Cambridge Institute of Technology, Bengaluru An Autonomous Institution

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Scheme and Syllabus (2023 Autonomous Batch) Artificial Intelligence and Machine Learning (III and IV Semester)

Department of Artificial Intelligence and Machine Learning

Scheme



Cambridge Institute of Technology, Bengaluru An Autonomous Institution Affiliated to VTU



3rd Semester

~	~	Course Title	Course Code	Teaching			_	~ ~	~~~	~ ~~~	
SI.No	Course	course mile	Course Cour	Dept.	L	Т	Р	Credits	CIE	SEE	Total
•	rype			-							
1	BSC	Applied Mathematics –III	MC201	BS	3	2	0	4	50	50	100
					2	0	0	2	50	50	100
2	PCC	Data Structure and	AI202	AIML	3	0	0	3	50	50	100
		Applications									
3	PCCL	Data Structure and	A1203	AIML	0	0	2	1	50	50	100
5	TCCL	Application Lab	111200								
											100
4	PCC	Operating System	AI204	AIML	3	2	0	4	50	50	100
	DOOL	On another a Carata na Lab	A 1205		0	0	2	1	50	50	100
5	PCCL	Operating System Lab	A1205	AIML	-	-					
6	IPCC	Principles of Artificial	AI206	AIML	2	0	2	3	50	50	100
		Intelligence									
					2	0	0	2	50	50	100
7	ESC	Engineering Science	AI22X	AIML	3	0	0	3	50	50	100
		Course									
0	DOC	Diele av fen En eineen	DC207	DC	2	0	0	2	50	50	100
8	BSC	biology for Engineers	BG207	DS	2	0	0	Z	30	30	100
		NSS – Phase 1	NS208	NSS							
		Physical Education (PE)	PE208	PED							
9	NCMC	(Sports and Athletics) – Phase 1			0	2	0	0	50	0	50
		Thuse T									
		Yoga for a Better Life -	YG208	Yoga							
		Phase 1									
10	NOMO	Additional Mathemati	DM200	DC	2	0	0	0	50	50	100
10	NCMC	Auditional Mathematics	DIM209	DO		-	-	-			
					18	6	6	21	500	450	950

IBSC: Integrated Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **IPCC :** Integrated Professional Core Course, **ESC:** Engineering Science Course, **IESC:** Integrated Engineering Science Course, IPEC, **HSMC:** Humanity and Social Science & Management Course, **AEC:** Ability Enhancement Course, **UHV:** Universal Human Value Course, **IPEC:** Integrated Professional Elective Course, **IOEC:** Integrated Open Elective Course, **CER :** Certification Course, **PROJ:** Project, **INT:** Internship, **NCMC:** Non-Credit Mandatory Course

L: Lecture, T: Tutorial, P: Practical,

CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation,

In **IPCC** courses, practical components shallbe included, but not limited to the few experiments. IPCC courses shall have list few practice experiments and open ended experiment based on the

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YG) with the concerned coordinator of the course during the III semester. Activities shall be carried out between III semesters to the IV semester (for 2 semesters). Successful completion of the registered course and requisite **CIE score is mandatory for the award of the degree**. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

FCC	۲
ESU	/

Sl.No.	Course Title	Course Code
1	Object Oriented Programming with C++	AI221
2	Unix Shell Programming	AI222
3	Introduction to Data Science	AI223



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4th Semester

						1	1	1		1	1
S1.N 0.	Course Type	Course Title	Course Code	Teaching Dept.	L	Т	Р	Credit s	CIE	SEE	Total
1	BSC	Applied Mathematics - IV	MC251	BS	2	2	0	3	50	50	100
2	PCC	Analysis & Design of Algorithms	AI252	AIML	3	0	0	3	50	50	100
3	PCCL	Analysis and Design of Algorithms Lab	AI253	AIML	0	0	2	1	50	50	100
4	PCC	Database Management Systems	AI254	AIML	3	0	0	3	50	50	100
5	PCCL	Database Management Systems Lab	AI255	AIML	0	0	2	1	50	50	100
6	IPCC	Java Programming	AI256	AIML	2	0	2	3	50	50	100
7	ESC	Engineering Science Course	AI26X	AIML	3	0	0	3	50	50	100
8	AEC	Ability Enhancement Course	AI27X	AIML	1	0	2	2	50	50	100
9	UHV	Universal Human Values and SCR	HV257	Dept.	2	0	0	2	50	50	100
		NSS – Phase 2	NS258	NSS							
10	NCMC	Physical Education (PE) (Sports and Athletics) – Phase 2	PE258	PED	0	2	0	0	50		50
		Yoga for a Better Life - Phase 2	YG258	Yoga							
					16	4	8	21	500	450	950

IBSC: Integrated Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **IPCC :** Integrated Professional Core Course, **ESC:** Engineering Science Course, **IESC:** Integrated Engineering Science Course, IPEC, **HSMC:** Humanity and Social Science & Management Course, **AEC:** Ability Enhancement Course, **UHV:** Universal Human Value Course, **IPEC:** Integrated Professional Elective Course, **IOEC:** Integrated Open Elective Course, **CER** : Certification Course, **PROJ**: Project, **INT**: Internship, **NCMC**: Non-Credit Mandatory Course

L: Lecture, T: Tutorial, P: Practical,

CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation,

In **IPCC** courses, practical components shall be included, but not limited to the few experiments. IPCC courses shall have list few practice experiments and open ended experiment based on the concepts coverd in the course. The expected outcome is students have to do the guided project related to the course.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YG) with the concerned coordinator of the course during the III semester. Activities shall be carried out between III semesters to the IV semester (for 2 semesters). Successful completion of the registered course and requisite **CIE score is mandatory for the award of the degree**. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Sl.No	Course Title	Course Code
1	Game Theory	AI261
2	Discrete Mathematical Structures	AI262
3	Data Mining and Data Warehousing	AI263

ESC

AFC	
ALC	

Sl.No.	Course Title	Course Code
1	Julia Programming	AI271
2	Full stack Development	AI272
3	R Programming	AI273

Syllabus

	Applied Mathematics –III			
	for Computer Science and			
Course Title	Engineering Stream Semester		III	
	(AIML, ISE, CSE,			
	CSE-IOT)			
Course Code	MC201	CIE	50	
Total No. of Contact Hours	50	SEE	50	
No. of Contact Hours/week	3:2:0	Total	100	
Cradita	Λ	Exam.	3 Hours	
	4	Duration	5 110015	

Course objective is to:

- Have a foundation in the fundamentals of logic, enabling them to apply logical reasoning effectively in their academic and professional pursuits.
- Develop skills in data analysis, problem-solving, and communication, preparing them to apply statistical techniques effectively in various fields such as science and engineering.
- To facilitate students with the knowledge and skills needed to effectively use regression analysis as a tool for understanding data relationships, making predictions, and drawing meaningful conclusions from data.

Module-1	RBT Levels L1,L2,L3	10 Hours
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Mathematical logic:

Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence – The laws of Logic, Logical implication – Rules of Inference. Quantifiers, Validity of Quantifiers.

Module-2	RBT Levels			
	L1,L2,L3			

Probability Distributions:

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson, Exponential and normal distributions.

Joint probability distribution:

Joint Probability distribution for two discrete random variables, expectation, covariance and correlation. Markov Chain: Introduction to Stochastic Process, Probability Vectors, Stochastic matrices, Regular stochastic matrices, Markov chains, Higher transition probabilities, Stationary distribution of Regular and absorbing states..

Module-4	RBT Levels	10 Hours
	L1,L2,L3	10 110015

Statistical Methods:

Correlation and Regression-Karl Pearson's coefficient of correlation and rank correlation-problems, Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form-y = ax + b, $y = ax^b$ and $y = ax^2 + bx + c$.

Module-5	RBT Levels L1,L2,L3	10 Hours
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Statistical Inference :

Introduction, sampling distribution, standard error, Type-I and Type-II errors. Testing of hypothesis, levels of significance, confidence limits, sampling of attributes, test of significance for large samples for mean and proportions. Students 't' distribution, Chi-square distribution as a test of goodness of fit.

Suggested Learning Resources:					
Textbooks:					
1	Ralph P. Grimaldi B. V. Ramana: "Discrete and Combinatorial Mathematics				
1	", 5th Edition, Pearson Education, 2004.				
2	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th				
2	edition, 2017.				
3	Kenneth H. Rosen: "Discrete Mathematics and its Applications", 6th Edition, McGraw				
5	Hill, 2007.				
Reference B	ooks:				
1	Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics - A Concept-				
1	based approach", Universities Press, 2016				
2	D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications,				
	Latest Edition, Thomson, 2004.				
3	Ralph P. Grimald1: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson				
	Education. 2004.				
4	Thomas Koshy – Elementary Number Theory with Applications, Academic Press,				
***	2nd edition, 2008.				
Web links an	d Video Lectures (e-Resources):				
M1: <u>https://y</u>	outu.be/xIUFkMKSB3Y?list=PL0862D1A947252D20				
M2: <u>https://y</u>	outu.be/_BIKq9Xo_5A				
M3: <u>https://y</u>	outu.be/Q9HNSfF7Hq4?list=PL3RvMHSY8k8lyQsWfHsFELUjfglQB0Ovn				
M4: <u>https://y</u>	outu.be/BA11yzRFGzo?list=PL13bOBUU3L9h4StzmTBjUnzosZYpCKcKZ				
M5: <u>https://y</u>	outu.be/OQV8WmUde1o?list=PLLqEsfz6HOamSu7v9zBZ11kVcCl2atzWL				
Activity-Base	ed Learning (Suggested Activities in Class)/ Practical Based learning				
Quiz, Group	Discussions, Seminar, In class assignments,				

CO1 Apply concepts of logical reasoning and mathematical proof techniques in proving the and statements.	
and statements.	orems
CO2 Explain the basic concepts of probability, random variables, probability distribution	

CO3	Apply suitable probability distribution models for the given scenario
CO4	Make use of the analysis to fit a suitable mathematical model for statistical data.
CO5	Compute the confidence intervals for the mean of the population

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2								2
CO2	2	2		2								2
CO3	2	2		2								2
CO4	2	2		2								2
CO5	2	2		2								2

Course Title	Data Structures and Applications	Semester	Ш
Course Code	AI202	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		·

Course objective is to:

- Explain fundamentals of data structures and their applications essential for programming/problem solving.
- Illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
- Demonstrate sorting and searching algorithms.
- Find suitable data structure during application development/Problem Solving.

Madula 1	RBT Level/s	Hours
Woddle-1	L1, L2, L3	8
Introduction : Data Structures, Classifications (Primitive & Non Primitive), I	Data structure Or	perations.

Review of Pointers and Dynamic Memory Allocation Functions.

Array: Array in c, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Pattern Matching algorithms (nfind, KMP).

Textbook 1 Chapter 1: 1.2, Chapter 2: 2.1- 2,5,2,7.3, Textbook 2: Chapter 1: 1.3, 1.4

		*			
Madula 2				RBT Level	Hours
Wiodule-2				L1, L2, L3	8

Stacks: Definition, Stack Operations, Stacks using Dynamic Arrays.
Stack Applications: Infix to postfix conversion, evaluation of postfix expression. Multiple Stacks.
Queues: Definition, Queue Operations, Circular Queues, Circular queues using Dynamic arrays.
Textbook 1: Chapter 3: 3.1 - 3.4, 3.6 - 3.7

Madula 2					RBT Level	Hours
Widdule-3					L1, L2, L3	8
T I I I T I	D 0	n	 0 11 1	1 11	 T I I I II	

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, Deletion and header linked lists. Linked Stacks and Queues. Doubly Linked lists.

Applications of Linked lists – Polynomials and Sparse matrix representation. Textbook 1: Chapter 4: 4 3 4 4 4 7 4 8 Textbook 2: Chapter 5: 5 1 - 5 10

Module-4	RBT Level	Hours
Module-4	L1, L2, L3	8

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder, Threaded binary trees. **Binary Search Trees** – Definition, Searching, Insertion, Deletion, AVL Search trees: Definition. Insertion and Deletion in an AVL Search tree. **Textbook 1**: Chapter 5: 5.1,5.2,5.3(5.3.1-5.3.3) 5.7(5.7.1-5.7.4) **Textbook 2**: Chapter 7: 7.10 – 7.12

Module_5	RBT Level	Hours
	L1, L2, L3	8
Graphs: Definitions, Terminologies, Matrix and Adjacency List	Representation Of	Graphs,
Elementary Graph operations.		
Hashing: Introduction, Static and Dynamic Hashing.		
Textbook 1 : Chapter 8: 8.1 – 8.3.		
Textbook 2: Chapter 8 : 8.1 – 8.3.		
 Graphs: Definitions, Terminologies, Matrix and Adjacency List Elementary Graph operations. Hashing: Introduction, Static and Dynamic Hashing. Textbook 1: Chapter 8: 8.1 – 8.3. Textbook 2: Chapter 8 : 8.1 – 8.3. 	Representation Of	Graphs,

Suggested Learning Resources:

Textbooks:

1	Fundamentals of Data Structures in C - Ellis Horowitz and Sartaj Sahni, 2nd edition, Universities
1.	Press,2014
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
Refe	erence Books:
1	Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage
1.	Learning,2014
2.	Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications,
э.	2 nd Ed, McGraw Hill, 2013
Web	b links and Video Lectures (e-Resources):
•	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
•	https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
•	https://nptel.ac.in/courses/106/102/106102064/

• https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Real world problem solving

Cours	se outcomes:					
CO1	Understand fundamentals of data structures and their applications essential for					
COI	programming/problem solving.					
CO2	Ability to apply Linear Data Structures: Stack and Queues to solve the given problems					
CO3	Ability to use the concept of Linear Data Structures in problem solving					
CO4	Apply Non-Linear Data Structures: Trees and Graphs.					
CO5	Understand the concepts of Hashing Techniques, Files and their Organization and Sorting					
	Algorithms.					

CO-PO Mapping														
		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS	PS
0/10	101												01	O2
CO1	3	3	3	2					1			2		
CO2	3	3	3	2					1			2		
CO3	3	3	3	1					1			2		
CO4	3	3	2	1					1			2		
CO5	3	2	2	2					1			2		

Data Structures Application Laboratory						
Course Code	AI203	CIE Marks	50			
L:T:P:S	0:0:2:0	SEE Marks	50			
Hrs./ Week	2	Total Marks	100			
Credits	1	Exam Hours	03			

Course Objectives: At the end of the course, the student will be able to:

CLO1	Dynamic memory management
CLO2	Linear data structures and their applications such as stacks, queues and lists
CLO3	Non-Linear data structures and their applications such as trees and graphs

Pgm. No.	List of Experiments /Programs	Hours	Cos				
	Pre requisite Experiments /Programs/Demo: Design algorithm and C Prog	gramming					
	PART-A						
1	Introduction to Data Structures:	2	CO1				
	Design, Develop and Implement a menu driven Program in C for the						
	tollowing Array operations						
	a) Creating an Array of N Integer Elements b) Display of Array Elements with Switchle Headings						
	b) Display of Afray Elements with Suitable Headings						
	d) Deleting an Element at a given valid Position (POS)						
	e) Exit						
2	Design, Develop and Implement a Program in C for the following operations	2	CO1				
	on Strings						
	a) Read a main String (STR), a Pattern String (PAT) and a Replace String						
	(REP)						
	b) Perform Pattern Matching Operation: Find and Replace all occurrences						
	of PAT in STR with REP if PAT exists in STR. Report suitable						
	messages in case PAT does not exist in STR						
			000				
3	Design, Develop and Implement a menu driven Program in C for the following	2	002				
	operations on STACK of Integers (Array Implementation of Stack with						
	a) Push an Element on to Stock						
	a) Pan an Element from Stack						
	c) Demonstrate how Stack can be used to check Palindrome						
	d) Demonstrate <i>Overflow</i> and <i>Underflow</i> situations on Stack						
	e) Display the status of Stack						
4	Design, Develop and Implement a Program in C for converting an Infix	2	CO2				
	Expression to Postfix Expression. Program should support for both parenthesi						
	and tree parenthesized expressions with the operators: +, -, *, /, % (Remaind						
	" (Power) and alphanumeric operands.		COL				
5	Design, Develop and Implement a Program in C for the following Stack	2	002				
	a) Evaluation of Suffix expression with single digit operands and						
	a) Evaluation of Suma expression with single digit operations and operators: $\pm - \frac{1}{2} / \frac{1}{2} \sqrt{2}$						
L	Operators. T, ", ', ', '0,						

	b) Solving Tower of Hanoi problem with n disks		
6	 Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a) Insert an Element on to Circular QUEUE b) Delete an Element from Circular QUEUE c) Demonstrate <i>Overflow</i> and <i>Underflow</i> situations on Circular QUEUE d) Display the status of Circular QUEUE e) Exit 	2	CO2
7	 Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a) Create a SLL of N Students Data by using <i>front insertion</i>. b) Display the status of SLL and count the number of nodes in it c) Perform Insertion and Deletion at End of SLL d) Perform Insertion and Deletion at Front of SLL e) Exit 	2	CO3
8	 Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo a) Create a DLL of N Students Data by using <i>front insertion</i>. b) Display the status of DLL and count the number of nodes in it c) Perform Insertion and Deletion at End of DLL d) Perform Insertion and Deletion at Front of DLL e) Exit 	2	CO3
9	 Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers a) Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b) Traverse the BST in Inorder, Preorder and Post Order. c) Search the BST for a given element (KEY) and report the d) appropriate message e) Delete an element(ELEM) from BST f) Exit 	2	CO4
10	 Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities a) Create a Graph of N cities using Adjacency Matrix. b) Print all the nodes reachable from a given starting node in a digraph using BFS method c) Check whether a given graph is connected or not using DFS method. 	2	CO5

Beyond Syllabus Virtual Lab Content

- Write a C Program to check whether two given lists are containing the same data.
 Write a C program to find the largest element in a given doubly linked list.
 Write a C program to Remove Nth node from end of the Linked List

Suggested Learning Resources: Textbooks/ Reference Books:

1	Fundamentals of Data	Structures in C -	· Ellis Horowitz ar	nd Sartaj Sahni,	2nd edition,	Universities
1.	Press,2014					

2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html

Activity-Based Learning (Suggested Activities in Class)/Practical Based learning:

Assign Group Project.

Cours	se outcomes:
CO1	Choose the Data manipulation functions for array and strings using memory allocation methods
CO2	Demonstration of stack operations on the expression using stacks
CO3	Determine the queue features on the problem using queue methods
CO4	Compare linked list classification using linked list method
CO5	Decide the hierarchical organization of data using binary search tree method

CO-PO Mapping														
CO/P	PO	PO1	PO1	PO1	PSO	PS								
0	1	2	3	4	5	6	7	8	9	0	1	2	1	O2
CO1	3											2	3	
CO2	3	2	1	1								2	3	2
CO3	3	2	1	1								2	3	2
CO4	3	2	1	1								2	3	2
CO5	3											2	3	

	-		
Course Title	Operating Systems	Semester	III
Course Code	AI204	CIE	50
Total No. of Contact Hours	50	SEE	50
No. of Contact Hours/week	3:2:0	Total	100
Credits	04	Exam. Duration	3 Hours
Teaching Dept	AIML		•

Course objective is to: The objective of this course is to study basic principles and role of operating system. In this course students learnt about various CPU scheduling techniques, process management, memory management techniques performed by operating system.

Madula 1. Introduction	RBT Level/s	Hours:
	L1, L2, L3	10
Introduction: What Operating Systems Do Computer System Architecture	Oparating System	Structure

Introduction: What Operating Systems Do, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Operating-System Services, System Calls, Types of System Calls.

Processes: Process Concept, Process Scheduling, Operations on Processes, Inter Process Communication, Basic Concepts of CPU Scheduling, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple-Processor Scheduling.

Textbook 1: Chapter – 1 (1.1, 1.3-1.5), 2 (2.1-2.4), 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 - 5.5)

Madula 2: Symphysization	RBT Level H	
Module-2: Synchronization	L1, L2, L3	10

Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples.

Deadlocks: System Model, Deadlock Characterization Definition, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Textbook 1: Chapter – 6 (6.1-6.9), 7

Madula 2. Mamany Managamant	RBT Level	Hours:
Module-5: Memory Management	L1, L2, L3	10

Memory Management: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.

Virtual Memory Management: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing, Cause of Thrashing, Working-Set Model.

Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6.2)

Madula 4. Ella Managament	RBT Level	Hours:
Module-4: File Management	L1, L2, L3	10

File Management: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection.

Mass Storage Structure: Overview of Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, Protection, Goals of protection, Principles of protection, Domain of protection, Access matrix.

Textbook 1: Chapter - 10,12 (12.1-12.6), 14(14.1-14.5)

Modulo 5. The Linux System	RBT Level	Hours:
Module-5: The Linux System	L1, L2	10

The Linux System: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Interprocess Communication, Network Structure, Security.

Windows 7: History, Design Principles, System Components.

Textbook 1: Chapter - 16, 17(17.1-17.3)

Suggested Learning Resources:

Textbooks:

1	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 9th edition,						
1	Wiley-India, 2016						
Refer	ence Books:						
1	Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition						
2	D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw-Hill, 2013.						
3	P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE),2014.						
4	William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.						
Web l	inks and Video Lectures (e-Resources):						
1.	https://youtu.be/mXw9ruZaxzQ						
2.	https://youtu.be/vBURTt97EkA						
3.	https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f						
4.	https://www.youtube.com/watch?v=3-LMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeRn6mkO						

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Assessment Methods:

Case Study on Unix Based Systems (10 Marks)

Lab Assessment (25 Marks)

Cours	e outcomes:
CO1	Explain the structure and functionality of operating system and apply the appropriate CPU scheduling
COI	algorithms for the given problem.
CO2	Analyse the various techniques for process synchronization and deadlock handling.
CO3	Apply the various techniques for memory management, concepts of file and secondary memory
COS	management.
CO4	Describe the need for information protection mechanisms, concepts Unix, Windows 7

CO-PO Mapping														
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	PS	PS
00/10	101											12	01	O2
CO1	3	3	3	2	2	-	-	-	-	-	-	-	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	3	-	3	2	2	-	-	3	-

Operating System Laboratory							
Course Code	AI205	CIE Marks	50				
L:T:P:S	0:0:2:0	SEE Marks	50				
Hrs./ Week	2	Total Marks	100				
Credits	1	Exam Hours	03				

Course objectives : At the end of the course, the student will be able to:

CO1	To Demonstrate the need for OS and different types of OS
CO2	To discuss suitable techniques for management of different resources
CO3	To demonstrate different APIs/Commands related to processor, memory, storage and file system management.

Pgm. No	List of Experiments/Programs	Hours	COs							
110.	Pre requisite Experiments/Programs/Demo									
	Proficiency in programming languages like C, C++, Python, etc									
	Familiarity with operating systems concepts like processes, threads,									
	memory management, and device drivers will be advantageous.									
	PART-A									
1	Develop a c program to implement the Process system calls (fork (),	1	1							
	exec(), wait(), create process, terminate process)									
2	Simulate the following CPU scheduling algorithms to find turnaround	2	2							
	time and waiting time a) FCFS b) SJF c) Round Robin d) Priority.									
3	Develop a C program to simulate producer-consumer problem using	2	3							
	semaphores									
4	Develop a C program which demonstrates interprocess communication	2	3							
	between a reader process and a writer process. Use mkfifo, open, read,									
	write and close APIs in your program.									
5	Develop a C program to simulate Bankers Algorithm for DeadLock	2	3							
	Avoidance.									
6	Develop a C program to simulate the following contiguous memory	2	4							
	allocation Techniques: a) Worst fit b) Best fit c) First fit									
7	Develop a C program to simulate page replacement algorithms: a) FIFO	2	4							
	b) LRU									
8	Simulate following File Organization Techniques a) Single level	2	5							
	directory b) Two level directory									
9	Develop a C program to simulate the Linked file allocation strategies.	2	5							
1.0										
10	Develop a C program to simulate SCAN disk scheduling algorithm.	2	5							

PART-B

Beyond Syllabus Virtual Lab Content

- 1. Write a Shell program to check the given number is even or odd
- 2. Write a Shell program to check the given year is leap year or not
- 3. Write a Shell program to find the factorial of a number
- 4. Write a Shell program to swap the two integers

Suggested Learning Resources:

Textbooks/ Reference Books:

- 1Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 8th edition,
Wiley-India, 2015
- 2 Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th EditionC
- 3 P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.

4 William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.

Web links and Video Lectures (e-Resources):

- 1. https://youtu.be/mXw9ruZaxzQ
- 2. https://youtu.be/vBURTt97EkA
- 3. https://www.youtube.com/watch?v=783KABtuE4&list=PLIemF3uozcAKTgsCIj82voMK3TMR0YE_f

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Assessment Methods

- Case Study on Unix Based Systems (10 Marks)
- Lab Assessment (25 Marks)

Cours	Course outcomes:						
CO1	Explain the structure and functionality of the operating system						
CO2	Apply appropriate CPU scheduling algorithms for the given problem.						
CO3	Analyze the various techniques for process synchronization and deadlock handling.						
CO4	Apply the various techniques for memory management						
CO5	Explain file and secondary storage management strategies.						

CO-PO Mapping														
		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	РО	PS	PS
0/10	101											12	01	O2
CO1	2	3	2	3	1							1	1	1
CO2	2	3	2	3	1							1	1	1
CO3	2	3	2	3	1							1	1	1
CO4	2	3	2	3	1							1	1	1
CO5	2	3	2	3	1							1	1	1

Course Title	Principles of Artificial Intelligence	Semester	ш
Course Code	AI206	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:0:2	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		

Course objective is to:

- Gain a historical perspective of AI and its foundations.
- Become familiar with basic principles of AI toward problem-solving
- Get to know approaches of inference, perception, knowledge representation, and learning

Madula 1	RBT	House
Module-1	LevelL1, L2	nouis:0
Introduction: What is AI? Foundations and History of AI Intelligent Agen	nts: Agents and	
Environment, Concept of Rationality, The nature of environment, The struct	ture of agents.	
Textbook 1: Chapter 1- 1.1, 1.2, 1.3 Chapter 2- 2.1, 2.2, 2.3, 2.4		
	RBT	
Module-2	LevelL1, L2	Hours:8
Problem-solving: Problem-solving agents, Example problems, Searching for	or Solutions	
Uninformed Search Strategies: Breadth First Search, Depth First Search, Ite	rative deepening	depth
first search.		
Textbook 1 : Chapter 3- 3.1, 3.2, 3.3, 3.4		
Madula 2	RBT	II.
Module-3	LevelL1, L2	Hours:8
Informed Search Strategies: Heuristic functions, Greedy best-first search,	A*search. Heuri	stic
Functions		
Logical Agents: Knowledge-based agents, The Wumpus world, Logic, Prop	positional logic,	
Propositional Theorem proving.		
Textbook 1 : Chapter 3-3.5,3.6, Chapter 7-7.1, 7.2, 7.3, 7.4, 7.5		
	RBT	
Module-4	LevelL1, L2,	Hours:8
	L3	
First Order Logic: Representation Revisited, Syntax and Semantics of Firs	t Order Logic, U	sing First
OrderLogic. Inference in First Order Logic: Propositional Versus First O	rder Inference, U	nification
and Lifting, Forward Chaining, Backward Chaining, Resolution.		
Text book 1: Chapter 8- 8.1, 8.2, 8.3 Chapter 9- 9.1, 9.2, 9.3, 9.4, 9.5.		
Madala 5	RBT Level	II
Module-5	L1,L2, L3	Hours:8
Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting	under Uncertaint	y, Basic
Probability Notation, Inference using Full Joint Distributions, Independence	, Bayes Rule and	l its use.
Wumpus World Revisited.		

Expert Systems: Representing and using domain knowledge, ES shells. Explanation, knowledge acquisition

Textbook 1: Chapter 13-13.1, 13.2, 13.3, 13.4, 13.5, 13.6 **Textbook 2**: Chapter 20- 20.1 to 20.4

Practice Experiments: *May cover all / major modules) NOTE: Programs need to be implemented in Python*

- 1. Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
- 2. Implement and Demonstrate the Best First Search Algorithm on Missionaries-Cannibals problems in Python
- 3. Implement A* Search algorithm
- 4. Solve 8-Queens Problem with suitable assumptions
- 5. Implementation of TSP using a heuristic approach
- 6. Implementation of the problem-solving strategies: either using Forward Chaining or Backward Chaining
- 7. Implement the resolution principle on FOPL-related problems
- 8. Implement the Tic-Tac-Toe game using Python.
- 9. Build a bot that provides all the information related to the text in the search box
- 10. Implement any Game and demonstrate the game-playing strategies

Suggested Learning Resources:

Textbooks:

1 Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson, 2015

2 Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2013

Reference Books:

- 1 George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
- 2 Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980

3 Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014

Web links and Video Lectures (e-Resources):

- 1. https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html
- 2. https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409
- 3. https://nptel.ac.in/courses/106/105/106105077/

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- 1. Group discussion on Real-world examples
- 2. Project-based learning
- 3. Simple strategies on gaming, reasoning and uncertainty, etc.

Cours	se outcomes:
COL	Apply knowledge of agent architecture, searching and reasoning techniques for different
COI	Applications
CO2	Compare various Searching and Inferencing Techniques.
CO3	Develop knowledge base sentences using propositional logic and first order logic
CO4	Describe the concepts of quantifying uncertainty.
CO5	Use the concepts of Expert Systems to build applications.

CO-PO	Mapp	ing												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	PS	PS
0/10	101											12	01	02
CO1	3	3	3	2	3							2	3	3
CO2	3	3	2	2	2							2	3	2
CO3	3	2	2	2	2							2	3	2
CO4	3	3	2	2	2							2	3	2
CO5	3	3	3	3	3	2			2	2	2	2	3	3

Course Title	Object Oriented Programming with C++	Semester	III
Course Code	AI221	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		·

Course objective is to:

- Understanding about object oriented programming and gain knowledge about the capability to store information together in an object.
- Understand the capability of a class to rely upon another class and functions.
- Understand about constructors which are special type of functions.
- Create and process data in files using file I/O functions.
- Use the generic programming features of C++ including Exception handling.

Madula 1	RBT Level	House 8
Wiodule-1	L1,L2,L3	110015. 0

Introduction to Object Oriented Programming: Computer programming background- C++ overview. First C++ Program -Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.

Textbook 1: Chapter 1(1.1 to 1.8)

Madula 2	RBT Level	Houma 9
Wiodule-2	L1,L2,L3	nouis: o

Functions in C++: Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.

Textbook 2: Chapter 3(3.2,3.3,3.4,3.13,3.14,3.19, 3.20), Chapter 4(4.3,4.4,4.5,4.6,4.7,4.9)

Modulo 3	RBT Level	Hours . 8
Module-5	L1,L2,L3	110015.0

Inheritance & Polymorphism: Derived class Constructors, destructors-Types of Inheritance Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.

Textbook 2: Chapter 6 (6.2,6.11) Chapter 8 (8.1 to,8.8)

|--|

	L1,L2,L3		
I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- B operations.	inary File Handli	ng during file	
Textbook 1: Chapter 12(12.5), Chapter 13 (13.6,13.7)			
Module-5	RBT Level L1,L2,L3	Hours:8	
Exception Handling: Introduction to Exception - Benefits of Exception handling- Try and catch block Throw statement- Pre-defined exceptions in C++			

Textbook 2: Chapter 13 (13.2 to13.6)

Suggested Learning Resources:				
Textbooks:				
1	Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.			
2	Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd , Fourth Edition 2010.			
Reference B	poks:			
1	Herbert Schildt: C++ The Complete Reference, 4th Edition, Tata McGraw Hill, 2014.			
2	Stanley B. Lippmann, JoseeLajore: C++Primer, 4th Edition, Addison Wesley. 3.			
3	Stephen Prata : C++ Primer Plus, 6th Edition, Pearson Education.			
Web links an	d Video Lectures (e-Resources):			
1. Basics of C	++ - https://www.youtube.com/watch?v=BClS40yzssA			
2. Functions of	of C++ - https://www.youtube.com/watch?v=p8ehAjZWjPw			
Tutorial Link: 1. <u>https://www</u> 2. <u>https://www</u>	www.www.www.www.www.www.www.www.www.ww			
Activity-Base	ed Learning (Suggested Activities in Class)/ Practical Based learning			

Assign small tasks to Develop and demonstrate using C++ $\ensuremath{\mathsf{Mini}}$ Projects

Course	e outcomes:
COL	Able to understand and design the solution to a problem using object-oriented programming
COI	concepts.
CO2	Implement classes and objects using functions.
CO3	Able to reuse the code with extensible Class types, User-defined operators and function
COS	Overloading.

CO4	Achieve code reusability and extensibility by means of Inheritance and Polymorphism
CO5	Implement the features of C++ including templates, exceptions and file handling for providing
	programmed solutions to complex problems.

CO-PO Mapping														
CO/	PO	PSO1	PSO2											
PO	1	2	3	4	5	6	7	8	9	10	11	12		
CO1	3	2	2	-	2	-	-	-	-	-	-	-	2	1
CO2	2	1	2	-	3	-	-	-	-	-	-	-	2	1
CO3	3	2	2	1	3	-	-	-	-	-	-	-	1	1
CO4	3	3	3	-	3	-	-	-	-	-	-	-	1	2
CO5	2	1	2	-	1	-	-	-	-	-	-	-	1	1

Course Title	Unix Shell Programming	Semester	III
Course Code	AI222	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML	•	

Course objective is to:

- To provide introduction to UNIX Operating System and its File System
- To gain an understanding of important aspects related to the SHELL and the process
- To develop the ability to formulate regular expressions and use them for pattern matching.
- To provide a comprehensive introduction to SHELL programming, services and utilities.

Module-1	RBT Level:L1,L2,L3	Hours: 8
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Introduction to unix-Brief History-What is Unix-Unix Components-Using Unix-Commands in Unix-Some Basic Commands-Command Substitution-Giving Multiple Commands **Text Book 2: Chapter 1**

Madula 2	RBT	II					
Ni odule - 2	Level:L1,L2,L3	Hours: 8					
The File system - The Basics of Files-What's in a File-Directories and File Names-							
Permissions INodes-The Directory Hierarchy, File Attributes and Permissions-The File Command							
knowing the File Type-The Chmod Command Changing File Permissio	ns-The Chown Co	mmand					
Changing the Owner of a File-The Chgrp Command Changing the Grou	up of a File						
Text Book 1: Chapter 2							
Text Book 2 :Chapter 3							
Modulo-3	RBT	Hourse					
Widdle-5	Level:L1,L2,L3	110015.0					
Using the Shell-Command Line Structure-Met characters-Creating	g New Command	ds-Command					
Arguments and Parameters-Program Output as Arguments-Shell Variab	lesMore on I/O	Redirection-					
Looping in Shell Programs.							
Text Book 1: Chapter 3							
Modulo 4	RBT	Hourse					
Wioddie-4	Level:L1,L2,L3	Houis:0					
Filters-The Grep Family-Other Filters-The Stream Editor Sed-The AWK Pattern Scanning and processing Language-Good Files and Good Filters.							

Text Book 2: Chapter 3 and Chapter 4.

Madula 5	RBT	Houns 18
Woulde-5	Level:L1,L2,L3	nouis:o

Shell Programming-Shell Variables-The Export Command-The Profile File a Script Run During Starting-The First Shell Script-The read Command-Positional parameters-The \$? Variable knowing the exit Status-More about the Set Command-The Exit Command-Branching Control Structures-Loop Control Structures-The Continue and Break Statement-The Expr Command:Performing Integer Arithmetic-Real Arithmetic in Shell Programs-The here Document

The Process-The Meaning-Parent and Child Processes-Types of Processes-More about Foreground and Background processes-Internal and External Commands-Process Creation-The Trap Command-The Stty Command-The Kill Command-Job Control.

Case study:

Application of Pandas in Salaries Exercise, Ecommerce Purchases Exercise, Numpy Exercise, Solving Linear System, Problem Set etc.

Text Book 2: Chapter 8 and Chapter 11

SuggestedLearningResources:Textbooks:

1	The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson. 2.
2	Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson.

Reference Books:

1

Unix and shell programmingby B.M. Harwani, OXFORD university press.

Web links and Video Lectures (e-Resources):

- https://www.geeksforgeeks.org/introduction-linux-shell-shell-scripting
- https://www.tutorialspoint.com/unix/shell_scripting.htm
- https://www.shellscript.sh/first.html

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

- Promote real-world problem-solving and competitive problem solving through group discussions to engage students actively in the learning process.
- Encourage students to enhance their problem-solving skills by implementing algorithms and solutions through programming exercises, fostering practical application of theoretical concepts.

Course	e outcomes:
CO1	Describe the architecture and features of UNIX Operating System and distinguish it from
COI	other Operating System
CO2	Demonstrate UNIX commands for file handling and process control
CO3	Write Regular expressions for pattern matching and apply them to various filters for a
005	specific task
CO4	Analyze a given problem and apply requisite facets of SHELL programming in order to
04	devise a SHELL script to solve the problem

CO-PO Mapping														
		PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS	PS
0/10	101												01	02
CO1	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO2	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO3	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO4	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO5	3	3	3	3	1	-	-	-	1	1	-	-	3	-

Course Title	Introduction to Data Science	Semester	III
Course Code	AI223	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML	•	•

Course objective is to:

CO 1. Demonstrate the proficiency with statistical analysis of data to derive insight from results and interpret the data findings visually.

CO 2. Obtaining the skills in data management by obtaining, cleaning and transforming the data.

CO 3. Make use of machine learning models to solve business-related challenges

CO 4. Experiment with decision trees, neural network layers and data partition.

CO 5. Demonstrate how social clustering shape individuals and groups in contemporary society.

Madula 1. Introduction	RBT	Level	Hours:
Module-1:Introduction	L1, L2		8
What is Date Crimerely Winneling Date materiality Day Charte Line		1 -	4. T

What is Data Science? Visualizing Data, matplotlib, Bar Charts, Line Charts, Scatterplots, Linear Algebra, Vectors, Matrices, Statistics, Describing a Single Set of Data, Correlation, Simpson's Paradox, Some Other Correlational Caveats, Correlation and Causation, Probability, Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem.

Text Book: Chapters 1, 3, 4, 5and 6

Statistical Hypothesis Testing. Example: Flipping a Coin, p-Values, Confidence Intervals, p-Hacking. Example: Running an A/B Test, Bayesian Inference, Gradient Descent, The Idea Behind Gradient Descent

Estimating the Gradient, Using the Gradient, Choosing the Right Step Size, Using Gradient Descent to Fit

Models, Minibatch and Stochastic Gradient Descent, Getting Data, stdin and stdout, Reading Files, Scraping the Web, Using APIs, Example: Using the Twitter APis, Working with Data, Exploring Your Data, Using Named Tuples, Dataclasses, Cleaning and Munging, Manipulating Data, Rescaling, An Aside: tqdm, Dimensionality Reduction. **Text Book : Chapters 7. 8. 9 and 10**

DDT Loval			
Module-3:Machine LearningKB1 Level L1,L2,L3Hours:8	Module-3:Machine Learning	RBT Level L1,L2,L3	Hours:8

Modeling, What Is Machine Learning?, Overfitting and Underfitting, Correctness, The Bias-Variance Tradeoff, Feature Extraction and Selection, k-Nearest Neighbors, The Model, Example: The Iris Dataset, The Curse of Dimensionality, Naive Bayes, A Really Dumb Spam Filter, A More Sophisticated Spam Filter, Implementation, Testing Our Model, Using Our Model, Simple Linear Regression, The Model, Using Gradient Descent, Maximum Likelihood Estimation, Multiple Regression, The Model, Further Assumptions of the Least Squares Model, Fitting the Model, Interpreting the Model, Goodness of Fit, Digression: The Bootstrap, Standard Errors of Regression Coefficients, Regularization, Logistic Regression, The Problem, The Logistic Function, Applying the Model, Goodness of Fit, Support Vector Machines.

Text Book : Chapters 11, 12, 13, 14, 15 and 16

Module-4:Decision Trees

RBT	Level	Hanner
L1,L2,I	L3	nouis:0

What Is a Decision Tree?, Entropy, The Entropy of a Partition, Creating a Decision Tree, Putting It All Together, Random Forests, Neural Networks, Perceptrons, Feed-Forward Neural Networks, Back propagation, Example: Fizz Buzz, Deep Learning, The Tensor, The Layer Abstraction, The Linear Layer, Neural Networks as a Sequence of Layers, Loss and Optimization, Example: XOR Revisited, Other Activation Functions, Example: Fizz Buzz Revisited, Softmaxes and Cross-Entropy, Dropout, **Example:** MNIST, Saving and Loading Models, Clustering, The Idea, The Model, Example: Meetups, Choosing k, Example: Clustering Colors, Bottom-Up Hierarchical Clustering **Text Book : Chapters 17, 18, 19 and 20**

Module-5:Natural Language Processing	RBT	Level	Hours:
Wiodule-5:Natural Language Processing	L1,L2,I	13	8

Word Clouds, n-Gram Language Models, Grammars, An Aside: Gibbs Sampling, Topic Modeling, Word Vectors, Recurrent Neural Networks, Example: Using a Character-Level RNN, Network Analysis, Betweenness Centrality, Eigenvector Centrality, Directed Graphs and PageRank, Recommender Systems, Manual Curation, Recommending What's Popular, User-Based Collaborative Filtering, Item-Based Collaborative Filtering, Matrix Factorization. **Text Book : Chapters 21, 22 and 23**

Suggested Learning Resources:

Textbooks:Text Books

1. Joel Grus, "Data Science from Scratch", 2nd edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-9352138326.

Reference Books

1. Emily Robinson and Jacqueline Nolis, "Build a Career in Data Science", 1st Edition, Manning Publications, 2020. ISBN: 978-1617296246.

2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978-1492032649.

3. François Chollet, "Deep Learning with Python", 1st Edition, Manning Publications, 2017. ISBN-13: 978-1617294433

4. Jeremy Howard and Sylvain Gugger, "Deep Learning for Coders with fastai and PyTorch", 1st Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2020. ISBN-13: 978-1492045526

Web links and Video Lectures (e-Resources):

- 1. Using Python : https://www.python.org
- 2. R Programming : https://www.r-project.org/
- 3. Python for Natural Language Processing : https://www.nltk.org/book/
- 4. Data set: https://bit.ly/2Lm75Ly
- 5. Data set: https://archive.ics.uci.edu/ml/datasets.html
- 6. Data set : www.kaggle.com/ruiromanini/mtcars
- 7. Pycharm : https://www.jetbrains.com/pycharm/
- 8. https://nptel.ac.in/courses/106/106/106106179/
- 9. https://nptel.ac.in/courses/106/106/106106212/
- 10. http://nlp-iiith.vlabs.ac.in/List%20of%20experiments.html

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Real world problem solving - Applying the machine learning techniques and developing models

Cours	e outcomes:
CO1	Identify and demonstrate data using visualization tools
CO^{2}	Make use of Statistical hypothesis tests to choose the properties of data, curate and manipulate
02	data.
CO3	Utilize the skills of machine learning algorithms and techniques and develop models.
CO4	Demonstrate the construction of decision tree and data partition using clustering.
CO5	Experiment with social network analysis and make use of natural language processing skills to
COS	develop data driven applications

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2		2			2						2
CO2			2		2							
CO3	2		2		2					2		
CO4			2									2
CO5			2									

Course Title	Biology for Engineers	Semester	III
Course Code	BG207	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/Week	2:0:0	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept.	Basic Sciences		

Course objective is to enable students:

- Acquire an understanding on basic modern biological concepts with an emphasis on how bioprocesses are analogous to engineering field, as a multidisciplinary field.
- Understand basic engineering principles imminently run physiological processes particularly about engineering designs and solutions that are arrived citing body functional examples.
- Explain aspects that many bio-solutions could be foundational to design, develop better processes, products and useful to achieve quality of life.

Module-1

RBT Level L1, L2 6 Hours

Biomimetics:

Biology for Engineers, Body Fluid: Blood – Mechanics of heart, Blood pressure, Life molecules: Water, Carbohydrates, Proteins, Lipids and Nucleic acids, Biomimetics: Bio-processes- engineering analogies.

Module-2	RBT Level L1, L2	6 Hours

Bioenergy:

Unit of life: Human and Plant cell, Metabolism: Enzymes as Bio-catalysts and physiological entities, Anabolism – Bioenergy from Sun-Photosynthesis, catabolism.

Module-3

RBT Level L1, L2	6 Hours

Biomechanics (Human body Movement Mechanics)

Normal Human Movement: Force-vector of body; Movement Angles; Muscle contraction-relaxation; Posture – Static & Dynamic; Ideal and abnormal posture, Practical: Stepping- Lifting- Sit-Stand.

Module-4	RBT Level L1, L2	6 Hours
	L	h

Bioelectronics

Brain & Computer: Senso-neural networks, Biosensors and IoT as applied to biology, Bionic Eye: Mechanism of Vision, Electronic Nose: Bio-olfactory mechanisms (Science of smell), Impulses: Cardiac and Nerve, Biological Clock and Circadian rhythm/

Module-5

RBT Level L1, L2,L36 Hours

Biopharma:

Metabolic syndromes, Cancer and its diagnostics, Lab on a chip, Drug Discovery

Suggested Learning Resources:

Textbooks:

1	Campbell, N.A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S.A.; Minorsky, P.V							
1	Jackson, R. B. Pearson. "Biology: A global approach", , Global Edition, 10/E, 2014							
r	David Nelson, Michael Cox. "Lehniger Principles of Biochemistry". W H Freeman &							
Ζ.	Company, Seventh Edition, 2017.							
Reference B	ooks:							
1	Janine M Benvus. "Biomimicry: Innovation inspired by Nature". William Morrow							
Paperbacks, 2002.								
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning								
Real world problem solving and puzzles using group discussion.								
Demo	nstration of solution to a problem though experiential learning.							
Б								

Demonstration using real objects taking students on educational tour.

Course	Course outcomes:							
At the	At the completion of the course. The student shall be able to							
	Apply and utilize essential knowledge of the biological mechanisms of living organisms from							
CO1	the perspective of engineers and find solutions to solve bio-engineering problems with							
	appropriate tools.							
	Distinguish and make use of optimal designs in engineering that are bio-mechanical in nature							
CO2	and build and use by observing and understanding bio-physiological processes involved in							
	sensing, locomotion, and knowledge application of range of bio-chemicals.							
CO2	Demonstrate that bio-chemical, bio-sensory, bioprocesses could be path-finders to optimise							
COS	similarities for functional aspects of electronic, computer, mechanical, electrical machines.							

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1				1					1
CO2	3	1	1				1					1
CO3	3	1	1				1					1

Course Title	NSS – Phase 1	Semester	III
Course Code	NS208	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/week	0:2:0	Total	50
Credits		Exam. Duration	
Teaching Dept	Any Department		

Course objective is to: National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work

2. Identify the needs and problems of the community and involve them in problem-solving

3.Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems

4.Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

5.Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

Module:1	RBT Level/s	4 Hours
	:L1, L2	inouis

Youth population in India and its characteristics:

Introduction to India: Physical, Socio-Economic and Demographic Background, Study on Indian Population Composition (Age composition), Youth composition, Youth policy, Importance of Youth Policy, Youth population in India, NSS as a Youth Organization.

Module:2	RBT Level/s :L1, L2	3 Hours
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Fundamentals of NSS:

Introduction to NSS, Origin of NSS, Aims and Objectives of NSS, NSS Motto, NSS Emblem, NSS Badge, NSS Day.

Module:3	RBT Level/s	3 Hours
	:L1, L2	

NSS Songs:

NSS Anthem (Hindi & Kannada), National Integration song, Rastriya sevayojane Madiharu. Uteh samajkeliye Uteh Uteh. Navellaru Ondagi Balona Banni. Hum Sab Mil ka rDeshka Apani.

Module:4	RBT Level/s	15 Hours
	:L1, L2	
Activity Based Programmes:

A. Campus Activities:

Shramadhan – Plantation, Cleaning, Watering, Weeding, Any other activities.

Awareness Programmes – Seminar, Workshops, celebration of National and International days, Personality Development Programmes, Group Activities, etc

B : Off Campus Activities:

Rally, Jatha, Visit to Adopted villages, Swatchatha Programme, Visit and Conserving Ancient monuments and heritage site, Socio Economic Survey of village/slum, Nature Camp, Environmental Education

Course outcomes: At the completion of the course. The student shall be able to							
CO1	Describe the concept of Youth and compare the international definitions of the term Youth.						
CO2	Students will be able to appreciate our demographic advantage and its role in nation building.						
CO3	Know the growth and evolution of NSS and its role in Nation building through community service						
CO4	Visualize the signs, symbols, logo of NSS and understand their broader meaning.						

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1	1					1
CO2						1	1					1
CO3						1	1					1
CO4						1	1					1

	Γ	1	
Course Title	Physical Education (PE) (Sports and Athletics) – Phase 1	Semester	Ш
Course Code	PE208	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/Week	0:2:0	Total	50
Credits		Exam. Duration	
Teaching Dept	Sports		

Course objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects.

Module – 1	RBT Level/s :L1, L2	5 Hours
Orientation:		

Introduction of Physical Education and sports, Importance of Physical fitness and healthy life style

- A. Lifestyle
- B. Fitness
- C. Food & Nutrition
- D. Health & Wellness
- E. Pre-Fitness test

Module – 2	RBT Level/s :L1, L2	15 Hours
General Fitness & Components of Fitness:	· · · · ·	
A. Warming up (Free Hand exercises)		
B. Strength – Push-up / Pull-ups		
C. Speed – 30 Mtr Dash		
D. Agility – Shuttle Run		
E. Flexibility – Sit and Reach		
F. Cardiovascular Endurance – Harvard step Test.		
Module - 3	RBT Level/s :L1, L2	5 Hours
Recreational Activities:		
A. Postural deformities.		
B. Stress management.		
C. Aerobics.		
D. Traditional Games.		

Course	Course outcomes:							
At the completion of the course. The student shall be able to								
	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition							
CO1	and Fitness							
CO2	Familiarization of health-related Exercises, Sports for overall growth and development							
CO3	Create a foundation for the professionals in Physical Education and Sports							
CO4	Participate in the competition at regional/state / national / international levels							
	Create consciousness among the students on Health, Fitness and Wellness in developing							
CO5	and maintaining a healthy lifestyle.							

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1
CO4			1			1	1					1
CO5			1			1	1					1

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Course Title	Yoga for a Better Life - Phase 1	Semester	III
Course Code	YG208	CIE	50
Total No. of Contact Hours	25	SEE	0
No. of Contact Hours/week	0:2:0	Total	50
Credits		Exam. Duration	
Teaching Dept	Yoga	•	

Course objectives:

1) To enable the student to have good health.

2) To practice mental hygiene.

3) To possess emotional stability.

4) To integrate moral values.

5) To attain higher level of consciousness.

Semester III	RBT Level/s :L1, L2	25 Hours

Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, importance of prayer Yogic practices for common man to promote positive health Rules to be followed during yogic practices by practitioner Yoga its misconceptions, Difference between yogic and non yogic practices.

Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds.

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting

- 1. Padmasana
- 2. Vajrasana

b. Standing

- 1. Vrikshana
- 2. Trikonasana

c. Prone line

- 1. Bhujangasana
- 2. Shalabhasana

d. Supine line

- 1. Utthitadvipadasana
- 2. Ardhahalasana

Suggested Learning Resources:

Textbooks:

- 1. Yogapravesha in Kannada by Ajitkumar
- 2. Light on Yoga by BKS Iyengar
- 3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
- 4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
- 5. Yoga for Children -step by step by Yamini Muthanna

Web links and Video Lectures (e-Resources): Refer links

- <u>https://youtu.be/KB-TYlgd1wE</u>
- <u>https://youtu.be/aa-TG0Wg1Ls</u>

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

• Physical

- 1. Improved body flexibility and balance
- 2. Improved cardiovascular endurance (stronger heart)
- 3. Improved digestion
- 4. Improved abdominal strength
- 5. Enhanced overall muscular strength
- 6. Relaxation of muscular strains
- 7. Weight control
- 8. Increased energy levels
- 9. Enhanced immune system

• Mental

- 1. Relief of stress resulting from the control of emotions
- 2. Prevention and relief from stress-related disorders
- 3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
 - 1. Life with meaning, purpose, and direction
 - 2. Inner peace and tranquility
 - 3. Contentment

Course outcomes: At the completion of the course. The student shall be able to						
CO1	Understand the meaning, aim and objectives of Yoga.					
CO2	Perform Suryanamaskar and able to Teach its benefits.					
CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods and benefits.					
CO4	Instruct Kapalabhati and its need and importance.					
CO5	Coach different types of Kriyas, method to follow and usefulness.					

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1
CO4			1			1	1					1
CO5			1			1	1					1

	Additional					
Course Title	Mathematics	Somostor	ш			
Course The	(Common for all	Semester	111			
	branches)					
Course Code	DM209	CIE	50			
Total No. of Contact Hours	30	SEE	50			
No. of Contact Hours/week	2:0:0	Total	100			
Credits	0	Exam. Duration	3 Hours			
Teaching Dept	Mathematics					

- Develop the knowledge of numerical methods and apply them to solve transcendental and differential equations.
- Study the fundamental concepts of vector calculus viz. Gradient, curl and divergence
- Familiarize the importance of Integral calculus and Linear Algebra.

Module-1	Numerical Analysis	RBT Levels L1, L2,L3	6 Hours

Solution of algebraic and transcendental equations –Newton-Raphson methods. Finite differences, Interpolation and extrapolation using Newton's forward and backward difference formulae, Newton's divided difference Numerical integration: Trapezoidal rule, Simpson's (1/3)rd and (3/8)th rules, Weddle's rule.

Numerical Solution of Ordinary Differential Equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order

Module-2	Ordinary Differential	Equations	RBT Levels L1, L2,L3	6 Hours
Introduction to first-ord	ler ordinary differential equa	tions pertaining to t	he applications for	or Computer
Science & Engineering	. Linear and Bernoulli's dif	ferential equations. I	Exact and reduci	ble to exact
differential equations - Integrating factors on $\frac{1}{N} \left(\frac{\partial M}{\partial y} - \frac{\partial N}{\partial x} \right) an \frac{1}{M} \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y} \right)$.				
Higher -order linear of	ordinary differential equations	with constant coe	efficients - Invers	se differential
operator,				
Modulo 2	Integral Calculus		RBT Levels	6 Hours
Wroutle-5	integral Calculus		L1, L2,L3	0 110015
Multiple Integrals: Eval	luation of double and triple	integrals, evaluation	of double integral	ls by change
of order of integration				

Module-4	Vector Calculus RBT I L1, L2		6 Hours
Scalar and vector fields. Gradient, solenoidal and irrational vecto	directional derivative, curl and diverger fields.	nce - physical in	terpretation,
Module-5	Linear Algebra	RBT Levels L1, L2,L3	6 Hours

Row reduction and echelon forms- Consistency of System of Equations. Solution sets of linear equations by Gauss Seidel, Gauss Jordan, Eigenvalues and eigenvectors Rayleigh's power method.

Suggested Learning Resources:				
Textbooks:				
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.			
2.	Erwin Kreyszig - Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015			
3	David C Lay: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018			
Reference B	ooks:			
1.	Srimanta Pal & Subodh C Bhunia - Engineering Mathematics, Oxford University Press, 3rd Reprint, 2016.			
2.	James Stewart: "Calculus" Cengage Publications, 7thEd., 2019.			
3.	Gilbert Strang, Linear Algebra and its Applications, 5th Edition (2016).			
4.	N.P Bali and Manish Goyal: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022. 4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics"			
Web links ar	nd Video Lectures (e-Resources):			
https://youtu.b	pe/Y7VWyyZ6B0g?si=rhxgG4vvrs3VS7mw			
https://youtu.be/zT83sJ5IrEE?si=Crb9_cIWw4tTJxmj				
https://youtu.be/9_m36W3cK74?si=h-bd19yVCgLF3VvW				
https://youtu.be/2DX8Vp1Q2-0?si=rQ76vQyXPATricZz				
https://youtu.be/AuUi_bUeTS4				
Activity-Base	ed Learning (Suggested Activities in Class)/ Practical Based learning:			
C				

Course Seminars, Quiz, In class assignments.

Course	Course outcomes: At the end of the course students will be able to			
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations.			
CO2	Apply numerical methods to find the solution of ordinary differential equations.			
CO3	$\label{eq:product} Apply the \ concept \ of \ change \ of \ order \ of \ integration \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ and \ variables \ to \ evaluate \ multiple \ integrals \ and \ variables \ and \ variables \ and \ variables \ and \ variables \ and $			
	their usage in computing area and volume.			
CO4	Use fundamentals of vectors to find gradient, curl and divergence.			
CO5	Test the consistency and solve the system of liner equations .			

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2		2								2
CO2	3	2		2								2
CO3	3	2		2								2
CO4	3	2		2								2
CO5	3	2		2								2

	Applied Mathematics-		
	IV for Computer		
Course Title	Science and	Comoston	IV/
Course The	Engineering Stream	Semester	1 V
	(AIML, ISE, CSE,		
	CSE-IOT)		
Course Code	MC251	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:2:0	Total	100
Crodita	2	Exam.	2 Hours
	5	Duration	5 110015
Teaching Dept	Mathematic s		

Course objective is to understand:

- The concepts of functions and groups
- The basic concepts of graphs and their properties, and operations of graphs
- Hamiltonian and Euler graphs, trees and matrix representation of the graph.

RBT RBT	Levels 8 Hours

Relations and Functions:

Cartesian Products and Relations, Properties of Relations, Functions – Plain and One-to-One, Onto Functions. Function Composition, and Inverse Functions., Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions.

Module-2	RBT Levels	8 Hours
	L1,L2,L3	
Group Theory:		
Klein 4-group, Additive group of Integers modulo n, Multiplicative grou	p of Integers m	nodulo-p and
permutation groups, Properties of groups, Subgroups, cyclic groups, Cose	ts, Lagrange's T	heorem.
Modulo 3	RBT Levels	8 Hours
Woulde-5	L1,L2,L3	8 110015
Graph Theory :		
Directed graphs, Definition -Application of graphs - finite, infinite and bipartite graphs - Incident and		
Degree – Isolated vertex, Pendant vertex and Null graph.		
Paths and circuits- Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected		
graphs and components.		

Madula 4	RBT Levels 8 Hour	8 Hours
Module-4	L1,L2,L3	o 110uis

Hamilton Cycle and Euler's circuit :

Eulerian and Hamiltonian Graphs-Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem.

Digraphs -Types of graphs and binary relation.

Module-5	RBT Levels L1,L2,L3	8 Hours
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Trees:

Rooted Trees, Binary trees, counting Trees and Spanning trees. Pendant vertices in a tree.

Connectivity Graphs: Vertex connectivity, Edge connectivity, cut set and cut vertices, Fundamental circuits.

Suggested I	Suggested Learning Resources:			
Textbooks:				
1	Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016.			
2	J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1st edition, 2008.			
3	Ralph P. Grimaldi-Discrete and Combinatorial Mathematics, Addision WesleyPublishing company, 2006.			
Reference B	ooks:			
1	R. Diestel, Graph Theory, free online edition, 2016: diestel-graph-theory.com/basic.html.			
2	Kenneth H. Rosen and Kamala Krithivasn-Discrete Mathematics and Its Applications, Mcgraw Hill publication, 2021.			
3	Robin J. Wilson, Introduction to Graph Theory, Longman Group Ltd., 2010			
Web links ar	d Video Lectures (e-Resources):			
M1: https://yo	utu.be/-peAUmrm4RM			
M2: https://yo	utu.be/utBfKsYUwe8			
M3: https://yo	utu.be/tORLeHHtazM			
M4: https://yo	utu.be/V8F8Wenuo?list=PLhSp9OSVmeyLB62fT9VNbjRkDEzJzzp			
M5: https://yo	utu.be/qNqrHO3woyE			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
Quiz, Group	Discussions, Seminar, In class assignments			

Course outcomes: At the end of the course students will be able to					
CO1	Apply the basic concepts of relations, functions and partially ordered sets for computer				
COI	representations				
COD	Illustrate the fundamental principles of Algebraic structures with the problems related to				
02	computer science & engineering.				
CO3	Apply concepts of trees and graph connectivity to solve real world problems.				
CO4	Solve the problems involving characterization and operations on graphs.				
CO5	Apply concepts of trees and graph connectivity to solve real world problems.				

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2		2								2
CO2	2	2		2								2
CO3	2	2		2								2
CO4	2	2		2								2
CO5	2	2		2								2

Course Title	Analysis & Design of Algorithms	Semester	IV
Course Code	AI252	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		•

- To learn the methods for analyzing algorithms and evaluating their performance.
- To demonstrate the efficiency of algorithms using asymptotic notations.
- Prepare students to solve problems using various algorithm design methods
- To learn the concepts of P and NP complexity classes.

Module-1				RBT Level:L1,L2,L3	Hours: 8
Introduction:	What is an Algorithm?	Fundamentals	of algorithmic p	roblem solving	

Introduction: What is an Algorithm? Fundamentals of algorithmic problem solving.

Performance Analysis Framework: Space complexity, Time complexity. Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation. Mathematical Analysis of Non recursive algorithms and recursive algorithms.

BRUTE FORCE APPROACHES: Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

Text book1:Chapter1(Sections 1.1,1.2),Chapter2(Sections 2.2,2.3,2.4), Chapter 3(Section3.1,3.2) Text book2:Chapter1(1.3:1.3.1-1.3.2)

DECREASE-AND-CONQUER: Insertion Sort, Topological Sorting.

Divide and Conquer: General method, Recurrence equation for divide and conquer, Finding the maximum and minimum. Merge sort, Quick sort and Stassen's Matrix Multiplication.

Text book1: Chapter 4 (Sections 4.1,4.2,4.5), Chapter 5 (Section 5.1,5.3)

Text book2:Chapter3(3.3)

Greedy Method: General method, Knapsack Problem, Job sequencing with deadlines, Minimum cost spanning trees: Prim's Algorithm and Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Optimal Tree problem: Huffman Trees and Codes.

Transform-and-Conquer: Heaps and Heap sort.

SPACE-TIME TRADEOFFS: Sorting by Counting: Comparison counting sort and distribution counting.

Text book1: Chapter 9 (Sections 9.1, 9.2, 9.3, 9.4), Chapter 6 (Section 6.4). Text book2: Chapter4 (4.1, 4.2, 4.4).

Module-4			Hours:8
DYNAMIC	PROGRAMMING. Transitive Closure Warshall's	Algorithm All Pa	irs Shortest
Paths: Floyd'	s Algorithm, Multistage Graphs, Travelling Sales Person p	roblem, Knapsack	problem and
Memory.			•
Backtracking	g: General method, N-Queens problem and Sum of subset	s problem.	
Text book1: Text book2:(Chapter 8(Sections 8.1,8.4), Chapter 11(Sections 11.1) Thanter5(5.2.5.9)		
ICAT DOOR2.	napter 5(5.2,5.7)	RBT	
Module-5		Level:L1,L2,L3	Hours:8
LIMITATIO Problems. Br problem. Case Studies application of management,	NS OF ALGORITHMIC POWER: Decision Trees anch-and-Bound: Assignment Problem, Knapsack proble : Data structure and Application play a vital role in mana various techniques in Healthcare, Agriculture, Biotechno and Education.	s, P, NP, and l em and Travelling ging records and a blogy, IT enable ser	NP-Complete Sales Person nalysis of the rvices, Waste
Text book1:	Chapter 10 (Section 10.2,10.3)Chapter 11 (Section 11.	2)	
Cuero c41	Looming Description		
Suggested	Learning Resources:		
Textbooks:			
1	Introduction to the Design and Analysis of Algorithms,	By Anany Levitin,	3rd Edition
1	(Indian), 2017, Pearson.		
2	Computer Algorithms/C++, Ellis Horowitz, Satraj Sahni	and Rajasekaran,	2nd Edition,
Rafaranca B	2014, Universities Press		
KULUIKU D	Introduction to Algorithms, Thomas H. Cormen, Charles	E Leiserson Ron	al L. Rivest
1	Clifford Stein, 3rd Edition, PHI.		
	Data Structures and Algorithms Made Easy - Data S	tructures & Algorit	nmic Puzzles
2	Author: Narasimha Karumanchi (M.Tech IIT Bombay,	Founder- CareerN	Ionk.com) 5
	th Edition		
3	Algorithms - Sanjoy Dasgupta, Christos H. Papadim	triou, and Umesh	V. Vazirani
4	Design and Analysis of Algorithms S Sridhar Oxford	(Higher Education)	
Web links a	nd Video Lectures (e-Resources):		
• Desig	m and Analysis of Algorithms: https://nptel.ac.in/cours	es/106/101/106101	060/
https:	//eu.udacity.com/course/intro-to-algorithmscs215.		
• Desig	n and Analysis of Algorithms course by Madhavan Muku	Ind	
Activity-Bas	ed Learning (Suggested Activities in Class)/Practical-I	Based learning	
• Prom	ote real-world problem-solving and competitive problem	solving through gro	oup
discus	sions to engage students actively in the learning process.		-
• Encou and se	rage students to enhance their problem-solving skills by plutions through programming exercises, fostering practic	implementing algoral application of th	rithms eoretical
conce	pts.		I

Course	e outcomes:
CO1	Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.
CO2	Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.
CO3	Make use of transform & conquer and greedy design approaches to solve the given real world or complex computational problems.
CO4	Apply dynamic programming and demonstrate backtracking and branch & bound methods to solve graph based computational problems.
CO5	Analyse various classes (P,NP and NP Complete) of problems and apply appropriate algorithm
005	design strategies to a given case study/use case

CO-PO	CO-PO Mapping													
	DO	PO2	PO	PO	PO	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO/PO	1		3	4	5					0	1	2	1	2
	1													
CO1	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO2	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO3	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO4	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO5	3	3	3	3	1	-	-	-	1	1	-	-	3	-

Analysis and Design of Algorithms Lab						
Course Code	AI253	CIE Marks	50			
L:T:P:S	0:0:2:0	SEE Marks	50			
Hrs./ Week	2	Total Marks	100			
Credits	1	Exam Hours	03			

Course objecti	ves: At the end of the course, the student will be able to:
CO1	To design and implement various algorithms in C/C++ programming using suitable development tools to address different computational challenges.
CO2	To apply diverse design strategies for effective problem-solving.
CO3	To Measure and compare the performance of different algorithms to determine their efficiency and suitability for specific tasks

Pgm.No.	List of Experiments/Programs	Hours	COs
	Prerequisite Experiments/Programs/Demo		
	Proficiency in C, C++, Data Structures, Problem-solving Design strategies.	2	C01
1	Design and implement C/C++ Program to sort a given set of r integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	2	CO1 CO2 CO3
2	Design and implement C/C++ Program to sort a given set of r integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus n. The elements can be read from a file or can be generated using the random number generator.	2	CO1 CO2 CO3
3	Design and implement $C/C++$ Program to obtain the Topological ordering of vertices in a given digraph.	2	CO1 CO2
4	 a. Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b. Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm. 	2	CO1 CO2
5	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm	2	CO1 CO2
6	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.	2	CO1 CO2
7	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm.	2	CO1 CO2
8	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.	2	CO1 CO2
9	Design and implement C/C++ Program for N Queen's problem	2	CO1 CO2

	using Backtracking.								
10	Design and implement C/C++ Program to find a subset of a given	2	CO1						
	set $S = \{sl, s2,,sn\}$ of n positive integers whose sum is equal	1	CO2						
	to a given positive integer d.								
	PART-B								
	Beyond Syllabus Virtual Lab Content								
1. Sc	olve the Travelling Sales Person problem using a dynamic programm	ing app	oroach.						
2. Pe	2. Perform insert and delete operations in Binary Search Tree.								
3. De	esion and implement Ford Fulkerson Algorithm in C								

Suggested L Textbooks/ 1	earning Resources: Reference Books:									
1	Computer Algorithms, by Horowitz E., Sahani S., Rajasekharan S., Galgotia									
1	2001.									
2	Introduction to Algorithms, Cormen T.H, Leiserson C. E, Rivest R.L, Stein C, 3rd Edition, PHI 2010									
	Data Structures and Algorithm Analysis in $C_{\pm\pm}$ by Mark Allen Weiss Pearson									
3	Education, 4th edition, 2012.									
	Data Structures - Seymour Lipschutz, Schaum's Outlines, Revised 1st edition,									
4	McGraw									
	Hill, 2014.									
Web links ar	d Video Lectures (e-Resources):									
1. <u>http://c</u>	ese01-iiith.vlabs.ac.in/									
2. https://	/visualgo.net/en.									
3. https://	ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j- design-and-									
analys	analysis-of-algorithms-spring-2015/.									
Activity-Base	ed Learning (Suggested Activities in Class)/ Practical Based learning									
Progra	umming Assignment									

- •
- Gate-Based Aptitude Test MOOC Assignment for Selected Module •

Course	e outcomes:
CO1	Acquire the knowledge on fundamentals of algorithmic design steps, analyse concepts and
COI	types of algorithm design techniques.
	Understand and analyze the design of algorithms using Brute force, Divide and Conquer,
CO2	Decrease and Conquer, Transform & conquer, Dynamic Programming, Greedy technique,
	Backtracking, Branch and Bound techniques
CO3	Assess the performance and correctness of algorithms.
CO4	Design solutions for various engineering applications using appropriate algorithms.

CO-PO	CO-PO Mapping													
	DO	PO2	PO	PO	PO	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO/PO	1		3	4	5					0	1	2	1	2
CO1	2	2	2	1	1	-	-	-	-	-		1		
CO2	2	1	2	2	1	-	-	-	-	-	-	1		
CO3	2	2	2	2	1	-	-	-	-	-	-	1		
CO4	2	2	2	1	1	-	-	-	-	-	-	1		

Course Title	Database Management System	Semester	IV
Course Code	AI254	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML	•	

- To Provide a strong foundation in database concepts, technology, and practice.
- To Practice SQL programming through a variety of database problems
- To Understand the relational database design principles.
- To Demonstrate the use of concurrency and transactions in database.
- To Design and build database applications for real world problems.
- To Understand basic Mongo DB functions

Module-1		RBT Level	Hours.							
WIGUUE-1									L1, L2, L3	Houis:0
		_	-	_			 -			

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications.

Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment.

Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets and structural constraints, Weak entity types, ER diagrams, Specialization and Generalization.

Textbook 1:Ch 1.1 to 1.8, 2.1 to 2.6, 3.1 to 3.10 RBT: L1, L2, L3

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations.

Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra.

Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping.

Textbook 1: Ch 5.1 to 5.3, Ch 8.1 to 8.5; Ch 9.1 to 9.2 Textbook 2: 3.5 RBT: L1, L2, L3

Madula 2	RBT Level	Hourse
Module-5	L1, L2, L3	nouis:0

SQL: SQL data definition and data types, Schema change statements in SQL, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL. Advanced Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL

Textbook 1: Ch 6: 6.1 to 6.5 Ch 7: 7.1 to 7.3 RBT: L1, L2, L3

Module-4

RBT Level L1, L2, L3 Hours:8

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL.

Textbook 1: Ch 14.1 to 14.7, Ch 20.1 to 20.6 RBT: L1, L2, L3

Module-5								Level	Hours
Module-5							L1, I	.2, L3	110015.0
C	Contral	•	Detaleses	T	11-1	4 1	f	0	

Concurrency Control in Databases: Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.

Database for Modern Web: Built for the internet, Mongo DB key features, Mongo DB core server and tools, History of Mongo DB, Diving into the Mongo DB shell, Creating and querying with indexes, Basic administration, Case Study.

Textbook 1:Chapter 21.1 to 21.5 Textbook 2: Chapter1: 1.1, 1.2, 1.3, 1.6 Chapter2: 2.1, 2.2, 2.3 RBT: L1, L2, L3

<u>a</u> , 11									
Suggested L	earning Kesources:								
Textbooks:									
1	Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th								
1	Edition, 2017, Pearson.								
2	MongoDB in Action by KYLE BANKER et. al. 2nd ed, Manning publication, 2016								
Reference Books:									
1	Johannes Gehrke, Raghu Ramakrishnan, Database Management Systems 3rd Edition,								
1	McGraw Hill Education, 2014								
Web links an	d Video Lectures (e-Resources):								
 https://online 	• https://onlinecourses.nptel.ac.in/noc22_ge24/preview								
•https://biodes	•https://biodesign.berkeley.edu/bioinspired-design-course/								
• https://www.	volutube $com/watch^{2}v - cwy XV00e8ss$								

https://www.youtube.com/watch?v=cwxXY9Qe8ss

https://www.youtube.com/watch?v=V2GvQXvjhLA

•https://nsf-gov-resources.nsf.gov/2023-

03/Bioinspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning) Mini Project:

• Project Based Learning

Course	outcomes:
CO1	Describe the basic elements of a relational database management system
CO2	Design entity relationship for the given scenario.
CO3	Apply various Structured Query Language (SQL) statements for database manipulation.
CO4	Analyse various normalization forms for the given application and Make use of MangoDB concept commands, and queries
	concept continuities and queries.

CO-PO Mapping

CO/PO	DO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS
00/10	FOI													O2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3		3	-	-	-	-	-	-	3	3	2

Database Management System Lab						
Course Code	AI255	CIE Marks	50			
L:T:P:S	0:0:2:0	SEE Marks	50			
Hrs./ Week	2	Total Marks	100			
Credits	1	Exam Hours	03			

Course objectives :At the end of the course, he student will be able to:

1	To Provide a strong foundation in database concepts, technology, and practice.
2	To Practice SQL programming through a variety of database problems
3	To Understand the relational database design principles.
4	To Design and build database applications for real world problems and Apply the aggregation and Map Reduction in MongoDB.

Pgm.No.	List of Experiments/Programs	Hours	Cos				
Prerequisite Experiments/Programs/Demo							
	PART-A						
1	 Create a table called Employee & execute the following. Employee(EMPNO,ENAME,JOB, MANAGER_NO, SAL, COMMISSION) 1. Create a user and grant all permissions to the user. 2. Insert the any three records in the employee table contains attributes EMPNO, ENAME JOB, MANAGER_NO, SAL, COMMISSION and use rollback. Check the result. 3. Add primary key constraint and not null constraint to the employee table. 	2	CO1,CO2				
	4. Insert null values to the employee table and verify the result.						
2	 Create a table called Employee that contain attributes EMPNO,ENAME, JOB, MGR,SAL & execute the following. 1. Add a column commission with domain to the Employee table. 2. 2. Insert any five records into the table. 3. Update the column details of job 4. Rename the column of Employ table using alter command. 5. Delete the employee whose Emp no is 105. 	2	CO1,CO2				
3	 Queries using aggregate functions (COUNT,AVG,MIN,MAX,SUM),Group by, Order by. Employee(E_ id, E_ name, Age, Salary) 1. Create Employee table containing all Records E_ id, E_ name, Age, Salary. 2. Count number of employee names from employee table 3. Find the Maximum age from employee table. 4. Find the Minimum age from employee table. 5. Find salaries of employee in Ascending Order. 6. Find grouped salaries of employees. 	2	CO3,CO4				
4	Create a row level trigger for the customers table that would fire	2	CO3,CO4				

	-		
	for INSERT or UPDATE or DELETE operations performed on		
	the CUSTOMERS table. This trigger will display the salary		
	difference between the old & new Salary.		
	CUSTOMERS(ID,NAME,AGE,ADDRESS,SALARY)		
5	Execute Aggregation operations \$avg, \$min,\$max, \$push,	2	CO4
	\$addToSet students encourage to execute several queries to		
	demonstrate various aggregation operators)(Use Mongo DB		
	commands)		
Activity Base	ed Learning (Suggested Activities in Class)/ Practical Based		
learning			
Mini Project	t:		
• Project Ba	sed Learning		

Cours	se outcomes:
At the	e end of the course, the student will be able to:
C01	Describe the basic elements of a relational database management system
CO2	Design entity relationship for the given scenario.
CO3	Apply various Structured Query Language (SQL) statements for database manipulation.
CO4	Analyse various normalization forms for the given application and Make use of Mango DB commands and queries.

CO-PO Mapping														
	DO	PO2	РО	PO	PO	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO/PO	1 1		3	4	5					0	1	2	1	2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	3		3	-	-	-	-	-	-	3	3	2

Course Title	Java Programming	Semester	IV
Course Code	AI256	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	2:0:2	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		·

- To understand Object Oriented Programming Features of JAVA.
- To learn the concept classes and their interrelationships and how to explode them application development.
- To develop programs which enable concurrent and parallel processing.
- To understand and implement error processing in java.
- To learn how to develop a java application using a standard framework.

Module-1	RBT Level:L1,L2,L3	Hours: 8
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Object oriented Programming: Need for OOP paradigm, summary of OOP concepts. Java Basics: Java buzzwords, data types, variables, scope and lifetime of variables, arrays, expressions, control statements (for each), type conversion and casting, simple java program. **Text Book:1, Chapters 2,3**

Madula 2	RBT	House 8
Wroddie-2	Level:L1,L2,L3	nouis: o

Introducing Classes: Concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, Methods: overloading methods and constructors, method binding, overriding and exceptions, parameter passing, recursion, nested and inner classes. **Text book: 1, Chapters 6,7**

Madula 3	RBT	Hourse
Woddle-5	Level:L1,L2,L3	nouis:o
Inheritance: Inheritance Basics, Using super, Creating a Multilevel Hier	rarchy, When Cons	structors Are
Executed, Method Overriding, Dynamic Method Dispatch, Using Aba	stract Classes, Usi	ng final with
Inheritance, Local Variable Type Inference and Inheritance. Interface	es: Interfaces, Defa	ult Interface
Methods, Use static Methods in an Interface, Private Interface Methods	•	
Text book:1, Chapter 8, 9.4-9.6		

	RBT	TT
Module-4	Level:L1,L2,L3	Hours:8

Exception handling: Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Multithreading: Thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication. Enumerations, autoboxing. **Text book: 1, Chapter 10, 11.1, 11.7-11.8,12.1, 12.3**

	DDT	l
Module-5		Hours:8
Introducing Swing: The Origins of Swing, Swing Is Built on the AWT, MVC Connection, Components and Containers, The Swing Packages Exploring Swing: JLabel and ImageIcon, JTextField, The Swing Butte JList, JComboBox, Trees, JTable. Case Studies: Hangman Game, Tic Tac Toe Game. Summarization Text book: 1. Chapter 31, 32	Two Key Swing F s, A Simple Swing ons, JTabbedPane, of all modules.	Features, The Application. JScrollPane,
Practice Component of IPCC		
Programming Experiments(Suggested and are not limited to)		
Program 1:		
Aim: Introduce the java fundamentals, data types, operators in java		
Program: Write a java program that prints all real solutions to the c Read in a, b, c and use the quadratic formula.	quadratic equation a	ax2+bx+c=0.
Program 2:		
Aim: Demonstrating creation of java classes, objects, constructors,	declaration and in	nitialization of
variables.		
Program : Create a Java class called Student with the following details USN Name Branch Phone Write a Java program to create n Student objects and print the USN, Na objects with suitable headings.	as variables within and Plane, Branch, and Pl	it. hone of these
Program 3:		
Aim: Discuss the various Decision-making statements, loop constructs	in java	
Program:A. Write a program to check prime numberB. Write a program for Arithmetic calculator using switch case menuProgram 4:		
Aim: Demonstrate the core object-oriented concept of Inheritance, poly	ymorphism	
Program: Design a super class called Staff with details as StaffId, Na class by writing three subclasses namely Teaching (domain, public Contract (period). Write a Java program to read and display at least 3 statements Program 5 :	ame, Phone, Salary ations), Technical aff objects of all thre	. Extend this (skills), and ee categories.
Aim: Write a java program to solve Tower of Hanoi Problem using Sta	nck.	
Problem : Move all the disks stacked on the first tower over to the la the middle. While moving the disks, certain rules must be followed. O larger disk cannot be placed on a smaller disk. Program 6 :	st tower using a he only one disk can b	lper tower in be moved. A

Aim: Write a Java Program to calculate area and perimeter of variety of shapes (circle and triangle)

Problem: Develop a JAVA program to create an abstract class Shape with abstract methods calculateAr and calculatePerimeter(). Create subclasses Circle and Triangle that extend the Shape class and implet the respective methods to calculate the area and perimeter of each shape.

Program 7:

Aim: Exception handling in java, introduction to throwable class, throw, throws, finally.

Program: Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero.

Program 8:

Aim: Java Program: Resizable Interface for Object Resizing with Rectangle Implementation.

Problem : Develop a JAVA program to create an interface Resizable with methods resizeWidth(int width) and resizeHeight(int height) that allow an object to be resized. Create a class Rectangle that implements the Resizable interface and implements the resize methods.

Program 9:

Aim: Write a Java program to generate random numbers using multiple threads.

Problem: Develop a Java program that implements a multi-threaded application with three threads. Each thread has a specific task as described as follows: First Thread (Random Number Generator): This thread generates a random integer every 1 second. Second Thread (Square Computation): This thread receives the random integer generated by the first thread and computes its square. After computing the square, it prints the result. Third Thread (Cube Computation): This thread receives the random integer generated by the first computation): This thread receives the random integer generated by the first thread and computes its cube. After computing the result.

Program 10:

Aim: Java Swing Program: Creating Buttons with JFrame Inheritance.

Problem: Develop a Java program using Swing to create a button and add it to a JFrame object inside the main method. Additionally, you should inherit the JFrame class without explicitly creating an instance of the JFrame class.

SuggestedLearningResources:Textbooks:

McGraw-Hill, ISBN: 9781260463422.	1	Java: The Complete	Reference,	Twelfth	Edition,	by	Herbert	Schildt,	November	2021,
	1	McGraw-Hill, ISBN:	97812604	63422.						

Reference Books:

1

Programming with Java, 6th Edition, by E Balagurusamy, Mar-2019, McGraw Hill Education, ISBN:9789353162337.

Web links and Video Lectures (e-Resources):

- Learn Java A Beginners Guide for 2024 GeeksforGeeks
- Java Tutorial: https://www.javatpoint.com/java-tutorial
- https://www.youtube.com/watch?v=GoXwIVyNvX0
- https://www.youtube.com/watch?v=bm0OyhwFDuY&list=PLsyeobzWxl7pe_IiTfNyr55kwJP WbgxB5

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

- Demonstration of online IDEs like geeksforgeeks, jdoodle or any other Tools.
- Mini Project

Course outcomes:

CO1 Ability to demonstrate proficiency in writing simple programs involving branching and

	looping structures and design class involving data members and methods for the given scenario.
CO2	Ability to apply the concepts of inheritance and interface in solving real world problems.
CO3	Ability to use the concept of multithreading and exception handling in solving complex problem.
CO4	Ability to use the concept of swings in solving the real-world problems.

СО-РО	CO-PO Mapping													
CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	3	2	3	3	1	-	-	-	1	-	-	-	3	3
CO2	3	2	3	3	1	-	-	-	1	-	-	-	3	3
CO3	3	2	3	3	1	-	-	-	1	-	-	-	3	3
CO4	3	2	3	3	1	-	-	-	1	-	-	-	3	3

Course Title	Game theory	Semester	IV
Course Code	AI261	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		

- Comprehend the basics of strategic gaming and mixed strategic equilibrium.
- Enable students to develop skills on extensive gaming strategies.
- Analyze and discuss various gaming models.
- Illustrate some real-time situations.

Level:L1,L2,L3	Madula 1	RBT	House 8
	Wodue-1	Level:L1,L2,L3	Hours: 8

Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions.

Modula-2	RBT	Hourse 8
Wiodule-2	Level:L1,L2,L3	110ш5. 0

Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population.

Module-3	RBT Level:L1,L2,L3	Hours: 8
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Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly.

Module-4 RBT Level:L1,L2,L3 How	urs: 8
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Bayesian Games, Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations.

Madula 5	RBT	House 8
Wodule-5	Level:L1,L2,L3	nouis: o

Competative Games: Strictly competitive games and maximization. Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.

SuggestedLearningResources:Textbooks:

1Martin Osborne: "An Introduction to Game Theory", Oxford University Press, First
Indian Edition, 2009, 7th impression, ISBN – 0195128958.

Reference Books:

1	Roger	B.	Myerson:	"Analysis	of	Conflict	Game	Theory",	Re-print	Edition,	Harvard
1	Univers	sity	Press, 200)8, ISBN -	- 97	8-067434	41166.				

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

- Quizzes
- Assignments
- Seminar

Course	outcomes:
CO1	Interpret the basics of strategic gaming and extensive games.
CO2	Analyze gaming strategies on real-time incidence.
CO3	Develop the models of gaming on real-time incidence.
CO4	Apply game theory in the real world problems.

CO-PO	Map	ping												
CO/P	PO	РО	PO	PO1	PO1	PO1	PSO	PSO						
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO2	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO3	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO4	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO5	3	3	3	3	1	-	-	-	1	1	-	-	3	-

Course Title	Discrete Mathematical Structures	Semester	IV
Course Code	AI262	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML	•	•

- To help students to understand discrete and continuous mathematical structures.
- To impart basics of relations and functions.
- To facilitate students in applying principles of Recurrence Relations to find the generating functions and solve the Recurrence relations.
- To have the knowledge of groups and their properties to understand the importance of algebraic properties relative to various number systems.

Module-1 RBT Level:L1,L2,L3	Hours: 8
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Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems.

Module-2	RBT Level:L1,L2,L3	Hours: 8
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Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions. Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition.

Module-3	RBT Level:L1,L2,L3	Hours:8				
Cartesian Products and Relations, Functions - Plain and One-to-One, Onto Functions. The Pigeonhole						
Principle, Function Composition and Inverse Functions. Properties of I	Relations, Computer	Recognition				
- Zero-One Matrices and Directed Graphs, Partial Orders - Hasse	Diagrams, Equivaler	ce Relations				
and Partitions.						
Modulo 4	RBT	Houme 18				
Ni odule -4	Level:L1,L2,L3	nouis:0				
Generating Function - Definition and Examples , Calculation tech function. First order linear recurrence relations with constant co homogeneous Solution. Second order linear recurrence relation homogeneous, non-homogeneous Solution.	nniques, Exponentia efficients –homoge s with constant	l generating neous, non- coefficients,				
Module-5	RBT Level:L1,L2,L3	Hours:8				

Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem.

Suggested Learning Resources:Textbooks:

1Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied
Introduction", 5th Edition, Pearson Education, 2004.2Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics", 5th Edition, Pearson
Education, 2004.

Reference Books:

1	Basavaraj S	Anami and	Venakanna	S	Madalli:	"Discrete	Mathematics -	Α	Concept-
1	based approac	h", Univers	ities Press,	20	16				

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- http://www.themathpage.com/
- http://www.abstractmath.org/

Activity-Based Learning (Suggested Activities in Class)/Practical-Based learning

Discrete mathematics, or the study of mathematical structures that are discrete rather than continuous, is used in many real-life applications such as Computing, Internet security, Network routing, Scheduling and planning, Online delivery services, etc.

Course	e outcomes:
CO1	Check the validity of predicates in Propositional and Quantified Propositional Logic using
001	truth tables, deductive reasoning and inference theory on Propositional Logic
	Solve counting problems by applying the elementary counting techniques - Rule of Sum, Rule
CO2	of Product, Permutation, Combination, Binomial Theorem, Pigeonhole Principle and Principle
	of Inclusion and Exclusion
CO3	Classify binary relations into various types and illustrate an application for each type of binary
005	relation, in Computer Science (Cognitive Knowledge Level: Understand)
CO4	Illustrate an application for Partially Ordered Sets and Complete Lattices, in Computer Science
C04	(Cognitive Knowledge Level: Apply)
CO5	Explain Generating Functions and solve First Order and Second Order Linear Recurrence
COS	Relations with Constant Coefficients (Cognitive Knowledge Level: Apply)

CO-PO	Мар	ping												
CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO2	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO3	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO4	3	3	3	3	1	-	-	-	1	1	-	-	3	-
CO5	3	3	3	3	1	-	-	-	1	1	-	-	3	-

Course Title	Data Mining and Data Warehousing	Semester	IV
Course Code	AI263	CIE	50
Total No. of Contact Hours	40	SEE	50
No. of Contact Hours/week	3:0:0	Total	100
Credits	3	Exam. Duration	3 Hours
Teaching Dept	AIML		

- To introduce the fundamental processes data warehousing and major issues in data mining.
- To impart the knowledge on various data mining concepts and techniques that can be applied to text mining, web mining etc.
- To develop the knowledge for application of data mining and social impacts of data mining.

Modula-1.	RBT	Hoursell
Wroume-1.	Level/s:L1,L2,L3	110015.00

Syllabus Content: Data Warehousing & Modeling :

Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Textbook 1: Ch.4.1,4.2,4.3		
Module-2	RBT Level:L1,L2,L3	Hours:08

Data warehouse implementation

Data Mining: - Data Mining Functionalities – Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation-Architecture Of A Typical Data Mining Systems- Classification Of Data Mining Systems.

Module-3 RBT Level:L1,L2,L3 Hours:0)8

Association Analysis:

1 0 01 0

Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining. Textbook 1: Ch 6.1 to 6.7

Module-4	RBT Level:L1,L2,L3	Hours:08
Classification:		
Classification and Prediction: - Issues Regarding Classification and Decision Tree Introduction – Bayesian Classification – Rule Based Back propagation – Support Vector Machines – Associative Classifi Classification Methods – Prediction – Accuracy and Error Measures Classifier or Predictor – Ensemble Methods – Model Section.	l Prediction – Clas Classification – Cla ication – Lazy Learn – Evaluating the A	ssification by ssification by ners – Other ccuracy of a
Textbook 2: Ch 8		
Module-5	RBT Level	Hours:08
Clustering Analysis:		
Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCA Based Clustering, Graph-Based Clustering, Scalable Clustering Algor	AN, Cluster Evaluat ithms.	ion, Density-

Textbook 1: Ch 10

Self-Learning Activities:

- 1. MySQL
- 2. Apache Hadoop
- 3. Apache Spark

Suggested Learning Resources: Textbooks:							
1.	Jiawei Han, MichelineKamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd						
	Edition, Morgan Kautmann Publisher, 2012.						
2	Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining,						
۷.	Pearson, First impression, 2014.						
Reference Books:							
1.	Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, Tenth						
	Impression, 2012.						
2	Michael.J.Berry, Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second						
	edtion,2012.						

Web links and Video Lectures (e-Resources):

W1: https://www.datanovia.com/en/courses

- W2: <u>https://www.nd.edu/</u>
- W3: https://www.edx.org/course/business-analytics-fundamentals

V1: https://www.youtube.com/watch?v=S8tZTPvn7Xw

https://www.coursera.org/lecture/cluster-analysis/3-1-partitioning-basedclustering-methods-

<u>LjShL</u>

V3: https://slideplayer.com/slide/5009801/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

Course outcomes:						
CO1	Interpret the contribution of data warehousing and data mining to the decisionsupport systems.					
CO2	Construct the data needed for data mining using preprocessing techniques.					
CO3	Discover interesting patterns from large amounts of data using Association Rule Mining.					
CO4	Extract useful information from the labeled data using various classifiers and Compile unlabeled data into clusters applying various clustering algorithms.					
CO5	Demonstrate capacity to perform a self-directed piece of practical work that requires the application of data mining techniques					

CO-PO Mapping														
CO/P	PO	PO1	PO1	PO1	PSO	PSO								
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO3	3	1	-	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	2	2	-

High-3, Medium-2, Low-1

V2:

Julia programming						
Course Code	AI271	CIE Marks	50			
L:T:P:S	1:0:2	SEE Marks	50			
Hrs. / Week	3	Total Marks	100			
Credits	2	Exam Hours	03			

Course objectives: At the end of the course, the student will be able to:						
CO1	To introduce the basics of Julia programming language					
CO2	To illustrate the data structures of Julia programming language					
CO3	To make use of built-in functions and packages					

Pgm. No.	List of Experiments / Programs	Hours	COs						
Prerequisite Experiments / Programs / Demo									
	Get familiar with the basics of the language such as variables, types, conditionals, loops, functions, and packages.	3							
1	 a. Develop a Julia program to simulate a calculator (for integer and real numbers). b. Develop a Julia program to add, subtract, multiply and divide complex numbers. c. Develop a Julia program to evaluate expressions having mixed data types (integer, real, floating-point number and complex). [Refer Book 2: Chapter 3, 4] 	3	CO1						
2	 a. Develop a Julia program for the following problem: A computer repair shop charges \$100 per hour for labour plus the cost of any parts used in the repair. However, the minimum charge for any job is \$150. Prompt for the number of hours worked and the cost of parts (which could be \$0) and print the charge for the job. b. Develop a Julia program to calculate a person's regular pay, overtime pay and gross pay based on the following: If hours worked is less than or equal to 40, regular pay is calculated by multiplying hours worked by rate of pay, and overtime pay is 0. If hours worked is greater than 40, regular pay is calculated by multiplying the hours in excess of 40 by the rate of pay by 1.5. Gross pay is calculated by adding regular pay and overtime pay. [Refer Book 1: Chapter 3] 	3	CO1						
3	a. An amount of money P (for principal) is put into an account which earns interest at r% per annum. So, at the end of one year, the amount becomes $P + P \times r/100$. This becomes the principal for the next year. Develop a Julia program to print the amount at the end of each year for the next 10 years. However, if the amount ever exceeds 2P, stop any further printing. Your program should prompt for the values of P and r. b. Develop a Julia program which reads numbers from a file (input.txt) and finds the largest number, smallest number, count, sum and average of numbers. [Refer Book 1: Chapter 4]	3	CO1						
4	a. Develop a Julia program and two separate functions to calculate GCD and LCM, b. Develop a Julia program and a	3	CO1						
	recursive function to calculate factorial of a number of Develop								
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	a Julia program and a recursive function to generate Fibonacci								
	series [Refer Book 1: Chapter 5]								
5	a Develop a Julia program which reads a string (word) and prints	3	CO1						
5	a. Develop a juia program which reads a suring (word) and prints whether the word is palindrome	3	COI						
	b Davalan a Julia program which roads and prints the words								
	b. Develop a Julia program which leads and prints the words								
	present in a me (input.txt) having Kandoni Data in which words								
	are dispersed fandomly (Assumption, a word is a contiguous								
	sequence of letters. A word is definited by any non-letter								
6	character of end-of-me). [Refer book 1. Chapter 0]	2	<u>CO1 CO2</u>						
0	a. Develop a juna program to determine and print the frequency	3	C01,C02						
	with which each letter of the alphabet is used in a given line of								
	b. A survey of 10 pop artists is made. Each person votes for an								
	artist by specifying the number of the artist (a value from 1 to 10).								
	Develop a Julia program to read the names of the artists, followed								
	by the votes, and find out which artist is the most popular. [Refer								
7	Book 1: Chapter /]	2	<u>CO1 CO2</u>						
/	a. Given a line of text as input, develop a Julia program to	3	C01,C02						
	determine the frequency with which each letter of the alphabet is								
	used (make use of dictionary)								
	b. Develop a Julia program to letch words from a file with								
	arbitrary punctuation and keep track of all the different words								
	found (make use of set and ignore the case of the letters: e.g. to								
0	and to are treated as the same word). [Refer Book 1: Chapter 10]	2	<u>CO1 CO2</u>						
0	a. Develop a juna program to evaluate expressions consisting of	3	01,002						
	rational, irrational number and noating point numbers)								
	b. Develop a juna program to determine the following properties								
	of a matrix: determinant, inverse, rank, upper & lower triangular								
	Matrix, Dafor Deals 2: Charter 5, 81								
0	Watrix. [Refer BOOK 2: Unapter 5, 8]	2	CO2 CO2						
フ	a. Develop a julia program to determine addition and subtraction	3	CO_2, CO_3						
	b Davalan a Julia program to parform multiplication acception								
	on matrices, apple matrices along the light of the second								
	on matrices: scalar multiplication, element-wise multiplication,								
10	a Develop a Julia program to generate a relation of (solid 9, dotted)	2	<u> </u>						
10	a. Develop a juna program to generate a plot of (solid & dotted) a function: $x = x^2$ (use suitable data naints for x)	3	003, 004						
	a function. $y = x^2$ (use suitable data points for x).								
	b. Develop a Julia program to generate a plot of mathematical equation: $y = \sin(y) + \sin(2y) = 0$								
	equation: $y = sin(x) + sin(2x)$. c. Develop a Julia program to								
	generate multiple plots of mathematical equations: $y = sin(x) + in(2x)$ and $x = sin(2x) + in(2x)$. [Define Death 2: Chart 12]								
	su(2x) and $y = su(2x) + su(5x)$. [Keter Book 2: Unapter 13]								
	PAK I-D								
word C-J	labus Virtual I ab Contant								
eyond Syl	labus Virtual Lab Content								

Suggested	Learning Resources:	
Textbooks	/ Reference Books:	

1	Julia – Bit by Bit (Programming for Beginners), by Noel Kalicharan, Springer: ISBN 978- 3-030-73935-
1	5, doi: https://doi.org/10.1007/978-3-030-73936-2, 2021.

2 Beginning Julia Programming (For Engineers and Scientists), by Sandeep Nagar, Apress-Springer: ISBN 978-1-4842-3170-8, doi: https://doi.org/10.1007/978-1-4842-3171-5, 2017.

Web links and Video Lectures (e-Resources):

- 1. <u>https://www.youtube.com/watch?v=4igzy3bGVkQ</u>
- 2. https://www.youtube.com/watch?v=JYs 94znYy0
- 3. <u>https://www.youtube.com/watch?v=X4Alzh3QyWU</u>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of simple projects
- For active participation of students, instruct the students to prepare dashboard based on Business Intelligence

Course	Course outcomes:			
CO1	Apply concepts of data-types, selection and looping constructs of Julia programming language			
CO2	Demonstrate the use of strings, functions, arrays and matrix operations in solving problems.			
CO3	Develop programs involving data structures to handle multi-valued data items.			
CO4	Make use of packages to generate plots of mathematical functions and equations.			

CO-PO	Map	ping												
CO/P	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO1	PO1	PO1	PSO	PSO
0	1	2	3	4	5	6	7	8	9	0	1	2	1	2
CO1	3	3	2	2	2							2	2	3
CO2	3	3	3	2	2				1			2	3	2
CO3	3	3	3	2	3				2			2	3	3
CO4	3	2	3	2	3						1	3	2	2

Course Title	Full Stack Development	Semester	IV
Course Code	AI272	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/week	2:0:0:0	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept	AIML	·	

Course objective is to:

Course Learning Objectives: This course will enable students to:

- Explain the use of learning full stack web development.
- Make use of rapid application development in the design of responsive web pages.
- Illustrate Models, Views and Templates with their connectivity in Django for full stack web development.
- Design and implement Django apps containing dynamic pages with SQL databases.

Module-1	RBTLevel		
MVC based Web Designing	L1,L2,L3	Hours: 6	
Web framework, MVC Design Pattern, Django Evolution, Views, Mapp	ing URL to View	ws, Working	
of Django URL Confs and Loose Coupling, Errors in Django.	-	_	
Textbook 1: Chapter 1 and Chapter 3			
Module-2	RBT Level	II.	
Django Templates	L1,L2,L3	Hours: 0	
Template System Basics, Using Django Template System, Basic Temp Development Pattern, Template Loading, Template Inheritance Textbook 1: Chapter 4	late Tags and H	Filters, MVT	
Module-3	RBT Level		
Django Models	L1,L2,L3 Hours:6		
Configuring Databases, Defining and Implementing Models, Basic Data A Representations, Inserting/Updating data, Selecting and deleting objects, S Textbook 1: Chapter 5	Access, Adding I Schema Evolution	Model String n.	
Module-4			
 Django Admin Interfaces Activating Admin Interfaces, Using Admin Interfaces, Customizing Admin Interfaces, Reasons to use Admin Interfaces Textbook 1: Chapters 6, 7 	RBT Level L1,L2,L3	Hours: 6	
Module-5 jQuery and AJAX	RBT Level L1,L2,L3	Hours:6	

Ajax Solution, Java Script, XHTMLHttpRequest and Response, HTML, CSS, JSON, iFrames, Settings of Java Script in Django, jQuery and Basic AJAX.

Textbook 2: Chapters 1, 2

Suggested L	earning Resources: https://nptel.ac.in/courses/106106156
Textbooks:	
1	Adrian Holovaty, Jacob Kaplan Moss, The Definitive Guide to Django: Web Development Done
	Right, Second Edition, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG
	Publishers, 2009.
2	Jonathan Hayward, Django Java Script Integration: AJAX and jQuery, First Edition, Pack
2	Publishing, 2011
Reference B	ooks:
1	Aidas Bendroraitis, Jake Kronika, Django 3 Web Development Cookbook, Fourth
	Edition, Packt Publishing, 2020
2	William Vincent, Django for Beginners: Build websites with Python and Django, First
Z	Edition, Amazon Digital Services, 2018
Web links ar	nd Video Lectures (e-Resources):
https://www.y	youtube.com/watch?v=ZmiJ4ZsQXRk&list=PLgWjD_CBfh0Bh9-
CvRE1dIhx	KsUpmx3Gj
Activity-Base	ed Learning (Suggested Activities in Class)/ Practical Based learning
Assign the gr	oup task to Design Web application

Course	e outcomes:
CO1	Understand the working of MVT based full stack web development with Django.
CO2	Designing of Models and Forms for rapid development of web pages.
CO3	Analyze the role of Template Inheritance and Generic views for developing full stack web applications.
CO4	Perform jQuery based AJAX integration to Django Apps to build responsive full stack web applications

CO-PO	Mapping	5												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	3	-	-	-	-	-	-	-	2	1
CO2	3	1	2	-	3	-	-	-	-	-	-	-	2	1
CO3	2	2	3	1	3	-	-	-	-	-	-	-	1	1
CO4	3	2	3	-	3	-	-	-	-	-	I	-	1	2

	R Programmin	28	
Course Code	AI273	CIE Marks	50
L:T:P:S	1:0:2	SEE Marks	50
Hrs. / Week	3	Total Marks	100
Credits	2	Exam Hours	03

Course objectives :				
CLO 1.	Show the installation of R Programming Environment.			
CLO 2	Utilize and R Data types for developing programs.			
CLO 3	Make use of different R Data Structures.			
CLO 4	Develop programming logic using R Packages.			
CLO 5	Analyze the data sets using R programming capabilities.			

Pgm. No.	List of Experiments / Programs	Hours	Cos								
	Prerequisite Experiments / Programs / Demo										
	R installation										
	PART-A										
1	Learn al the basics of R-Programming (Data types, Variables, Operators etc.)	3	CO1,CO2								
2	Implement R-Loops with different examples.	3	CO1,CO2								
3	Learn the basics of functions in R and implement with examples.	3	CO1,CO2								
4	Implement data frames in R. Write a program to join columns and rows in a data frame using c bind () and r bind () in R.	3	CO1,CO2								
5	Implement different String Manipulation functions in R.	3	CO2,CO3								
6	Implement different data structures in R(Vectors ,Lists ,Data Frames)	3	CO2,CO3								
7	Create pie charts and bar charts using R.	3	CO3 ,CO4								
8	Create a data set and do statistical analysis on the data using R.	3	CO3, CO5								
9	Write R program to find Correlation and Covariance	3	,CO4,CO5								
10	Write R program for Regression Modeling.	3	CO4,CO5								

PART-B

Beyond Syllabus Virtual Lab Content Writing and Reading Sequence Data in R: https://vlab.amrita.edu/?sub=3&brch=311&sim=1835&cnt=2

Suggested Learning Resources: Textbooks/ Reference Books:								
01	Jared P.Lander, R for Everyone: Advanced Analytics and Graphics,2 nd Edition,PearsonEducation,2018.							
02	S.R.Mani Sekhar and T.V.Suresh Kumar, Programming w Edition, CENGAGE, 2017.	rith R,1 st						

Web links and Video Lectures (e-Resources):

- 1. https://www.r-project.org/
- 2. https://www.tutorialspoint.com/r/index.htm

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of simple projects
- For active participation of students, instruct the students to prepare web-based projects
- Organizing Group wise discussions on issues

Course	e outcomes:
CO1	To understand the fundamental syntax of R through readings, practice exercises,
CO2	To demonstrations and writing R code.
CO3	To apply critical programming language concepts such as data types, iteration and different
005	String Manipulation functions in R.
CO4	To understand control structures, functions, and different data structures in R(Vectors ,Lists
0.04	,Data Frames)
CO5	To prepare or tidy data for in preparation and pie charts and bar charts using R.

	PO	PO8	PO9	PO1	PO1	PO1	PSO	PSO						
CO/PO	1	2	3	4	5	6	7			0	1	2	1	2
CO1	3				3		1		2	2	2	2	2	2
CO2	2		2		2		1			3	1	1		2
CO3	2				3		1			3	2			2
CO4	2		2		2		1		3	3	1	2	1	3
CO5	3				2		1		2	3	2		2	3

Course Title	Universal Human Values and SCR	Semester	IV
Course Code	HV257	CIE	50
Total No. of Contact Hours	30	SEE	50
No. of Contact Hours/Week	2:0:0	Total	100
Credits	2	Exam. Duration	3 Hours
Teaching Dept	Any Department		

Course objective is to:

This course is intended to:

• To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

• To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

• To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

• This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Module – 1	RBT Level/s :L1, L2	06 Hours
Introduction to Value Education: Introduction to Value Education	ation :Right U	nderstanding,
Relationship and Physical Facility (Holistic Development and the Role	of Education) U	Inderstanding
Value Education, Self-exploration as the Process for Value Education,	Continuous Ha	appiness and
Prosperity - the Basic Human Aspirations, Happiness and Prosperity - 0	Current Scenario	, Method to
Fulfil the Basic Human Aspirations		

Module – 2	RBT Level/s :L1, L2	06 Hours
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Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

		Module-3				RBT Level/s :L1, L2	06 Hours
**	 1		 1		1		- -

Harmony in the Family and Society :Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

	Module-4	RBT Level/s :L1, L2	06 Hours					
Harmony in regulation and existence at A	Harmony in the Nature/Existence : Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence							
Module-5		RBT Level/s :L1, L2	06 Hours					
Implications of the Holistic Understanding – a Look at Professional Ethics :Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession Suggested Learning Resources:								
1	The Textbook A Foundation Course in Human Values a Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Exc ISBN 978-93-87034-47-1 The Teacher's Manual for A Foundation Course in Hur	nd Professional el Books, New man Values and	Ethics, R R Delhi, 2019. Professional					
2	Ethics, R R Gaur, R Asthana, G		110100010100					
Reference B	ooks:							
1	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Pral	kashan, Amar ka	ntak, 1999.					
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, N	lew Delhi, 2004.						
3	The Story of Stuff (Book).		11 •					
4	The Story of My Experiments with Truth - by Mohandas K	aramchand Gan	dhi					
5	Small is Beautiful - E. F Schumacher							
5 Small is Beautiful - E. F Schumacher 6 Slow is Beautiful - Cecile Andrews Web links and Video Lectures (e-Resources): Value Education websites, https://www.uhv.org.in/uhv-ii, http://uhv.ac.in, http://www.storyofstuff.com Al Gore, An Inconvenient Truth, Paramount Classics, USA Charlie Chaplin, Modern Times, United Artists, USA IIT Delhi, Modern Technology – the Untold Story Gandhi A., Right Here Right Now, Cyclewala Productions https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw https://fdp-si.aicte-india.org/8dayUHV_download.php https://www.youtube.com/watch?v=8ovkLRYXIjE https://www.youtube.com/watch?v=nGRcbRpvGoU https://www.youtube.com/watch?v=nGRcbRpvGoU								
 Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning Teaching-Learning Process (General Instructions) These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. 1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence. 								

- 2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
- 3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
- 4. Support and guide the students for self-study activities. 5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- 5. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self evolution.
- 6. Encourage the students for group work to improve their creative and analytical skills.

Course outcomes:

Course outcome (Course Skill Set) At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

Expected to positively impact common graduate attributes like:

- 1. Ethical human conduct
- 2. Socially responsible behaviour
- 3. Holistic vision of life
- 4. Environmentally responsible work
- 5. Having Competence and Capabilities for Maintaining Health and Hygiene
- 6. Appreciation and aspiration for excellence (merit) and gratitude for all

CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1
CO4			1			1	1					1

Course Title	NSS - Phase 2	Semester	IV
Course Code	NS258	CIE	50
Total No. of Contact Hours	25 Hours	SEE	0
No. of Contact Hours/week	0:2:0	Total	50
Credits	0	Exam. Duration	
Teaching Dept.	Any Department		

Course objective is to: National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work

2. Identify the needs and problems of the community and involve them in problem-solving

3.Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems

4.Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

5.Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

Module:1	RBT Level/s	4 Hours
	: L1, L2	4 110015

Organic farming

Indian Agriculture (Past, Present and Future) Connectivity for marketing. Waste management– Public, Private and Govt organization, 5 R's.Plantation and adoption of plants. Know your plants. Awareness on Organic farming

Module:2	RBT Level/s	2 Hours
	: L1, L2	5 nouis

Developing Water conservation techniques

To develop sustainable water management system, - Role of different stakeholders- Implementation

Developing Sustainable Water management system for rural areas and implementation approaches

Module: 3	RBT Level/s :L1, L2	8 Hours

Activity Based Programmes:

A. Campus Activities: Celebration of national importance days

Awareness Programmes – Preparing an actionable business proposal for enhancing the village income and approach for implementation. Importance of health, hygiene, and sanitation Healthy life style, HIV /AIDS, drugs and substance

Madular 4	RBT Level/s	10 Hours
Module: 4	:L1, L2	10 Hours

Off Campus Activities:

Govt. school Rejuvenation and helping them to achieve good infrastructure and results, Women Empowerment Programme, Health Camps, Blood grouping awareness and Blood donation, Legal awareness Programme, Literacy Programme, Water Conservation Programme, One Day Special Camp in a village (preferably in adopted village.

Course	e outcomes:						
At the completion of the course. The student shall be able to							
CO1	Describe the concept of Youth and compare the international definitions of the term Youth.						
CO2	Students will be able to appreciate our demographic advantage and its role in nation building.						
CO3	Know the growth and evolution of NSS and its role in Nation building through community service						
CO4	Visualize the signs, symbols, logo of NSS and understand their broader meaning.						

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1	1					1
CO2						1	1					1
CO3						1	1					1
CO4						1	1					1

Course Title	Physical Education (PE) (Sports and Athletics) – Phase 2	Semester	IV	
Course Code	PE258	CIE	50	
Total No. of Contact Hours	25 Hours SEE		0	
No. of Contact Hours/Week	0:2:0	Total	50	
Credits		Exam. Duration		
Teaching Dept	Sports		·	

Course objective:

Physical education aims to develop all aspects of the human personality through physical and sports activities. Being a subject of science, it has its own value in society and human life. Physical Education is a form of one of the most effective means of education imparted through exercises, fun activities and sports. It is an integral part of the education system. It caters to the need for development of the students on physical, mental and social aspects

Module – 1	RBT Level/s :L1, L2	5 Hours
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Ethics and Moral Values:

- A. Ethics in Sports.
- B. Moral Values in Sports and Games

Module – 2	RBT Level/s :L1, L2	15 Hours						
Specific Games (Any one to be selected by the student)								
A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.								
B. Throw ball – Service, Receive, Spin attack, Net Drop & Jump	throw.							

- C. Kabaddi Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
- D. Kho-Kho-Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 up.
- E. Table Tennis Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash.

F. Athletics (Track / Field Events) – Any event as per availability of Ground.

Module - 3	RBT Level/s :L1, L2	5 Hours
Role of Organization and administration		

Course outcomes:

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

CO1	Understand the ethics and moral values in sports and athletics.										
CO2	Perform in the selected sports or athletics of student's choice										
CO3	Understand the roles and responsibilities of organization and administration of sports and										
005	games										

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1

Course Title	Yoga for a Better Life - Phase 2	Semester	IV		
Course Code	YG258	CIE	50		
Total No. of Contact Hours	25	SEE	0		
No. of Contact Hours/week	0:2:0	Total	50		
Credits	0	Exam. Duration			
Teaching Dept	Yoga				

Course objectives:

1) To enable the student to have good health.

2) To practice mental hygiene.

3) To possess emotional stability.

4) To integrate moral values.

5) To attain higher level of consciousness.

SEMESTER IV RBT Level/s :L1, L2 25 Hours
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Patanjali's Ashtanga Yoga, its need and importance. Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan.

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana Different types of Asanas

a. Sitting

1. Sukhasana

2. Paschimottanasana

b. Standing

1. Ardhakati Chakrasana

2. Parshva Chakrasana

c. Prone line

1. Dhanurasana

d. Supine line

1. Halasana

2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds Meaning, Need, importance of Pranayama.

Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama Pranayama –

1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana

Suggested Learning Resources:

Textbooks:

- 1. Yogapravesha in Kannada by Ajitkumar
- 2. Light on Yoga by BKS Iyengar
- 3. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly
- 4. Yoga Instructor Course hand book published by SVYASA University, Bengaluru
- 5. Yoga for Children -step by step by Yamini Muthanna

Web links and Video Lectures (e-Resources):

Refer links

- https://youtu.be/KB-TYlgd1wE
- https://youtu.be/aa-TG0Wg1Ls

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as;

- coronary heart disease,
- depression,
- anxiety disorders,
- \bullet asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse). If you practice yoga, you may receive these physical, mental, and spiritual benefits:

• Physical

- 1. Improved body flexibility and balance
- 2. Improved cardiovascular endurance (stronger heart)
- 3. Improved digestion
- 4. Improved abdominal strength
- 5. Enhanced overall muscular strength
- 6. Relaxation of muscular strains
- 7. Weight control
- 8. Increased energy levels
- 9. Enhanced immune system

• Mental

- 1. Relief of stress resulting from the control of emotions
- 2. Prevention and relief from stress-related disorders
- 3. Intellectual enhancement, leading to improved decision-making skills

• Spiritual

- 1. Life with meaning, purpose, and direction
- 2. Inner peace and tranquility
- 3. Contentment

Course outcomes:

At the completion of the course. The student shall be able to						
CO1	Understand the meaning, aim and objectives of Yoga.					
CO2	Perform Suryanamaskar and able to Teach its benefits.					
CO3	Understand and teach different types of Pranayama, Asanas by name, its importance, methods					
	and benefits.					
CO4	Instruct Kapalabhati and its need and importance.					
CO5	Coach different types of Kriyas, method to follow and usefulness.					

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1			1	1					1
CO2			1			1	1					1
CO3			1			1	1					1
CO4			1			1	1					1
CO5			1			1	1					1