a mobile Ad-hoc networks using Simulation Tool.
- 3. Implement a Low Energy Adaptive Hierarchy protocol using Simulation Tool.
- 4. Implement a Power Efficient Gathering in Sensor Information System using Simulation Tool.
- 5. Implement a Sensor Protocol for Information via Negotiation (SPIN) using Simulation Tool.
- 6. Implement a Power Efficient and Delay Aware MAC protocol using Simulation Tool.
- 7. Implement a Predictive Wake-up MAC protocol using Simulation Tool.
- 8. Implement a Proactive and Reactive based MAC protocol using Simulation Tool.
- 9. Implement a Transmission Control Protocol using Simulation Tool.
- 10. Implement a Scheduling based protocol for WSNs using Simulation Tool.



Semeste	r: 6 <sup>th</sup>											
Paper co	de: IOT	306T							L	Т	/P (	Credits
Subject:	Mobil	e Comp	uting						3	0	(i)	}
Marking	Scheme	9							·		<u> </u>	
Teachers	Contin	uous Ev	aluatio	n: 25 M	arks							
End term	ו Theor	/ Examir	nation:	75 Marl	ks							
INSTRUC	TIONS	ΓΟ ΡΑΡΕ	R SETT	ERS:						Maxim	um M	arks: 75
								•	ion pape abus. Thi		ion sho	ould have
								f 15 mai				
					-					nits as	per the	syllabus.
Εv	eryunit	should	have t	two que	estions.	Howeve	er, stud	ents ma	iy be as	ked to	attem	ot only 1
qu	lestion f	rom ea	ch unit.	Each qu	uestion	should k	be 15 ma	arks.				
						-		-				per. The
			•							•		extbooks.
5. Th Course			of (scie	ntific) c	alculato	ors/ log-t	ables/ c	lata-tabl	les may l	be spec	ified if	required.
1.			1 hasic	concent	s of wir	eless se	nsor net	works				
2.						g protoc						
3.								work ma	anageme	ent mo	dels for	WSN.
4.									etworks			
Course	Outcom	nes:										
CO1	Under	stand th	ne WSN	l concer	ots, chal	lenges a	nd appl	ications				
CO2	Learn	the hard	dware a	and soft	ware co	mponer	nts and t	the oper	ating en	vironm	ent	
									_			enges and
CO3		issues	•			0 1				0		0
CO4	Learn	the Mid	dlewar	e archit	ecture 8	& Netwo	ork Man	agement	t for WS	N		
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	-	-	2	2	2	-	1	1	-	_	1	1
CO2	-	2	2	2	2	-	1	-	-	-	1	1
CO3	-	2	2	2	2	-	1	-	-	-	1	1
CO4	1	1	2	2	2	1	1	1			1	1

#### **Course Overview:**

The course on Mobile Computing provides a concise yet comprehensive overview of the fundamental concepts and technologies in the field. Students will learn about the architecture of mobile computing systems, wireless communication protocols, mobile application development, and location-based services. Topics covered include mobile operating systems, mobile device hardware, mobile network infrastructure, mobile security, and emerging trends in mobile computing. Practical exercises and case studies will enhance students' understanding of mobile computing applications and their impact on various industries.



#### Unit I

[10] **Introduction:** Introduction to Mobile Computing, Applications of Mobile Computing, Generations of Mobile Communication Technologies, Multiplexing, Spread spectrum, MAC Protocols, SDMA, TDMA, FDMA, CDMA. Mobile Device Operating Systems: Special Constraints & Requirements, Commercial Mobile Operating Systems.

#### Unit II

Mobile Telecommunication System: Introduction to Cellular Systems. GSM: Services & Architecture, Protocols, Connection Establishment. Frequency Allocation, Routing, Mobility Management, Security Architecture, Handover Security

# Unit III

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Mobile Network Layer: Mobile IP, DHCP, AdHoc Network, Proactive Protocol-DSDV, Reactive Routing Protocols DSR, AODV, Hybrid routing, ZRP, Multicast Routing- ODMRP, Vehicular Ad Hoc networks (VANET), MANET Vs VANET, Security.

#### Unit IV

#### [10]

Mobile Transport and Application Layer: Mobile TCP, WAP: Architecture, WDP, WTLS, WTP, WSP, WAE, WTA Architecture – WML. Software Development Kit: iOS, Android, BlackBerry, Windows. M-Commerce Structure: Pros & Cons. Mobile Payment System: Security Issues

# **Text Books:**

- 1. Jochen Schiller, Mobile Communications, PHI, Second Edition, 2003.
- 2. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning.

# **Reference Books:**

- 1. Dharma Prakash Agarwal, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
- 2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, -Principles of Mobile Computing, Springer, 2003.



Semester: 6 <sup>th</sup>					
Paper code: IOT306P		L	T/P	Cred	its
Subject: Mobile Computing Lab		0	2	1	
Marking Scheme:					
1. Teachers Continuous Evaluation: 40 Marks					
2. End term Examination: 60 Marks					
Instructions for Evaluators:	M	aximu	um Ma	rks: 60	
1. This is the practical component of the corresponding the	eory pape	r.			
2. The practical list shall be notified by the teacher	r in the i	first	week	of the	class
commencement under the intimation to the office of t	the HOD/	Instit	ution i	n which	they
appear is being offered from the list of practicals below.					-
3. Instructors can add any other additional experiments ov	ver and ab	ove th	he men	itioned i	n the
experiment list which they think is important.					
4. At least 8 experiments must be performed by the studer	nts.				
Course Objectives:					
1. To analyze different types of routing protocols					
2. To create meaningful insights in the field of MANET	T and VAN	IET			
Course Outcomes:					
<b>CO1</b> Analyze techniques such as image denoising, image	e segment	tation	. Image	e enhand	cement
and edge detection.			,		
CO2 Apply spatial and frequency domain filters on an ir	mage data	set.			
	008 PO		PO10	PO11	PO12
0					
CO1         2         2         2         2         1         1         1	2 :	1	1	1	2
CO2         2         2         2         2         1         1         1	2 :	1	1	1	2

# LIST OF EXPERIMENTS:

- 1. Study and install a Network Simulator (CISCO packet tracer/GNS3)
- 2. Study and implement Reactive Routing Protocol on a Network Simulator
- 3. Study and implement Dynamic Source Routing Protocol on a Network Simulator
- 4. Study and implement Ad-hoc On Demand Distance Vector (AODV) on a Network Simulator
- 5. Study and implement Hybrid routing on a Network Simulator
- 6. Study and implement Multicast Routing ODMRP i.e. On Demand Multi Cast Routing Protocol
- 7. Study and implement Vehicular Ad Hoc networks (VANET)
- 8. Study and implement MANET (Mobile Ad-hoc Network)
- 9. Prepare a case study for a comparative analysis of MANET Vs VANET
- 10. Compare and contrast the various routing protocols using an industrial case study.



Semeste	nester: 6 <sup>th</sup> L       T/P       Credits         ier code: IOT308T       J       O       3         iject: Soft Computing       3       O       3         rking Scheme											
Paper co	ode: IOT	308T							L	Т/	P Cro	edits
Subject:	Soft Co	omputing	g						3	0	3	
Marking	s Schem	е							•	•		
1. 1	eachers	s Continu	ious Ev	aluatior	n: 25 Ma	rks						
2. E	nd tern	n Theory	Examir	nation: 7	75 Mark	S						
		·										
INSTRUC	CTIONS		R SETTI	ERS:				Maximu	ım Mar	ks: 75		
2. Q ol 3. A Ev qu 4. Th st 5. Th	uestion bjective part fro veryunit uestion ne ques andard, <u>ne requi</u> <b>Objecti</b> To To te	No. 1 sh or short m Questi t should from eac tions are / level of irement o	ould be answe ion No. have t th unit. to be the qu of (scient student	e compu r type q 1, the wo que Each qu framed estions ntific) ca ts with s to dev	ulsory ar uestions rest of th estions. uestion s keeping to be as alculator an unde relop pro	nd cover s. It shou he pape Howeve should b g in viev ked sho rs/ log-t rstandii	r the en- uld be o er shall o er, stude the 15 ma v the lea uld be a ables/ d ng of op y in solvi	tire sylla f 15 mar consist o ents ma arks. arning o t the lev <u>ata-tabl</u> timizatio ng optin	bus. Thi ks. f four ur y be asl utcomes rel of the es may k on appro nization	s questi nits as p ked to a of cour prescri aches a problen	er the s attempt se/pape bed text fied if re nd its ty ns using	yllabus. only 1 er. The books. quired. pes. classica
4.	To pr	provide oficiency chniques	unders in solv	standing	of heur	istic and	d hybrid	optimiz	ation ap	proache	es and d	evelop
Course	Outcon	•	•									
CO1 CO2	Stu rea Stu	udents w al-world udents v	applica vill be	tions. able to	o compi	rehend,	analyz	e and s	olve the	e classio	cal opti	
соз	Stu	oblems in udents N utimizatic	will be	able	to appl	y and	analyze	the pe	erforma	nce of		euristic
CO4		udents w ferent o						• •			•	
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	3	2	3	1	1				1		1
CO2	3	3	3	3	2	1				1	1	1
CO3	3	3	3	3	3	2	1			1		1
CO4	ļ							2				+
04	3	3	3	3	3	2	1	3		1		1



#### **Course Overview**

Soft Computing is a multidisciplinary subject combining artificial intelligence techniques and optimization methods to solve complex real-world problems. This course provides an overview of fuzzy logic, neural networks, and genetic algorithms. Students will learn about the principles, algorithms, and applications of soft computing methods in areas such as pattern recognition, data mining, optimization, and control systems. Emphasis is placed on practical implementations and case studies to develop problem-solving skills in various domains.

#### Unit I

Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Applications of Soft Computing, Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, unsupervised and reinforcement Learning, ANN training Algorithms perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.

#### Unit II

Deep Learning Concepts: Regularization, Bias Variance, Batch Normalization, Weight Initialization Strategies, Learning vs Optimization, Early Stopping, Mini-Batch algorithm, Methods - Batch Gradient Descent (GD), GD with momentum. Improved Optimization: Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout, drop connect, batch normalization). Deep Learning in Practice: Practical Tips for Training Deep Neural Networks, Performance Metrics, Baseline Methods, Data Requirements, Hyperparameter Tuning: Manual vs Automatic, Grid vs Random, Model based hyperparameter tuning.

#### Unit III

Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation, Operations. Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Fuzzy Logic: Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp Sets, Fuzziness of Fuzzy Sets.

#### Unit IV

Introduction of Neuro-Fuzzy Systems: Architecture of Neuro Fuzzy Networks. Application of Fuzzy Logic: Medicine, Economics etc. Genetic Algorithm: An Overview, GA in problem solving, Implementation of GA.

#### [10]

[8]

# [12]

#### [10]



#### **Text Books**

- 1. Hertz J. Krogh, R.G. Palmer, —Introduction to the Theory of Neural Computation , Addison-Wesley, California, 1991.
- 2. G.J. Klir & B. Yuan, —Fuzzy Sets & Fuzzy Logic ||, PHI, 1995.
- 3. Melanie Mitchell, —An Introduction to Genetic Algorithm ||, PHI, 1998.
- 4. F. O. Karray and C. de Silva, —Soft computing and Intelligent System Design∥, Pearson, 2009.

#### **Reference Books**

- 1. Neural Networks-A Comprehensive Foundations||, Prentice-Hall International, New Jersey, 1999.
- 2. Freeman J.A. & D.M. Skapura, —Neural Networks: Algorithms, Applications and Programming Techniques||, Addison Wesley, Reading, Mass, (1992).



Seme	ester: 6 <sup>tl</sup>	h										
Pape	r code:	IOT308P	)						L	T/P	Credits	5
Subje	ect: Sof	t compu	ting La	b					0	2	1	
Mark	king Sch	eme										
1.	Teache	ers Conti	nuous	Evaluati	on: 40 N	Marks						
2.	End ter	rm Exam	inatior	n: 60 Ma	irks							
INS	TRUCTIC	ONS TO F	PAPER	SETTERS	5:			Maxi	mum Ma	arks: 60		
1.	This is	the prac	tical co	ompone	nt of the	e corres	ponding	theory	paper.			
2.	The p	ractical	list sh	all be	notified	by the	e teach	er in th	e first	week o	f the cl	ass
	comm	encemei	nt unde	er the in	timatior	n to the	office o	f the HC	D/ Instit	ution in	which tl	ney
		r is being	-									
3.						•		s over a	nd abov	e the m	entioned	d in
		perimen				-						
		t 8 expe	riment	s must k	pe perfo	rmed by	y the stu	idents.				
Cou	rse Obje	ectives:										
	<b>1.</b> To d	esign an	d imple	ement s	oft com	puting n	nodels f	or a vari	ety of ta	sks, inclu	uding im	age
		-	•		-	-			, g, and sp		-	-
			-						g approp		-	
	tech	niques										
Cou	rse Outo	comes:										
	Impl	ement s	oft cor	nnuting	models	for a v	ariety of	tasks i	ncluding	image (	lassifica	tion
CO1									n recogni			cion,
						•		•				
CO2		• •							optimize			rned
		•		•		-			by apply	-		
		mes (CO)	-					-	ale 1: Low			<u> </u>
CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO 12
CO1	2	2	2	2	1	1	1	2	1	1	1	2
CO2	2	2	2	2	1	1	1	2	1	1	1	2

#### LIST OF EXPERIMENTS:

- 1. Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
- 2. Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
- 3. Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.
- 4. Design a neural network for classifying movie reviews (Binary Classification) using IMDB dataset.



- 5. Design a neural Network for classifying news wires (Multi class classification) using Reuters dataset.
- 6. Design a neural network for predicting house prices using Boston Housing Price dataset.
- 7. Build a Convolution Neural Network for MNIST Hand written Digit Classification.
- 8. Build a Convolution Neural Network for simple image (dogs and Cats) Classification
- 9. Use a pre-trained convolution neural network (VGG16) for image classification.
- 10. Implement one hot encoding of words or characters.
- 11. Implement word embeddings for IMDB dataset.
- 12. Implement a Recurrent Neural Network for IMDB movie review classification problem.
- 13. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
- 14. Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox
- 15. Implement TSP using GA.



Semester	: 6 <sup>th</sup>											
Paper co									L	T/P	Crea	dits
Subject: C	Cloud Co	mputing	g						3	0	3	
Marking	Scheme											
1.	Teache	ers Conti	nuous	Evaluati	on: 25 N	Лarks						
2.	End ter	rm Theo	ry Exar	minatior	i: 75 Ma	rks						
NSTRUCT	IONS TO	) PAPER	SETTE	RS:			ſ	Maximu	m Mark	s: 75		
1. T	here sho	ould be S	) quest	ions in t	he end t	erm ex	aminatio	on quest	ion pape	er.		
2. Q	uestion	No. 1 sh	ould b	e compi	lsory ar	nd cover	r the ent	ire sylla	bus. This	s questic	on should	d have
	-							of 15 mai				
	-					• •				-	er the syl	
									y be asl	ked to a	ttempt	only 1
•	uestion <sup>-</sup>			•						of		
	-					-		-			se/pape oed textl	
	-		•							•	fied if re	
	Objecti					13/1081				oc speci		quire
1.		course	introdu	ices abo	out the c	loud en	vironme	nt.				
2.	-								o millio	ns of us	sers in r	nodei
		rnet.	en a c	system		mpone		e obtaile e				
3.	Clou	ud conce	epts ca	pabilitie	s across	the var	ious clo	ud servi	ce mode	els inclu	ding laas	S, Paa
	Saas	S, and de	evelopi	ing cloud	d based	softwar	e applic	ations o	n top of	cloud pl	atforms	
4.	This	course	also	introduc	es abo	ut the	data in	tensive	comput	ing and	studies	aboı
	diffe	erent clo	oud app	olication	s.							
Course	Outcon											
CO1					oncepts	and te	rminolo	gies in	cloud co	omputin	g, paral	lel ar
01		ributed						1 1.00				
CO2				кnowle	age in	virtualiz	zation a	ind diffe	erent te	cnnolog	y exam	pies
		ualizatio		ا من ا		a.u.c.b. 11	a	al la - •	- h. 11 -		al -	
CO3	Und	erstand	s the c	ioua cor	nputing	archite	cture an	d how to	A bilua c	neka clo	ouas.	
CO4	Able	e to desi	gn data	a intensi	ve appli	cations	using M	lap-Redu	ice prog	rammin	g.	
Course C					-						n, 3: High	<u> </u>
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO1
CO1	3	1	-	-	-	1	1	_	-	2	-	-
CO2	3	3	3	3	3	-	-	_	_	2	_	_
CO3	3	3	3	2	2	_		_	_	2	_	_
-	5	5	5	<b>∠</b>	<b>∠</b>	-	I -	-	I –	<b>∠</b>	1 -	1 -
CO4	3	3	3	2	3	2	1	_		2	_	-



#### Unit I

[6]

Introduction: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies.

Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs. Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for **Distributed Computing** 

# Unit II

[8]

Virtualization: Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

**Cloud Computing Architecture:** Introduction, Cloud Reference Model, Types of Clouds, Economics of the Cloud, Open Challenges

#### Unit III

Cloud Application Platform: Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Programming and Management High-Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming.

Data Intensive Computing: Map-Reduce Programming: What is Data-Intensive Computing? Technologies for Data-Intensive Computing.

# Unit IV

**Cloud Applications:** Scientific Applications, Healthcare: ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Biology: Gene Expression Data Analysis for Cancer Diagnosis, Business and Consumer Applications, Multiplayer Online Gaming.

Advanced Topics in Cloud Computing: Energy Efficiency in Clouds, Market Based Management of Clouds

# **Text/Reference Books**

- 1. Mastering Cloud Computing: by Rajkumar Buyya, Christian Vecchiola and S. Thamarai Selvi, McGraw Hill Education.
- 2. Cloud Computing: by Rajkumar Buyya, TMH

# [12]

[12]



Paper code: IOT310PLT/PCreeSubject: Cloud Computing Lab021Marking Scheme1.Teachers Continuous Evaluation: 40 Marks2.1.Teachers Continuous Evaluation: 40 Marks2.End term Examination: 60 MarksINSTRUCTIONS TO PAPER SETTERS:Maximum Marks: 601.This is the practical component of the corresponding theory paper.2.The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.3.Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.4.At least 8 experiments must be performed by the students.	
Marking Scheme         1. Teachers Continuous Evaluation: 40 Marks         2. End term Examination: 60 Marks         INSTRUCTIONS TO PAPER SETTERS:       Maximum Marks: 60         1. This is the practical component of the corresponding theory paper.         2. The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.         3. Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.	class
<ol> <li>Teachers Continuous Evaluation: 40 Marks</li> <li>End term Examination: 60 Marks</li> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>This is the practical component of the corresponding theory paper.</li> <li>The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.</li> <li>Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li> </ol> </li> </ol>	class
<ol> <li>End term Examination: 60 Marks</li> <li>INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60         <ol> <li>This is the practical component of the corresponding theory paper.</li> <li>The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.</li> <li>Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li> </ol> </li> </ol>	class
INSTRUCTIONS TO PAPER SETTERS:       Maximum Marks: 60         1. This is the practical component of the corresponding theory paper.       2. The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.         3. Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.	class
<ol> <li>This is the practical component of the corresponding theory paper.</li> <li>The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.</li> <li>Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li> </ol>	class
<ol> <li>The practical list shall be notified by the teacher in the first week of the commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.</li> <li>Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li> </ol>	class
<ul> <li>commencement under the intimation to the office of the HOD/ Institution in whic appear is being offered from the list of practicals below.</li> <li>3. Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li> </ul>	class
<ul><li>appear is being offered from the list of practicals below.</li><li>3. Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.</li></ul>	0.0.00
3. Instructors can add any other additional experiments over and above the mentio the experiment list which they think is important.	h they
the experiment list which they think is important.	
	ned in
4 At least 8 experiments must be performed by the students	
Course Objectives:	
1. To demonstrate the use of virtualization and cloud computing	
Understanding of virtualization technologies such as hypervisors, virtual machir	nes, and
<b>2.</b> containers used in cloud computing.	
Course Outcomes:	
Deploy and manage virtual machines and containers on a cloud platform.	
CO1 CO1	
<b>CO2</b> Configure and manage cloud storage, network, and security services.	
Course Outcomes (CO) to Programme Outcomes (PO) Mapping (Scale 1: Low, 2: Medium, 3	8: High <b>)</b>
CO/ PO01 PO02 PO03 PO04 PO05 PO06 PO07 PO08 PO09 PO10 PO11	PO12
PO	
CO2     2     2     2     1     1     1     1     1	-

# LIST OF EXPERIMENTS (Cloud Computing Lab)

- 1. Install virtualbox/vmware workstation 45 5 install a c compiler in the virtual machine and execute a sample program
- 2. Create type 2 virtualization in vmware. Allocate memory and storage space as per requirement. Install guest os on that vmware.
- 3. Adding a new virtual disk to a virtual machine. Convert basic disc to dynamic disc and vice versa
  - a. Shrink and extend virtual disk



- b. Create, manage, configure and schedule snapshots
- c. Create spanned, mirrored and striped volume
- d. Create raid 5 volume
- 4. Sharing and data transfer between the virtual machines
- 5. Create type 2 virtualization on esxi 6.5 server
- 6. Create a vlan in cisco packet tracer
- 7. Create a vpn from one virtual machine to another virtual and pass data secure way
- 8. Find procedure to set up the one node hadoop cluster
- 9. Simulate a cloud scenario using cloudsim and run a scheduling algorithm that is not present in cloudsim.
- 10. Data analytics in the cloud: Perform data analytics and processing in a cloud environment using services such as AWS EMR, Google Cloud Dataproc, or Azure Hdinsight.
- 11. Implement cloud security controls such as encryption, access management, and network security using cloud-native services.



Semeste	er: 6 <sup>th</sup>											
Paper co	ode: IO	<b>312T</b>							L	T/	P C	redits
Subject:	Mech	atronics	: Found	lations	and App	lication	IS		3	0	3	
Marking	Schem	е										
1	. Teac	hers Con	tinuou	s Evalua	tion: 25	Marks						
2	. End t	erm The	ory Exa	iminatio	n: 75 M	arks						
INSTRUC								Maximu	-			
		ould be 9						•				
				•	•					is questi	ion sno	uld have
	-	or short m Quest								nits as r	er the	syllabus.
-						• •				•		ot only 1
	•	from eac		•					,			
4. Tł	ne ques	tions are	e to be	framed	keeping	g in viev	w the lea	arning o	utcome	s of cou	rse/pa	per. The
												xtbooks.
			of (scie	ntific) c	alculato	rs/ log-t	ables/ d	lata-tabl	es may	be speci	fied if r	equired.
Course 1.							- :		+ :		-+	
1.		e analyze evelopme		elemer	its requ	urea to	o integ	rate the	e entire	e mech	atronic	systems
2.				nization	concent	s mecha	tronics	elements	selectio	n and n	rocess	parameter
		timizatio			concept	5 meene		cicilicitis	Sciectio		1000035	purumeter
3.	To	analyze	the co	ncepts c	of engine	eering s	ystem a	nd dyna	mic resp	onse of	the sys	stem.
4.	Тс	realize t	the con	cepts of	f real tin	ne inter	facing a	nd data a	acquisiti	on.		
Course	Outcor	nes:										
CO1	Ar	nalyze t	he ele	ements	require	ed to	integra	te the	entire	mecha	atronic	systems
01	de	velopme	ents.									
CO2	-		•	ation co	oncepts	mechatr	onics el	ements	selectior	n and p	rocess	parameter
		timizatio		onte of	onginoo	ring over	tom on	d dynam	ic roco	nco of	the me	chatronic
CO3		stem.		epts of	enginee	ing sys		u uynan	nc respt	JISE OI	the me	echatronic
CO4		alize the	conce	pts of re	al time	interfac	ing and	data acc	uisition	•		
		es (CO) to					-		•	: Mediur	n, 3: Hi	gh)
CO/PO	PO01		PO03		-	PO06	PO07	PO08	PO09	PO10	PO11	
CO1	2	2	2	2	1	1	-	-	-	-	-	-
CO2	2	3	3	3	3	1	-	-	-	-	-	-
CO3	3	3	3	3	2	1	-	-	-	-	-	-
CO4	3	2	3	3	3	2	1	-	-	-	-	1
		1	1		1	1	1				1	



**Course Overview:** The course introduces the various elements required to design and integrate the mechatronic systems and to acquire the modelling skills to capture the system dynamics of hybrid systems and to familiar the system identification techniques and to practice the design and assembly of mechanical system in software environment for integrating various system subelements. It also analyzes and evaluate the functions of systems models for integrating the virtual elements of mechatronics.

#### UNIT I:

**Introduction:** Introduction to Mechatronics System, Elements of mechatronics system, mechatronics in manufacturing, product and design, Measurement Systems, Control System, comparison between traditional and mechatronics approach.

**Applications of Mechatronics system:** Mechatronic approach to design, motion control using dc motor, ac motor and servomotor, temperature control of hot/cold reservoir, Boat Auto pilot, Pick and place robots, high speed tilting train, automatic car park system, coin counter, engine management system, automated guided vehicle, autonomous mobile system, antilock brake system control, Auto-Focus Camera, Printer, Domestic Washing Machine, Optical Mark Reader, Bar Code Reader

#### UNIT-II:

**System Models:** Mathematical models, Mechanical, Electrical, hydraulic and Thermal Systems, Modelling of dynamic systems.

**Design of Mechatronics systems:** Stages in designing mechatronics system, Traditional and Mechatronic design.

#### UNIT III:

Mechanical Actuation System: Cams, Gear trains, Ratchet and Pawl, Belt and chain drives, Bearings.

**Hydraulic and Pneumatic Actuation System**: Introduction to Hydraulic and Pneumatic Systems, Directional Control valves, Flow control valves.

**Electrical Actuation System:** Electrical systems, Solid State Switches, Solenoids, D.C. motors, A.C. motors, Stepper motors.

# Unit IV:

**Programmable logic controllers:** Programmable logic controllers (PLC) Structure, Input / Output Processing, principles of operation, PLC versus computer, Programming Languages, programming using Ladder Diagrams, Logic Functions, Latching, Sequencing, Timers, Internal Relays And Counters, Shift Registers, Master and Jump Controls, Jumps, Data Movement, Code Conversion, Data handling and manipulation, selecting a PLC.

# Text Books:

- 1. W.Bolton, (2003) *Mechatronics*, Pearson education, second edition, fifth Indian Reprint.
- 2. Smaili, A., & Mrad, F. (2008). *Mechatronics: Integrated technologies for intelligent machines*. Oxford University Press.
- 3. Alciatore, D. G. (2007). *Introduction to mechatronics and measurement systems*. Tata McGraw-Hill Education.

[12]

[10]

[10]

# [10]



#### **Reference Books:**

- 1. R.K Rajput, (2007) A textbook of mechatronics, S. Chand & Co.
- 2. D. A. Bradley, Dawson D., Buru N.C. and. Loader A.J, (1993) *Mechatronics*, Chapman and Hall.
- 3. Necsulescu, D. S. (2002). *Mechatronics*. Pearson College Division.
- 4. Kamm, L. J. (1995). Understanding electro-mechanical engineering: an introduction to mechatronics (Vol. 3). John Wiley & Sons.
- 5. Nitaigour Premchand Mahadik, (2003) *Mechatronics*, Tata McGraw-Hill publishing Company Ltd, 2003.



# **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, **SURAJMAL VIHAR-110092**

Sem	ester:	5 <sup>th</sup>										
Раре	er code	: IOT312	Ρ						L	T/P	Cred	its
		echatror	nics: Fo	undatio	ons and	Applica	tions La	b	0	2	1	
Mar	king Sc	heme										
1.	Teac	ners Cont	tinuous	s Evalua	tion: 40	Marks						
2.	End t	erm Exar	ninatio	n: 60 M	larks							
INST	RUCTI	ONS TO F	PAPER	SETTERS	5:			Max	imum M	arks: 60		
1.	This i	s the pra	ctical co	ompone	nt of the	corresp	onding	theory p	aper.			
2.	The p	oractical li	ist shall	be notif	fied by th	ne teach	er in the	e first we	ek of the	class co	nmence	ment
	unde	r the inti	imation	to the	office o	f the H	OD/ Inst	titution	in which	they ap	pear is	being
	offer	ed from t	he list o	of practi	cals belo	w.						
3.	Instru	uctors cai	n add a	ny othe	r additio	nal expe	eriments	s over ar	nd above	the mer	ntioned i	n the
	expe	riment lis	t which	they th	ink is im	portant.						
4.	At lea	ast 8 expe	eriment	s must k	pe perfor	rmed by	the stu	dents.				
Cour	rse Obj	ectives:										
1	То	apply a s	suitable	e sensor	r and im	age pro	cessing	techniq	ue for M	echatro	nics syst	ems
2	То	develop	a mod	el of pn	eumatic	and hy	draulic o	circuits l	oy using	simulati	on softv	vare
Cour	rse Out	comes:										
CO1		Applying	a suita	hle sens	or and i	mage n	rocessir	ng techn	ique for	Mechat	ronics s	/stems
CO2		Developi						-				-
		omes (CC	0				,			8 5		
Cours	se Oull	omes (cc		granning	Outcom	ies (PO)	wappin	5	(Scale 1	: Low, 2:	Medium	. 3: High
CO/ PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	2	2	2	2	1	1	1	2	1	1	1	2
CO2	2	2	2	2	1	1	1	2	1	1	1	2

# Lab Experiments:

- 1. Study and demonstration of mechatronics system and its components.
- 2. Demonstrate Data Logger device and analyse
- 3. Air Compressor with Storage Tank
- 4. Multi Flow Process Trainer with Computerized Data Logging System
- 5. DC Servo Motor with PID Controller
- 6. Study and Demonstration of PLC Hardware and Software.
- 7. Demonstrate different mechanical components and their working in the automation system.



- 8. Study of the following equipment:
  - a) Flow Control Valves
  - b) Directional Control Valves
  - c) Pressure Control Valves
- 9. Circuits for reciprocating motion of a single acting and double acting pneumatic cylinders.
- 10. Circuits for speed control of a
- 11. (a) Single acting pneumatic cylinder.
  - (b) Double acting Pneumatic cylinder.



Semester: 6 <sup>th</sup>			
Paper code: IOT314T	L	T/P	Credits
Subject: Big Data in IOT	3	0	3
Marking Scheme			

1. Teachers Continuous Evaluation: 25 Marks

2. End term Theory Examination: 75 Marks

#### **INSTRUCTIONS TO PAPER SETTERS:**

#### Maximum Marks: 75

- 1. There should be 9 questions in the end term examination question paper.
- 2. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.
- 3. Apart from Question No. 1, the rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, students may be asked to attempt only 1 question from each unit. Each question should be 15 marks.
- 4. The questions are to be framed keeping in view the learning outcomes of course/paper. The standard/ level of the questions to be asked should be at the level of the prescribed textbooks.
- 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.

Course	e Object	ives:											
1.	To i	ntroduc	e the c	oncept o	of big da	ita and i	ts types						
2.	Тоа	To analyze different types of virtualizations to work with big data											
3.	Тоа	To apply different analytics in big data											
4.	To f	To familiarize the students with Hadoop ecosystem and its distribution											
Course	Outcor	nes:											
CO1	Und	Understand the concept of big data and its types.											
CO2	Ana	Analyze different types of virtualizations to work with big data											
СОЗ	Арр	Apply Map Reduce fundamentals and different analytics in big data											
CO4	Des	ign the	Hadoop	o ecosys	tem and	l its dist	ribution	l					
Course C	Outcome	s (CO) to	Progra	mme Ou	tcomes (	PO) Map	oping	(9	Scale 1: L	.ow, 2: N	Лedium,	3: High)	
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
CO1	3	1	-	-	-	1	1	-	-	2	-	-	
CO2	3	3	3	3	3	-	-	-	-	2	-	-	
CO3	3	3	3	2	2	-	-	-	-	2	-	-	
CO4	3	3	3	2	3	2	1	-	-	2	-	-	



#### **Course Overview:**

Big data analytics is a field of study that focuses on the use of various analytical and statistical methods to extract insights, patterns, and trends from large and complex data sets. The goal of this course is to help businesses and organizations make more informed decisions, improve operational efficiency, and identify new business opportunities.

#### UNIT I:

Introduction to Big Data- The Evolution of Data Management, Defining Big Data, Understanding the Waves of Managing Data, building a Successful Big Data Management Architecture, Examining Big Data Types: Structured Data, Unstructured Data. Putting Big Data Together. Brief History of Distributed Computing, Basics of Distributed Computing for big data.

#### UNIT II:

Exploring the Big Data Stack- Layer 0: Redundant Physical Infrastructure, Layer 1: Security Infrastructure, Layer 2: Operational Databases, Layer 3: Organizing Data Services and Tools, Layer 4: Analytical Data Warehouses. Big Data Analytics, Big Data Applications.

**Virtualization:** Basics of Virtualization, Server virtualization, Application virtualization, Network virtualization, Processor and memory virtualization, Data and storage virtualization, Managing Virtualization with the Hypervisor, Implementing Virtualization to Work with Big Data.

#### UNIT III:

Analytics and Big Data- Basic analytics, Advanced analytics, Operationalized analytics, Monetizing analytics, Text Analytics and Big Data, Social media analytics, Text Analytics Tools for Big Data, Attensity, Clarabridge, OpenText.

**MapReduce Fundamentals-** Understanding the map function, Adding the reduce function. Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

#### UNIT IV:

Exploring Hadoop- Hadoop & its Features, Hadoop Ecosystem, Hadoop 2.x Core Components, Hadoop Storage: Understanding the Hadoop Distributed File System, Hadoop Processing: MapReduce Framework, Different Hadoop Distributions. Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

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#### Textbooks:

- 1. Judith S. Hurwitz, Alan F. Nugent, Fern Halper, Marcia A. Kaufman, "Big Data For Dummies", John Wiley & Sons, Inc.(2013)
- 2. Robert D. Schneider, "Hadoop For Dummies", John Wiley & Sons, Inc. (2012).
- 3. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
- 4. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

#### **Reference Books:**

- 1. Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill (2012).
- 2. Nathan Marz, James Warren, "Big Data: Principles and best practices of scalable realtime data systems", Manning Publications (2015)
- 3. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, "Learning Spark: Lightning-Fast Big Data Analysis", O. Reilly Media, Inc. (2015).



Seme	ster: 6	th															
Paper	code:	IOT314	Р						L	T/P	Cred	its					
		Data in	IOT La	b					0 2 1								
Marki	ng Sch	eme															
1.	Teach	ers Cont	inuous	Evaluat	tion: 40	Marks											
2.	End te	rm Exan	ninatio	n: 60 M	arks												
INSTR	υςτιο	NS TO P	APER S	SETTERS	5:			Maxi	imum M	larks: 60	)						
1.	This is	the pra	ctical c	ompone	ent of th	e corre	spondin	ng theory	y paper.								
2.	The p	oractical	list sł	nall be	notified	d by th	ne teacl	her in t	the first	week	of the	class					
	comm	enceme	ent und	er the i	ntimatic	on to th	e office	of the H	OD/ Inst	titution i	n which	they					
	appea	r is bein	g offer	ed from	the list	of prac	ticals be	elow.									
3.	Instru	ctors ca	n add a	any othe	er additi	onal ex	perimer	nts over	and abo	ove the i	mention	ed in					
	the ex	perimer	nt list w	hich th	ey think	is impo	ortant.										
4.	At lea	st 8 expe	erimen	ts must	be perfe	ormed l	by the st	tudents.									
Course	Objec	tives:															
1	То а	analyse a	and im	plemen	t differe	nt fram	e work	tools by	taking s	ample d	ata sets						
2		•						ng an ap	-	•							
				inpicific		Sheepes	by taki		plication								
		omes:															
CO1		· · ·					· ·	mming i		•							
CO2			-	_	ata anal	ytics to	conduct	t experir	nents, a	s well as	to anal	yze					
Course		nd inter mes (CO		-	Outcom		Mannin	a									
course	Outco	ines (CO	) 10 PTO	grannie	Outcon	ies (PO)	wappin	-	cale 1: Lo	ow. 2: M	edium.	3: High)					
CO/P	PO0	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12					
0	1																
CO1	2	2	2	2	1	1	1	2	1	1	1	2					
CO2	2	2	2	2	1	1	1	2	1	1	1	2					

# LIST OF EXPERIMENTS:

- 1. Install Apache Hadoop.
- 2. Develop a map reduce program to calculate the frequency of a given word in a given file.
- 3. Develop a map reduce program to find the maximum temperature in each year.
- 4. Develop a map reduce program to find the grade of students.
- 5. Develop a map reduce program to implement matrix multiplication.
- 6. Develop a map reduce program to find the maximum electrical consumption in each year given electrical consumption for each month in each year.



- 7. Develop a map reduce program to analyze weather data set and print whether the day is shiny or cool day.
- 8. Develop a map reduce program to find the tags associated with each movie by analyzing movie lens data.
- 9. Develop a map reduce program to analyze Uber data set to find the days on which each basement has more trips using the following data set. The uber data set consists of four columns they are:

Dispatching, base, no. date active, vehicle trips.

- 10. Develop a map reduce program to analyze titanic dataset to find the average age of the people (both male and female) who died in the tragedy. How many people survived in each class.
- 11. Develop a program to calculate the maximum recorded temperature year wise for the weather data set in Pig Latin.
- 12. Write queries to sort and aggregate the data in a table using HiveQL.



Semester: 6 <sup>th</sup>			
Paper code: IOT316T	L	T/P	Credits
Subject: Introduction to Robotics	4	0	4
Marking Scheme			

1. Teachers Continuous Evaluation: 25 Marks

2. End term Theory Examination: 75 Marks

INSTRU		ΙS ΤΟ ΡΑΡ	ER SETT	ERS:						Maxim	um Ma	rks: 75	
		e should be 9 questions in the end term examination question paper.											
		on No. 1 s						•			on shou	ld have	
		ive or short answer type questions. It should be of 15 marks.											
3. A	part f	rom Ques	tion No	. 1, the	rest of t	he pape	er shall o	consist c	of four u	nits as p	er the s	yllabus.	
E	Everyunit should have two questions. However, students may be asked to attempt or											only 1	
q	uestic	estion from each unit. Each question should be 15 marks.											
standard/ level of the questions to be asked should be at the level of the prescribed textbooks. 5. The requirement of (scientific) calculators/ log-tables/ data-tables may be specified if required.													
			t of (scie	ntific) c	alculato	rs/ log-t	ables/ c	lata-tab	les may	be speci	fied if re	quired.	
Course	-		معامه	+- +- :-		<u></u>		:	wah at		:+h :+a a		
1.		Ability of Furtherm			-					-	ith its g	grippers.	
2.		Ability of						-	-		t using i	acobian	
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5.		method.	student	s to use	the uyn	anne ar	ialysis O	TUICES	using La	grangian		wtoman	
4.		Ability of	studont	s to imn	lomont	tha anli	no and c	offling n	rogramm	ning of r	ohots		
Course			student	s to imp	lement			Junie b	logrann		00013.		
Course			vill bo a	hla ta ir	nnlomor	at tha n	nochani	sms of r	abot alc	ng with	ite gripe	ors and	
CO1		Student will be able to implement the mechanisms of robot along with its grippers and understand kinematics of robot using DH representation											
CO2		Student w	vill be ab	le to uti	lize the o	differen	tial moti	ion and v	velocitie	s of robo	ot using ja	acobian.	
		Student w	vill be ab	le to us	e the dyi	namic a	nalysis c	of forces	using La	grangiar	n and Ne	wtonian	
CO3		method.											
604		Student w	vill he al	ole to im	nlemen	t the on	line and	loffline	nrogran	nming of	robots		
CO4					•					-			
		mes (CO) to								: Mediun	n, 3: High <b>PO11</b>	· · · · · · · · · · · · · · · · · · ·	
CO/PO	PO0	1 PO02	PO03	P004	PO05	PO06	PO07	PO08	PO09	PO10	1011	PO12	
CO1	3	2	2	3	3	2	1	-	1	3	1	2	
CO2	3	3	3	3	3	1	1	-	2	3	1	2	
CO3	3	3	3	3	3	1	1	-	3	3	2	3	
CO4	3		-		-				-			-	
0.4	5	3 3 3 3 2 - 3 3 2 3											

#### **Course Overview:**

This course provides an overview of robot mechanisms, dynamics, and intelligent controls. Topics include planar and spatial kinematics, and motion planning; mechanism design for manipulators and mobile robots, multi-rigid-body dynamics, 3D graphic simulation; control design, actuators, and sensors; wireless networking, task modeling, human-machine interface, and embedded software.

#### Unit I

Fundamentals of Robot Technology: Robot definition, automation and robotics, Robot anatomy, Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission

End effectors: Mechanical and other types of grippers, Tools as end effectors, Robot and effector interface, Gripper selection and design.

Sensors and actuators used in robotics: Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots

#### Unit II

Kinematics of Robots: Transformation Matrices, Inverse transformation matrices, Forward and Inverse kinematic equation for position and orientation, Denavit-Hartenberg representation of robot, inverse kinematic solution for articulated robot, Numericals.

Differential Motions and velocities: Jacobian, Differential motions of a frame, Differential motion between frames, Calculation of the Jacobian, Inverse Jacobian, Numericals.

# Unit III

Dynamic analysis of Force: Lagrangian and Newtonian mechanics, Dynamic equations form multiple -DOF Robots, Static force analysis of Robots, Transformation of forces and moments between coordinate frames, Numericals.

**Trajectory Planning:** Basics of Trajectory planning, Joint space trajectory planning, Cartesian Space trajectories, Numericals.

# Unit IV

Robot Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

Off-line programming systems: Introduction, central issues in on-line and offline programming, Programming examples.

Application of robots: Typical applications of robots in material transfer, machine loading/unloading; processing operations; assembly and inspection.

# Text Books

- 1. Saha, S. K. (2014). Introduction to robotics. Tata McGraw-Hill Education.
- 2. Mittal, R. K., & Nagrath, I. J. (2003). *Robotics and control*. Tata McGraw-Hill.
- 3. Fu, K. S., Gonzalez, R., & Lee, C. G. (1987). Robotics: Control Sensing. Vis. Tata McGraw-Hill Education.
- 4. Niku, S. B. (2001). Introduction to robotics: analysis, systems, applications (Vol. 7). New Jersey: Prentice hall.



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#### **Reference Books**

- 1. Spong, M. W., & Vidyasagar, M. (2008). *Robot dynamics and control*. John Wiley & Sons.
- 2. Choset, H., Lynch, K. M., Hutchinson, S., Kantor, G. A., & Burgard, W. (2005). *Principles of robot motion: theory, algorithms, and implementations*. MIT press.
- 3. Bhaumik, A. (2018). From AI to robotics: mobile, social, and sentient robots. CRC Press.



Semest	er: 6 <sup>th</sup>											
Paper o	ode: IC	DT318T							L	T/P	Credit	S
Subject	: Gree	n loT ar	nd Sust	tainable	e Compi	uting			4	0	4	
Markin	•											
		rs Contin				-						
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		NS TO P								Aarks: 7		
		re should be 9 questions in the end term examination question paper										
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		nave obj					-					
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	-	abus. Ev	-			-					-	
	narks.	o attemp	ot only	' 1 ques	tion fro	m each	unit. Ea	ach que	stion s		e 15	
		estions a	ro to b	o fram	ad kaon	ing in v	iow the	loarnin		omero	f	
	•	paper. T			•	-			-			
	-	the pres		-		the qu	CSCIONS		SKCU SI			
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	f requir				,					•		
	•	ectives	5:									
1.	То	underst	and th	e good	practice	es of su	stainab	ility.				
		design G			-							
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	sus	tainabili	ity, life	e cycle a	ssessme	ent and	l code o	of condu	icts.			
Course		omes:										
CO1	Un	derstan	d the g	good pra	actices o	of susta	inabilit	y.				
CO2		sign Gre										
CO3	Red	cognize	the im	pact of	loT on e	environ	ment					
CO4	Inc	ulcate tl	he eco	logical f	footprin	t of IT,	and the	e issues	of lifed	ycle, su	ıstainabil	ity,
	life	cycle as	ssessm	nent and	d code o	of cond	ucts.					
	-	es (CO)		-							Medium,	
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	) PO11	PO1
CO1	3	1	<b> </b> _	-	-	1	1	_	-	2	_	2
CO2	3	3	3	3	3	-	-	_	-	2		-
CO3	3	3	3	2	2	_	_	_	-	2	_	-
CO4	3	3	3	2	3	2	1	_	-	2		<u> </u>
	5	5	5	2	5	2	1			2		



#### **Course Overview:**

Green IoT and Sustainable Computing is a course that explores the intersection of Internet of Things (IoT) and sustainable practices. It focuses on designing and implementing energy-efficient IoT systems, minimizing environmental impact, and promoting sustainability in computing. Students will learn about green technologies, energy harvesting, renewable energy sources, and eco-friendly approaches to data storage and processing. The course also covers strategies for reducing e-waste and implementing sustainable computing practices in various industries.

#### UNIT I:

Green IoT, Green IoT based Technologies: Identification, sensing, communication technologies, computation, services, semantic, life cycle of Green IoT, Impact of IoT on Healthcare, Impact of IoT on environment monitoring: agriculture, smog control, waste management, smart water, Impact of IoT on suburban sector. Impact of IoT on People and Goods Transportation: smart parking, Smart Traffic Congestion Detection, Smart Logistics/Shipment, Recycling

**UNIT II: IOT in Energy Sector:** IoT and Energy Generation, Smart Metropolises, Smart Grid, Smart Buildings Structures, Difficulties of relation IoT: Energy Consumption in IoT, Synchronization of IoT with Subsystems, Client Privacy

#### UNIT III:

Challenges and Opportunities for Green IoT, Architecture of Green IoT, Green Infrastructure, Green Spectrum Management, Green Communication, Green Security and Servicing Provisioning, Future of G-IoT, Green Radio-Frequency, Green Data Centers, green RFID Tags, cloud based smart parking system, smart traffic signal

#### UNIT IV:

Green IT and sustainability, ecological footprint of IT, and the issues of lifecycle, sustainability, life cycle assessment and code of conducts; energy measurement and other useful metrics for Green IT, Usage of software tools and hardware to measure and estimate energy consumption; **Sustainable software:** Ecological design, applying good practices to write energy efficient software; energy footprint of data centers and cloud computing, standards and good practices for energy efficiency in servers

#### Text Books:

- 1. Green Internet of Things and Machine Learning, Roshani Raut, Sandeep Kautish, Zdzislaw Polkowski, Anil Kumar, Chuan-Ming Liu, John Wiley & Sons, 10-Jan-2022.
- 2. Green Computing: Tools and Techniques for Saving Energy, Money, and Resources, Bud E. Smith, **Auerbach** Publications

#### **Reference Book:**



- 1. Green Computing Approach Towards Sustainable Development, M Afshar, Sapna Jain, Hena Parveen, Dreamtech Press
- 2. The Age of AI: And Our Human Future (B PB) Paperback Import, 4 August 2022 by <u>Daniel</u> <u>Huttenlocher</u>, <u>III Schmidt, Eric</u>, <u>Henry A Kissinger</u>



Semeste	er: 6 <sup>th</sup>												
Paper co	ode: IO	Т320Т							L	T,	/P	Credits	
Subject:	Optin	nization A	lgorith	ms and	its App	lication	s		3	0		3	
Marking	Schen	ne											
1	. Teac	hers Cont	tinuous	s Evalua	tion: 25	Marks							
2	. End	term The	ory Exa	minatio	n: 75 M	arks							
	NSTRUCTIONS TO PAPER SETTERS:       Maximum Marks: 75         1. There should be 9 questions in the end term examination question paper.												
			•								ion ch		
	<ol> <li>Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 15 marks.</li> </ol>												ve
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2.		able stud					•	•	•				ical
	techn					1		0				0	
3.	To de	velop pro	ficiency	y in solv	ing opti	mizatio	n proble	ms using	g meta-h	euristio	s tecl	nniques.	
4.	-	ovide und		-		-						-	
	•	iency in s	olving	optimiza	ation pro	oblems	using he	uristic a	nd hybri	d optin	nizatio	on	
	techn	•											
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CO2		roblems i											
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CO3	0	otimizatic	on tech	niques t	o solve	differer	it optimi	ization p	roblems				
CO4		udents w						, ,			•		
-		fferent o		•				•					s.
Course C	PO01	es (CO) to PO02	Progran PO03		tcomes ( PO05	PO) Maj PO06	pping PO07	(Scale : <b>PO08</b>	1: Low, 2 <b>PO09</b>	: Mediui PO10	n, 3: ⊦ <b>PO1</b>		12
-							1.007	1000	1005		.01		
CO1	3	3	2	3	1	1				1			1
CO2	3	3	3	3	2	1				1			1
CO3	3	3	3	3	3	2	1			1			1
CO4	3	3	3	3	3	2	1	3		1			1



#### **Course Overview:**

The course covers developments of advanced optimization models and solution methods for technical and economical planning problems. The basis in the course is the optimization process, from a real planning problem to interpretation of the solutions of the underlying optimization problem. In the modeling part we focus on problems with discrete elements, but also knowledge about important classes of optimization problems and their properties will be highlighted

#### Unit I

**Introduction to Optimization Approaches and Types:** Introduction to optimization problems and their significance, Types of optimization problems: continuous, discrete, and combinatorial, Objective functions and constraints, Classification of optimization approaches, Overview of mathematical programming, heuristic, and meta-heuristic techniques

#### Unit II

**Classical Approaches in Optimization:** Unconstrained optimization: methods of steepest descent and Newton's method, Constrained optimization: Lagrange multipliers and KKT conditions, Linear programming: formulation, simplex method, and duality, Integer programming: branch and bound, cutting plane, and branch and cut algorithms

#### Unit III

**Meta-Heuristic Approaches:** Overview of meta-heuristic optimization, Genetic algorithms: representation, selection, crossover, and mutation operators, Particle swarm optimization: movement rules and parameter settings, Simulated annealing: cooling schedules and neighborhood search, Ant colony optimization: pheromone trails and decision-making, Tabu search: tabu list and aspiration criteria

#### Unit IV

**Heuristics and Hybrid Approaches:** Greedy algorithms and local search, Simplicial decomposition and cutting plane methods, Hybrid algorithms: combining meta-heuristics with classical approaches, Nature-inspired optimization: swarm intelligence, artificial bee colony, and harmony search

#### **Text Books**

- 1. Edwin K.P. Chong and Stanislaw H. Zak, Introduction to Optimization, Wiley
- 2. Xinyu Ye and Ding-Zhu Du, Optimization Methods and Applications
- 3. Xinjie Yu, Introduction to Evolutionary Algorithms
- 4. Fred Glover and Gary A. Kochenberger, Handbook of Metaheuristics

#### **Reference Books**

- 1. David G. Luenberger and Yinyu Ye, Linear and Nonlinear Programming
- 2. Mokhtar S. Bazaraa, Hanif D. Sherali, and C. M. Shetty, Nonlinear Programming: Theory and Algorithms Jorge Nocedal and Stephen J. Wright, Numerical Optimization

# [10]

[8]

#### [12]

#### [10]



Paper co	r: 6 <sup>th</sup>											
-	de: IOT 🗄	322T							L	T/I	P Cro	edits
Subject:	Crypto	graphy a	and Ne	twork S	ecurity				4	0	4	
Marking	Scheme										-	
1. T	eachers	Continu	ous Eva	aluation	: 25 Mai	rks						
2. E	nd term	Theory l	Examin	ation: 7	5 Marks	5						
INSTRUC	TIONS T	O PAPEI	R SETTI	ERS:					Ma	ximum	Marks:	75
1. Th	ere shou	uld be 9	questic	ons in th	e end te	erm exa	minatio	n questi	on pape	r.		
	estion N				-					s questio	on shou	ld have
	jective o											
	art from											
	ery unit			-					y be as	ked to a	attempt	only 1
-	estion fr e questi			-					utcomo	of cou	rcolooo	or Tho
	andard/l							-				
	e require		•							-		
Course C					<u>iculator</u>	0, 108 0	10100 <i>j</i> u			<u>e speen</u>		quireur
1.		erstand	the fur	ndamen	tals of c	ryptogr	aphy					
2.	То аса	uire kno	wledge	on star	ndard al	gorithm	s used t	o provid	le confid	entiality	. Integr	itv and
	To acquire knowledge on standard algorithms used to provide confidentiality. Integrity and authenticity											
3.	To ana	lyze con	cepts, i	ssues, p	rinciple	s of sec	urity rel	ated pro	nerties	and vali		
	model	chacking					arrey i ci		perties	anu van	date usi	ng
		CHECKIN	g						perties		uate usi	ng
4.		ly knowl	ledge o	-		nputers	ecurity	technolo				ng
	technic	ly knowl ques to a	ledge o	-		nputers	ecurity	technolo				ng
Course	technic <b>Outcom</b>	ly knowl ques to a <b>es:</b>	ledge o achieve	differe	ntial priv	nputer s vacy for	security linear c	technolo Jueries	ogies as	well as [	Design	ng
Course CO1	technic <b>Outcom</b> Under	ly knowl ques to a <b>es:</b> stand th	ledge o achieve e know	differe	ntial priv bout se	nputer s vacy for curity se	security linear c ervices,	technolo Jueries data priv	ogies as	well as [	Design	ng
Course	technic Outcome Under Analyse	ly knowl ques to a <b>es:</b> stand th e about a	ledge o achieve e know Symme	differe /ledge a etrical a	ntial priv bout see nd Asym	nputer s vacy for curity se	security linear c ervices, al crypto	technolo Jueries data priv ography.	ogies as vacy and	well as [ mechai	Design nisms.	
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Course CO1 CO2	technic Outcome Under Analyse Analyse Signatu	ly knowl ques to a es: stand th e about e and t ures.	ledge o achieve e know Symme Jnders	differen vledge a etrical an tand ak	bout seend Asympout the	nputer s vacy for curity se metrica e conce	ecurity linear c ervices, al crypto ept of	technolo jueries data priv graphy. Data in	ogies as vacy and tegrity,	well as [ mechai Authen	Design nisms. tication	, Digital
Course CO1 CO2	technic Outcome Under Analyse Signatu Investig	ly knowl ques to a es: stand th e about e and l ures. gate Var	ledge o achieve e know Symme Jnders ious ne	differen vledge a etrical an tand at	bout see nd Asym bout the	nputer s vacy for curity se imetrica e conce applicat	ecurity linear c ervices, al crypto ept of	technolo Jueries data priv ography.	ogies as vacy and tegrity,	well as [ mechai Authen	Design nisms. tication	, Digital
Course CO1 CO2 CO3 CO4	technic Outcome Under Analyse Signatu Investig problem	ly knowl ques to a es: stand th e about e and t ires. gate Var m using	ledge o achieve e know Symme Jnders rious ne online	differen vledge a etrical au tand ak etwork s learning	bout see nd Asym bout the security	nputer s vacy for curity se imetrica e conce applicat	ecurity linear of ervices, al crypto ept of ions and	technolo Jueries data priv ography. Data in d Design	vacy and tegrity, mechar	well as I mechai Authen hisms fo	Design nisms. tication r query	, Digital release
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Course CO1 CO2 CO3 CO4 Course C CO/PO	technic Outcome Under Analyse Signatu Investig problem	ly knowl ques to a es: stand th e about e and t ures. gate Var m using s (CO) to	ledge o achieve e know Symme Jnders rious ne online	differen vledge a etrical au tand ak etwork s learning	bout see nd Asym bout the security	nputer s vacy for curity se imetrica e conce applicat	ecurity linear of ervices, al crypto ept of ions and	technolo Jueries data priv ography. Data in d Design	vacy and tegrity, mechar	well as I mechai Authen hisms fo	Design nisms. tication r query	, Digital release
Course CO1 CO2 CO3 CO4 Course C CO/PO CO1	technic Outcome Under Analyse Signatu Investig probler	ly knowl ques to a es: stand th e about e and t ures. gate Var m using s (CO) to	ledge o achieve e know Symme Jnders ious ne online <b>Progra</b>	differen vledge a etrical an tand ak etwork s learning mme Out	bout see nd Asym bout the ecurity g algorith	nputer s vacy for curity se imetrica e conce applicat hms. <b>PO) Maj</b>	ecurity linear of ervices, al crypto ept of ions and	technolo jueries data priv ography. Data in d Design (Scale	vacy and tegrity, mechar 1: Low, 2	well as I mechai Authen hisms fo : Mediur	Design nisms. tication r query n, 3: Hig	, Digital release
Course CO1 CO2 CO3 CO4 Course C CO/PO	technic Outcome Under Analyse Signatu Investig probler Outcomes	ly knowl ques to a es: stand th e about e about ures. gate Var m using s (CO) to PO02	ledge o achieve e know Symme Jnders ious ne online <b>Progra</b>	differen vledge a etrical an tand ak etwork s learning mme Out	bout see nd Asym bout the ecurity g algorith	nputer s vacy for curity se metrica e conce applicat hms. <b>PO) Maj</b>	ecurity linear c ervices, al cryptc ept of ions and <b>oping</b> <b>PO07</b>	technolo jueries data priv ography. Data in d Design (Scale	vacy and tegrity, mechar 1: Low, 2	well as I mechai Authen nisms fo : Mediur <b>PO10</b>	Design nisms. tication r query n, 3: Hig	, Digital release
Course CO1 CO2 CO3 CO4 Course C CO/PO CO1	technic Outcome Analyse Signatu Investig probler Outcomes PO01 3	ly knowl ques to a es: stand th e about a about ures. gate Var m using c(CO) to PO02 1	ledge o achieve Symme Jnders ious ne online <b>Prograr</b>	differen vledge a etrical an tand ak etwork s learning nme Out	bout see nd Asym bout the ecurity g algorith tcomes ( PO05	nputer s vacy for curity se metrica e conce applicat hms. <b>PO) Maj</b>	ecurity linear c ervices, al cryptc ept of ions and <b>oping</b> <b>PO07</b>	technolo jueries data priv ography. Data in d Design (Scale	vacy and tegrity, mechar 1: Low, 2	well as I mechai Authen nisms fo : Mediur PO10 2	Design nisms. tication r query n, 3: Hig	, Digital release



#### **Course Overview:**

Cryptography and Network Security is a comprehensive course covering the fundamentals of secure communication and information protection in computer networks. Students will explore encryption techniques, cryptographic algorithms, and protocols used to ensure confidentiality, integrity, and authentication. The course also delves into network security concepts such as firewalls, intrusion detection systems, and secure network design. Practical applications and case studies are included to enhance understanding of securing data transmission, securing network infrastructure, and addressing emerging security challenges.

#### UNIT - I

Security Concepts: Introduction, The need for security and Data Privacy, Security approaches, Principles of security, Types of Security attacks, Security services and mechanisms, A model for Network Security, Social Aspects of Privacy, Legal Aspects of Privacy and Privacy Regulations, Database Security, Statistical Database security, Inference Control, Hippocratic databases.

Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

#### UNIT - II

Symmetric key Ciphers: Block Cipher principles, DES, AES, RC5, IDEA, Block cipher operation, Stream ciphers, RC4.

Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange.

#### UNIT-III

Cryptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme.

**Key Management and Distribution**: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure

#### **UNIT-IV**

Anonymization: Linkage and re-identification attacks, k-anonymity, I-diversity, t-closeness, implementing anonymization, Anonymizing complex data, Privacy and anonymity in mobile environments, Database as a service, Privacy in Cloud infrastructure

Differential Privacy (DP): Formalism and interpretation of DP, Fundamental DP mechanisms and properties, Interactive and non-interactive DP, DP for complex data Local Differential Privacy (LDP)



# SURAJMAL VIHAR-110092

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#### [12]



#### TEXT BOOKS

- 1. Cryptography and Network Security Principles and Practice: William Stallings, Pearson Education, 6th Edition
- 2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
- 3. C. Dwork and A. Roth, The Algorithmic Foundations of Differential Privacy, now Publishers, 2014.

#### **REFERENCE BOOKS:**

- 1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.
- 2. Cryptography and Network Security: Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
- 3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
- 4. Charu C. Aggarwal, Privacy-Preserving Data Mining: Models and Algorithms, 1st Edition, Springer, 2008.



Semeste	er: 6 <sup>th</sup>														
Paper co	ode: IO	Г324Т							L	Т/	P Cre	edits			
Subject:	Proce	ss Auton	nation						3	0	3				
Marking	Schem	e													
1. T	eacher	s Continu	Jous Ev	aluatior	n: 25 Ma	irks									
2. E	nd terr	n Theory	Examir	nation: 7	75 Mark	s									
INSTRU	CTIONS	S TO PAP	ER SET	TERS:				Maxim	num Ma	rks: 75					
2. Qu ob 3. Ay Ev qu 4. Th st	uestion ojective oart fro very uni- uestion ne ques andard <u>ne requ</u> Object	underst	iould be answe ion No. have t ch unit. to be the qu of (scie tand th	e compu r type q 1, the wo que Each qu framed estions ntific) ca e Funda	ulsory ar uestions rest of t stions. uestion s keeping to be as alculaton	nd cover s. It shou he pape Howeve should b g in view ked sho rs/ log-t and ba	r the en- uld be o er shall c er, stude be 15 ma v the lea uld be a ables/ d	tire sylla f 15 mar consist o ents ma arks. arning o t the lev ata-tabl	ibus. Thi ks. f four ur y be as utcomes vel of the es may b	s question nits as po ked to a s of cour e prescri poe specif	er the so attempt se/pape bed text ied if re	yllabus. only 1 er. The books. quired.			
		plicatior													
2. 3.		install t													
4.	<ul> <li>To understand benefits of given industrial automation systems, describe their functi and compare characteristics of given automation systems.</li> </ul>														
Course									hat ava d	:+ for or	+ +: -				
CO1 CO2 CO3	At at At	<ul> <li>Able to Map and assess some of the business processes that are fit for automation.</li> <li>Able to connect to UiPath Automation Cloud, download the installer, and set up their own attended automation environment and Build an automation using StudioX.</li> <li>Able to effectively automate tasks involving use of Excel files, adapt the automation</li> </ul>													
CO4		oject to o ole to app			-	annlicati	ion of in	dustrial	automa	tion					
		es (CO) to	,					uustiidi	autoind						
		, - •	- 0- 31			-, <b>r</b>	. 0		(Scale	1: Low, 2	: Mediur	n, 3: High			
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12			
CO1	3	3	3	3	3	1	-	-	-	-	-	-			
CO2	3	3	3	3	3	1	-	-	-	-	-	-			
CO3	3	3	3	3	3	1									

**Course Overview:** Process and Industrial Automation specialization offers comprehensive knowledge and professional-level skills focused on developing and deploying software robots. It starts with the basic concepts of Robotic Process Automation. In the present global scenario, industries are moving towards complete automation. Hence, this course is foundation of engineers who want to specialize in industrial and process automation field.

#### Approved by BoS of USAR : 1/08/22, Approved by AC sub-committee : 29/08/22

Applicable from Batch Admitted in Academic Session 2021-22 Onwards Page | 202

#### **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

#### UNIT I:

Introduction to process automation: Definition of automation, Socio economic impacts of automation, Types of Automation, Introduction to Robot Process Automation, How is Automation Driving the Digital Transformation? Role of Automation in Business; Build first automation process with UiPath StudioX.

#### UNIT-II:

Automation using StudioX: computational concepts when building an automation project, Identify the tasks that are suitable for automation, break-down a task and document it in a Robot-Path. Introduction to file and folder automation,

Introduction to UI Automation: Introduction to UI automation, recording UI interactions, using the Object Repository, UI automation activities, extracting data from an application, using of different control flow activities and its use.

#### Unit III:

Error Handling: Use StudioX tools to validate and analyze automation projects for handling and troubleshooting errors, build automations using best practices that increase reusability and readability.

Email Automation: Use actions and resources related to email automation, create automation projects using StudioX email specific activities, create email content using both text and HTML options.

**Excel Automation:** Automate tasks involving use of Excel files such as usage of cell activities, range activities, pivot activities, chart activities and workbook activities.

#### Unit IV:

Introduction to Industrial Automation: Need and benefits of Industrial Automation, Automation Hierarchy, Basic components of Automation systems, description of each component, types of automation systems-flexible, fixed and programmable systems

The Future Automated Factory: Future Automated Factory, Human Workers in the Future Automated Factory, The social impact.

#### **Text Books:**

- 1. "Robotic Process Automation using UiPath StudioX: A Citizen Developer's Guide to Hyperautomation" Javed, A., Sundrani, A., Malik, N. and Madison, S. (2021), Apress Publishing Limited
- 2. "Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere" Mullakara, N. and Asokan, A.K. (2020), Packt Publishing Limited
- 3. "Industrial Automation and Process Control", Stenerson, J. (2002) PHI Learning, New Delhi

#### **Reference Books:**

- 1. "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Taulli, T. (2020), Apress Publishing Limited
- 2. <u>https://academy.uipath.com/learning-plans/rpa-citizen-developer-foundation</u>
- 3. Gopal, M. (1993). Modern control system theory. New Age International.



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Maximum Marks: 60

Semester: 6 <sup>th</sup>			
Paper code: IOT324P	L	T/P	Credits
Subject: Process Automation Lab	0	2	1

#### **Marking Scheme**

- 1. Teachers Continuous Evaluation: 40 Marks
- 2. End term Examination: 60 Marks

INSTRUCTIONS	TO PAPER SETTERS:
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- 1. This is the practical component of the corresponding theory paper.
- 2. The practical list shall be notified by the teacher in the first week of the class commencement under the intimation to the office of the HOD/ Institution in which they appear is being offered from the list of practicals below.
- 3. Instructors can add any other additional experiments over and above the mentioned in the experiment list which they think is important.
- 4. At least 8 experiments must be performed by the students.

#### **Course Objectives:**

- **1.** Gain a comprehensive understanding of the fundamentals and principles of Robotic Process Automation (RPA) using UiPath.
- **2.** Acquire hands-on experience in designing, developing, and deploying RPA solutions using UiPath Studio.

#### Course Outcomes:

- **CO1** Develop the ability to identify and assess automation opportunities within business processes and effectively apply UiPath tools and techniques to automate them.
- **CO2** Demonstrate proficiency in designing, implementing, and maintaining automated workflows using UiPath, resulting in increased operational efficiency, reduced errors, and enhanced productivity in real-world scenarios.

CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	2	2	2	3	2	-	1	-	-	1	-
CO2	3	2	2	2	3	3	1	1	1	1	1	-

#### LIST OF EXPERIMENTS

- 1. Introduction to Robot Process Automation (RPA) and UiPath:
  - Understanding the concept of RPA and its applications.
  - Implementing RPA using UiPath: Installation and exploring the user interface components.
- 2. UiPath Studio Essentials:
  - Mastering keyboard shortcuts in UiPath Studio.
  - Customizing keyboard shortcuts for efficient workflow.
- 3. Automation Projects in UiPath:
  - Working with automation projects in UiPath.
  - Debugging and troubleshooting techniques for automation projects.



- 4. Visual Workflow Design:
  - Designing visual workflows for automation.
  - Creating intuitive and easy-to-understand automation processes.
- 5. Error Handling in UiPath:
  - Implementing error handling mechanisms in UiPath.
  - Handling exceptions and managing error scenarios effectively.
- 6. Email Automation:
  - Automating email-related tasks using UiPath.
  - Sending, receiving, and processing emails automatically.
- 7. PDF Automation:
  - Automating PDF-related tasks with UiPath.
  - Extracting data, filling forms, and manipulating PDF documents.
- 8. Excel Automation:
  - Automating Excel tasks using UiPath.
  - Data extraction, manipulation, and reporting in Excel.
- 9. Gmail Automation:
  - Automating Gmail tasks using UiPath.
  - Managing emails, attachments, and labels in Gmail automatically.
- 10. Real-Time Project Automation:
  - Applying UiPath skills to automate a real-time project.
  - Designing and implementing a complete automation solution using UiPath.



Semest	er: 6 <sup>th</sup>												
Paper c	ode: IO	Т326Т							L	T/F	P Cre	dits	
Subject	: Social	Networ	k Analy	ytics					3	0	3		
Markin	g Schen	ne											
Teacher	rs Conti	nuous Ev	aluatic	n: 25 N	larks								
		ry Exami			ks								
INSTRU	CTIONS	ΤΟ ΡΑΡ	ER SET	TERS:						Maxii	mum Ma	arks: 75	
1. T	here sh	ould be s	9 quest	ions in t	the end	term ex	aminati	on ques <sup>.</sup>	tion pap	er.			
		n No. 1 sł								s questio	on shoul	d have	
	-	e or shor			•								
	-	om Ques it should									-		
		from ea							iy DE dS	גבת וה מ	ittempt		
-		stions ar		-					utcome	s of cou	rse/pape	er. The	
		/ level o				-		-					
5. т	he requ	irement	of (scie	entific) o	alculato	ors/log-	tables/	data-tab	les may	be speci	fied if re	equired.	
Course	e Object	ives:											
1.		Underst											
2.		To analyze social media data to comprehend user sentiments and recommend the											
		essential information appropriately. Model and visualize the social network											
<u> </u>	-					-	aial nat	works					
		tect and	anaiyze	e the co	mmunit		cial net	WOIKS					
Course	e Outco	mes:											
CO1	Un	derstand	l the ke	ey conce	pts and	theorie	s of soci	al netwo	ork analy	ysis.			
	An	alyze soc	ial net	work da	ta: Stud	ents sho	ould be a	able to c	ollect, p	reproce	ss, and a	analyze	
CO2		ial netw	ork dat	a using	various	tools ar	nd softw	are pack	ages, su	ich as Ge	ephi, Ne	tworkX,	
	and											<u> </u>	
CO3		sign a sy:			ate info	rmatior	ı availab	le on the	e web to	model	and buil	d Social	
		twork Ap ply socia	•		usis to re	al_worl	d nrobl	mc in v	arious fi	alde and	develor	<b>`</b>	
CO4		ategies a			-		•				ueveiu	,	
Course C		s (CO) to							1: Low, 2	: Mediur	n, 3: High	ו <b>)</b>	
CO/PO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	
CO1	2	1	2	-	-	1	-	-	-	-	1	-	
CO2	2 1 2 1 3 1 - 1 1 1 1							1					
CO3	2	1	2	1	-	1	-	1	-	1	1	-	
CO4	2	1	2	1	2	2	1	1	1	1	1	1	
	<u> </u>			<u> </u>			<u> </u>	<u> </u>	<u> </u>	-		1	



#### **Course Overview:**

This course explores the use of social network analysis to understand the growing connectivity and complexity in the world around us on different scales-ranging from small groups to the World Wide Web. It examines how we create social, economic, and technological networks, and how these networks enable and constrain our attitudes and behavior. The course will discuss how social network concepts, theories, and visual-analytic methods are being used to map, measure, understand, and design a wide range of phenomena such as social networking sites, recommender systems, trust and reputation systems, search engines.

#### UNIT-I

**Fundamentals of Social Network Analysis:** Social Network Perspective, Fundamentals concepts in Network Analysis: Sociogram, Sociometry. Social Network Data: Types of Networks: One-Mode, Two-Mode, Affiliation, Ego-centered and Special Dyadic Networks, Network Data, Measurement and Collection, Notations for Social Network Data: Graphs, Directed, Singed, Valued graphs, Multigraph, Relations and Matrices.

#### UNIT-II

**Centrality and Prestige:** Prominence: Actor-Centrality, Prestige, Group-Centrality, Prestige, Non directional Relations-Degree, Closeness, Betweenness, Eigen Vector Centrality, Directional Relations-Centrality, Prestige.

**Structural Balance and Transitivity:** Structural Balance: Signed Non directional, Signed Directional Relations, Checking for Balance, Index for Balance, Clusterability-Theorems, Clustering Coefficient and Transitivity.

#### UNIT-III

**Cohesive Subgroups:** Social Group and Subgroup-Notation, Subgroups Based on Complete Mutuality: Clique, Reachability and Diameter: n-cliques, n-clans and n-clubs, Subgroups Based on Nodal Degree: k-plexes, k-cores, Measures of Subgroup Cohesion, Community detection using Subgroups and Betweenness.

Roles and Positions: Structural Equivalence: Definition, Social Roles and, Positional Analysis, Measuring Structural Equivalence, Representation of Network Positions, Block Models-Introduction, Network Positions and roles-Introduction

#### UNIT-IV

**Dyadic and Triadic Methods**: Dyads: Definitions, Dyad Census, Index, Simple Distributions, Triads: Random Models and Substantive Hypotheses, Triad Census, Distribution of a Triad Census- Mean and Variance, Testing Structural Hypotheses.

**Models in Social Network:** Small world network- Watt Strogatz networks - statistical models for social networks - network evaluation model - Preferential attachment - power law - Random Model : Erdos -Renyi model - Barabasi Albert model - Epidemic model - Case study: Text and opinion Analysis

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#### Textbooks:

- 1. Wasserman Stanley, and Katherine Faust, Social Network Analysis: Methods and Applications, Structural Analysis in the Social Sciences. Cambridge University Press, 2012 Online Edition.
- 2. Albert-László Barabási, Network Science, Cambridge University Press, 1st edition, 2016.

#### **Reference Books:**

- 1. John Scott, "Social Network Analysis", Sage Publications Ltd., Fourth Edition, 2017.
- 2. David Knoke & Song Yang, "Social Network Analysis", Sage Publishing, Third Edition, 2020



Seme	ester: 6 <sup>t</sup>	h										
Раре	er code:	IOT326F	0						L	T/P	Credi	ts
Subje	ect: Soc	ial Netv	vork Aı	nalytics	Lab				0	2	1	
	king Sch											
	Teache					Marks						
	End te											
I	NSTRUC	TIONS T	O PAPI	ER SETT	ERS:			Μ	aximum	Marks:	60	
Cou	<ol> <li>The com they</li> <li>Inst in the d. At lease object</li> </ol>	practic mencer appear ructors ne exper east 8 ex ectives:	al list ment u is beir can ado iment operimo	shall b nder th ng offere d any of list whic ents mu	e notifie e intima ed from ther ado ch they t st be pe	ed by t ation to the list litional hink is i rformed	he teac the offi of pract experim importa d by the	cher in ice of th icals bel ients ove	er and a	week Instituti	ion in w	hich
1.	Under	stand th	ne com	ponents	s of the s	social ne	etwork					
2.	Analyze social media data to understand user sentiment and recommend the requisite information accordingly											
3.	Mode	l and vis	ualize	the soci	al netwo	ork						
4.	Apply algorithms to solve research problems on social network and analyze the communities in social networks.											
Cou	rse Out	comes:										
CO1	Develo	op socia	l netwo	ork appl	ications	using vi	isualizat	ion tool	5.			
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CO1	2	2	2	2	3	1	-	1	-	1	1	-
CO2	2	2	2	2	3	2	1	1	1	1	1	1

#### LIST OF EXPERIMENTS

- 1. Study and demonstrate to find the basic properties of a Graph/Social Network.
- 2. Demonstrate the calculation of Centrality measures.
- 3. Demonstrate the ranking of web pages in a web graph.
- 4. Find divisions in a Social Network.
- 5. Implement Community Detection algorithms on a Social Network.
- 6. Demonstrate modelling of Social Networks.



- 7. Visualize multidimensional Social Network.
- 8. Applications of Classification and Clustering on a Social Network.
- 9. Design and implement a Sentiment Analyzer.
- 10. Design and implement a Social Network.



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3. 4.	componen	ts of CP	S								
4.	To analyze	the role	e of Data	Analyt	ics in C	PS					
	To underst	and arc	hitecture	e and fu	unction	ing of C	PS				
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Course O	digital twir	าร.									
	Outcomes:										
CO1	Explain the	e compo	onents of	Cyber	Physica	l Syster	ns (CPS)	and Inc	lustry 4	.0.	
CO2	Apply the	trends	and be	st prac	ctices f	for dev	eloping	and de	eployin	g indu	istry 4.
	solutions.						_				
CO3	Analyze th	e integr	ation of A	AI, ML a	and IOT	to CPS					
I	Design and	develo	op a digita	ai twin.							
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СО/РО	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12
CO1	3	1	-	-	-	1	1	-	-	2	-	-
CO2	3	3	3	3	3	-	-	-	-	2	-	-
CO3	3	3	3	2	2	-	-	-	-	2	-	-
CO4	3	3	3	2	3	2	1	-	-	2	-	-

#### **Course Overview:**

The course Cyber Physical Systems and Industry 4.0 is all about the integration of cyber-physical systems in and outside of organization. This course covers the foundations and characteristics of CPS with respect to fourth industrial revolution. CPS adoption by industries has also been covered in the course. Description of Digital Twin as digital representation of the physical object has also been given followed by various case studies such as Smart Manufacturing, Agriculture, Healthcare etc.

#### Unit I

Review: Internet of Things: Applications, Vulnerabilities and Need for Cyber Resilience, Fourth Industrial Revolution, Foundations of Cyber Physical Systems (CPS), Elements of Industry 4.0 Solution, Data Analytics and its Application in CPS.

#### Unit II

Mapping of Operational and Business Goal with Industry 4.0, Challenges of Industrial CPS, Handling and Analyzing IoT Data-ML, AI, AR/VR, Architecture of Industrial CPS, Schematic Functioning of Industrial CPS, Complimenting Concepts & Technologies to Industrial CPS. Industrial CPS as Socio-Technical System.

#### Unit III

Cyber physical System Adoption and Application, Value Creation based on Industrial CPS, Organization Integration and Strategic Alliances based on Industrial CPS. Case Studies: Moving from individual process to operation and supply chain management, Secure Data Aggregation Using Cyber Physical Systems for Environment Monitoring.

#### Unit IV

Manufacturing and CPS: Digital Connectivity and Sensors, Digital Engineering and Digital Operation, Digital Twins: Product, Manufacturing and Performance Twins, Developing a Digital Twin, Case Studies: Energy Management in Smart Grid, Medical Cyber Physical System Security, Agriculture and CPS, Smart Manufacturing.

#### Textbook:

1. D. Goyal, S. Balamurugan, K. Senthilnathan, I. Annapoorani, M. Israr, "Cyber-Physical Systems and Industry 4.0: Practical Applications and Security Management", Feb 2022, CRC Press

#### **Reference Papers:**

1. <u>https://blog.isa.org/cyber-physical-systems-the-core-of-industry-4.0</u>

2. https://www.rinf.tech/digital-twin-development-why-when-and-how/



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Paper code: IOT330TLSubject: Blockchain Technology4Marking Scheme1.1. Teachers Continuous Evaluation: 25 Marks	T/P		
Marking Scheme	• / •	Cre	dits
-	0	4	ŀ
1. Teachers Continuous Evaluation: 25 Marks			
2. End term Theory Examination: 75 Marks			
INSTRUCTIONS TO PAPER SETTERS: Maximum N	larks: 7	'5	
1. There should be 9 questions in the end term examination question pa	per.		
2. Question No. 1 should be compulsory and cover the entire syllabus.		uestion s	should
have objective or short answer type questions. It should be of 15 marl			
3. Apart from Question No. 1, the rest of the paper shall consist of four un	•		
Every unit should have two questions. However, students may be asl	ked to a	attempt	only 1
<ul><li>question from each unit. Each question should be 15 marks.</li><li>4. The questions are to be framed keeping in view the learning outcomes</li></ul>	oftho	courso/	napor
The standard/ level of the questions to be asked should be at the le			
textbooks.		ine pres	ensea
5. Instructors can add any other additional experiments over and above t	he mer	ntioned i	n the
experiment list which they think is important.			
6. The requirement of (scientific) calculators/ log-tables/ data-tables	s may	be spec	ified if
required.			
Course Objectives:			
<b>1.</b> To articulate the fundamentals of blockchain and able to explain cr	yptogr	aphic co	ncepts
underlying blockchain technology.			
2. To make use of wallet transactions, crypto tokens, analyse t	he blo	ck deta	ils and
Ethereum blockchain transactions.			
3. To study smart contracts and to examine various types of Bloc	kchain	networ	ks and
consensus algorithms.			
<b>4.</b> To study and implement solidity.			
Course Outcomes:			
To study the concept of money, fundamentals of blockch	nain ar	nd to	
			explain
cryptographic concepts underlying blockchain technology.			•
CO1cryptographic concepts underlying blockchain technology.CO2To learn and apply the central concept of the blockchain ecosyst	tem an	d PoW,	•
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#### Approved by BoS of USAR : 1/08/22, Approved by AC sub-committee : 29/08/22 Applicable from Batch Admitted in Academic Session 2021-22 Onwards

#### **Course Overview:**

The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. This course includes the fundamental design and architectural primitives of Blockchain, consensus protocols, types of the Blockchain system and the security aspects, methods to deploy smart contracts on different platforms, along with various use cases from different application domains in real life.

#### UNIT I

Background leading blockchain, Shortcoming of current transaction system, The emergence of Blockchain, Bitcoin blockchain, Blockchain Architecture, Conceptualization, Blockchain components, Cryptocurrencies, Characteristics of cryptocurrencies, Alt coins, Crypto wallets, Creation of Blocks, Wallet Transactions, Transaction details in a Block, Merkle Tree, Hash functions, pseudo random numbers, public key cryptosystem, Generation of keys, Digital signatures.

#### UNIT II

Blockchain types-Public Blockchain, Private Blockchain, Federated Blockchain, Ethereum blockchain, Go Ethereum, Gas, Gas price, Gas Limit, ETH, MetaMask, Public Test Networks, set up a Ethereum node using Geth, Mining in Blockchain, Double spending, Consensus algorithms: Proof of Work, Proof of Stake, Attacks on Bitcoin (Sybil Attacks, 51% Attack, etc.), Byzantine fault, Node failure.

#### Unit III

Byzantine General Problem, BFT (Byzantine fault tolerance), PBFT (Practical Byzantine fault tolerance), Delegated Proof of Stack, Paxos Consensus algorithm, Raft Algorithm, Solo Miner, Pool Miners, Deployment of Smart contracts in Blockchain, Remix, Compilation of smart contracts, Deployment environments, JavaScript Environment

#### **UNIT IV**

Solidity: Data types in solidity, Operators, State variables, Global Variables, Local variables. Solidity arrays, Solidity functions, Structs in solidity, Inheritance, Special variables, Solidity mapping, Function overloading, Personal Blockchain network, Ganache, Contract deployment to Ganache network, Modifiers in solidity, Events, Emerging applications of Blockchain.

#### Text Book:

1. Bettina Warburg, Bill Wanger and Tom Serres, Basics of Blockchain (1 ed.), Independently published, 2019. ISBN 978-1089919445.

2. Holbrook and Joseph, Architecting enterprise blockchain solutions (1 ed.), John Wiley & Sons, 2020. ISBN 978-0000000.

3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

#### **GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY,** EAST DELHI CAMPUS, SURAJMAL VIHAR-110092

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### [10]

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#### **Reference Book:**

**1.** Bashir and Imran, Mastering blockchain: "Distributed ledger technology, decentralization, and smart contracts explained (1 ed.), Packt Publishing

Ltd, 2018. ISBN 978- 11111111.

2. Andreas M. Antonopoulos. 2017. Mastering Bitcoin: Unlocking Digital Crypto-Currencies (2nd. ed.). O'Reilly Media, Inc.



Semest	er: 6 <sup>th</sup>											
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#### **Course Overview:**

The aim of the course is to provide students with the necessary skills and knowledge to understand, design, develop, and apply AR and VR technologies in various fields. This Course aims to introduce students to the fundamental concepts and technologies of AR and VR, including the hardware and software used to create and experience these immersive environments.

#### UNIT I

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality - Primary Features and Present Development on Virtual Reality - Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker - Sensor - Digital Glove - Movement Capture - Videobased Input - 3D Menus & 3DScanner – Output - Visual /Auditory / Haptic Devices.

#### UNIT II

Visual Computation in Virtual Reality: Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large-Scale Environments & Real Time Rendering.

#### UNIT III

Interactive Techniques in Virtual Reality: Body Track - Hand Gesture - 3D Manus - Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega - MultiGen - Virtools.

**Application of VR in Digital Entertainment:** VR Technology in Film & TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR.

#### UNIT IV

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

#### Text Books

- 1. Burdea, G. C., P. Coffet., "Virtual Reality Technology", Second Edition, Wiley-IEEE Press, 2003/2006.
- 2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, 2013.

#### **Reference Books**

1. Alan Craig, William Sherman, Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.