Siddaganga Institute of Technology-Tumakuru

Department of Master of Computer Applications

SCHEME & SYLLABUS

I - IV SEMESTER

2023-2025

VISION STATEMENT

"To effectively mould quality and responsible Computer Professionals, with a mind of service and spirituality for nurturing the technological competence"

MISSION STATEMENT

"Imparting quality education to students to make them professionals in their domain replete with IT and computational skills par excellence"

Program Educational Objectives

PEO 1 *Pursue career in computer applications domain by developing abilities that are in synchrony with changing needs of Industry or academia*

PEO 2 *Demonstrate professionalism when working with teams and align with ethical principles.*

PEO 3 *Engage in lifelong learning to upgrade the professional skills*

Program Outcomes (POs)

PO1: (Foundation Knowledge): Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO2: (Problem Analysis): Identify, review, formulate and analyse problems for primarily focusing on customer requirements using critical thinking frameworks.

PO3: (Development of Solutions): Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.

PO4: (Modern Tool Usage): Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO5: (Individual and Teamwork): Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO6: (Project Management and Finance): Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

PO7: (Ethics): Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware

PO8: (Life-long learning): Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

Scheme of Teaching and Examinations – 2023
Master of Computer Applications (MCA)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA /Tutorial					
1	BSC	N1MC01	Mathematical Foundations for Computer Applications	03	- -	02	3	50	50	100	4
2	PCC	N1MC02	Operating Systems and UNIX	03	- -	02	3	50	50	100	4
3	PCC	N1MC03	Professional Web Development - I	03	- -	02	3	50	50	100	4
4	PCC	N1MC04	Object Oriented Programming with Java	03	- -	02	3	50	50	100	4
5	PCC	N1MC05	Computer Networks	03	--		3	50	50	100	3
6	IPCC	N1MCI01	Data Structures and Algorithms	03	02	-	3	50	50	100	4
7	PCCL	N1MCL1	Professional Web Development – I Lab	--	03	--	3	50	50	100	1.5
8	PCCL	N1MCL2	Java Lab	--	03	--	3	50	50	100	1.5
9	AEC	N1ARAS	Aptitude Related Analytical Skills	36 hrs. during the entire semester				100	---	100	0
10	BC	N1MCBC	Basics of Programming	03	-	-	3	50	50	100	0
			Total	**21**	**08**	**08**	**27**	**550**	**450**	**1000**	**26**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, PCCL: Professional Core Courses Lab, AUD/AEC –Audit Course / Ability Enhancement Course, PP-Passing is Mandatory *Only for non-computer science students,

Scheme of Teaching and Examinations – 2023
Master of Computer Applications (MCA)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA /Tutorial					
1	PCC	N2MC01	Database Management Systems	03		02	03	50	50	100	4
2	PCC	N2MC02	Advanced Java	03		02	03	50	50	100	4
3	IPCC	N2MCI01	Professional Web Development – II	03	02		03	50	50	100	4
4	PCC	N2MC04	Software Engineering and Project Management	03			03	50	50	100	3
5	PEC	N2MCE1X	Professional Elective 1	03			03	50	50	100	3
6	PEC	N2MCE2X	Professional Elective 2	03			03	50	50	100	3
7	PCCL	N2MCL1	DBMS Lab	--	03		03	50	50	100	1.5
8	PCCL	N2MCL2	Advanced Java Lab		03		03	50	50	100	1.5
9	PCCL	N2MCL3	Cloud Computing Lab	--	04	--	03	50	50	100	2
10	NCMC	HSS08	Soft Skills	36 Hrs. for the entire semester				100	--	100	0
			Total	**18**	**12**	**04**	**27**	**550**	**450**	**1000**	**26**

Note PCC: Professional Core Courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. PCCL: Professional Core Courses Lab

Professional Elective 1		Professional Elective 2	
Course Code under N2MCE1X	**Course title**	**Course Code under N2MCE2X**	**Course title**
N2MCE14	C# and .Net	N2MCE24	Introduction to Internet of Things
N2MCE15	Software Testing	N2MCE25	Entrepreneurship
N2MCE16	Introduction to Cyber Security	N2MCE26	Foundations of Block Chain

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA/ Tutorial					
1	PCC	N3MC01	Python Programming for Data Analytics	03		02	03	50	50	100	4
2	MCC	N3MC02	Research Methodology and IPR	03			03	50	50	100	3
3	PEC	N3MCE3X	Professional Elective 3	03	--		03	50	50	100	3
4	PEC	N3MCE4X	Professional Elective 4	03	--		03	50	50	100	3
5	IPCC	N3MCI01	Mobile Application Development	03	02		03	50	50	100	4
6	SP	N3MCSP1	Societal Project	--	04		02	100	-	100	2
7	PCCL	N3MCL1	Python and Data Analytics Lab	--	03	--	03	50	50	100	1.5
8	MP	N3MCL2	Mini Project	--	03	--	02	50	50	100	1.5
9	INT	N3MCINT	Internship	(04 weeks of Internship Completed during the intervening vacation of II and III semesters.)			03	100	--	100	4
			Total	**15**	**12**	**02**	**25**	**550**	**350**	**900**	**26**

Note: PCC: Professional Core Courses, PEC: Professional Elective Courses. IPCC-Integrated Professional Core Courses, PCCL: Professional Core Courses Lab, INT: Internship, SP: Societal Project, MP: Mini Project

Professional Elective 3		Professional Elective 4	
Course Code under N3MCE3X	**Course title**	**Course Code under N3MCE4X**	**Course title**
N3MCE34	Machine Learning	N3MCE44	Artificial Intelligence
N3MCE35	Big Data	N3MCE45	Agile Software Process
N3MCE36	Digital Marketing	N3MCE46	Augmented Reality and Virtual Reality

Scheme of Teaching and Examinations – 2023
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IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical / Seminar	Skill Development Activities (Hours are for interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PROJ	N4MCMP	Major Project					50	50	100	20
2	SEM	N4MCTS	Technical Seminar					100		100	2
3	AEC	N1MCAE	MOOC Certification Course					100	---	100	0
			Total					**250**	**50**	**300**	**22**

Note: PROJ-Project Work, SEM- Seminar, AEC- Ability Enhancement Courses (Mandatory)

Each Course (PCC/PCE/IPCC/BSC/PCCL/MCC/BC) shall have 50% CIE and 50% SEE.

Theory courses:
Course structure – 5 Units; 3(L)+0(P)+0(SDA/Tutorials)

Course structure – 5 Units; 3(L)+0(P)+2(SDA/ Tutorials)

Description	*Schedule*	*Duration (min)*	*Conducted for*	*Average /Weight*	*Marks after scaled down*
Test-1	5th Week	90	50 marks	50 marks	35 marks
Test-2	10th Week	90	50 marks		
Test-3	15th Week	90	50 marks		
Assignment	Between 2nd & 3rd Test	-	15 marks	5 marks	15 marks
ABL	13th -14th week	-	15 marks	10 marks	
OR					
SDA	Between 2nd & 3rd Test	-	50 marks	15 marks	
CIE					**50 marks**

Activity Based Learning (ABL) - Seminar / Group Discussion / Micro project / Case study - any or combination of these.

Question Paper Pattern

CIE : *CIE pattern is 3 questions with a maximum 4 subdivisions and all questions are compulsory.*

SEE: *Ten questions from five units, each unit having 2 questions with internal choice.*

Summary of evaluation pattern

Description	***Conducted for***	***Reduced to***	***Minimum for Eligibility***
CIE	50 marks	50 marks	25 marks
SEE	100 marks	50 marks	20 marks
Total (CIE+SEE)		**100 marks**	**50** marks

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures not less than 50% (50 marks out of 100) from the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Four/Three credit Integrated Professional Core Course (IPCC):

Course structure – 5 Units; 3(L)+2(P)+0(SDA/ Tutorial)

(a) For theory component:

Description	*Schedule*	*Duration (min)*	*Conducted for*	*Average /Weight*	*Marks after scaled down*
Test-1	5th Week	90	50 marks	50 marks	18 marks
Test-2	10th Week	90	50 marks		
Test-3	15th Week	90	50 marks		
Assignment	Between 2nd & 3rd Test	-	15 marks	5 marks	12 marks
ABL	13th -14th week	-	15 marks	7 marks	
CIE					**30 marks**

Activity Based Learning (ABL) - Seminar / Group Discussion / Micro project / Case study - any or combination of these.

Question Paper Pattern
CIE: *CIE pattern is 3 questions with a maximum of 4 subdivisions and all questions are compulsory.*
SEE: *Ten questions from five units, each unit having 2 questions with internal choice. However, in SEE, the questions from the laboratory component shall be included.*

(b) For laboratory component:

CIE marks for the practical course is computed by adding the average of the marks secured by the student for conducting each of the experiments with the marks secured in the test conducted at the end of the semester.

Table: Break-up of CIE marks for practical component in Integrated Courses

Description	***Conducted for***	***Average /Weight***	***Marks after scaled down***
Regular Lab Work and Writing lab records	20 marks 15 marks	35 marks	15 marks
Lab test and Viva-voce at the end of the semester	10 marks 05 marks	15 marks	5 marks
CIE			**20 marks**

No SEE for Laboratory component.

Summary of evaluation pattern for 4 credit Integrated course

Description		***Conducted for***	***Reduced to***	***Minimum for Eligibility***
CIE	Theory	50 marks	30 marks	15 marks
	Practical	50 marks	20 marks	10 marks
SEE	Theory	100 marks	50 marks	20 marks
Total (CIE+SEE)			**100 marks**	**50** marks

If a student fails to secure 50% of maximum marks in Theory and Practical components of CIE, student has to repeat the entire course.

Two / 1.5 Credit Laboratory Course

CIE marks for the practical course is computed by adding the average of the marks secured by the student for conducting each of the experiments with the marks secured in the test conducted and also the marks secured for the open ended experiments at the end of the course, if any.

Break-up of CIE marks for practical courses

Details	***Marks***	***Minimum for Eligibility***
Regular Lab Work	35 marks	
Lab test and Viva-voce at the end of the semester	15 marks	
CIE	**50 marks**	**25 marks**
SEE	**50 marks**	**20 marks**
Total	**100 marks**	**50 marks**

Audit Courses: Aptitude Related Analytical Skills (ARAS): These courses are designed to help students enhance their skills in communication, language, personality development and Aptitude related analytical skills. Only CIE marks will be considered for evaluation.

Aptitude Related Analytical Skills (0 Credit)

Description	*Duration (min)*	*Conducted for*
Test-1	90	50 marks
Test-2	90	50 marks
CIE		**100 marks**

Minimum marks to qualify is 50%.
No SEE component for ARAS.

MOOC Certification Course: MOOC is the ONLINE course. Students must register and complete the online certification courses individually. Students shall take up any online certification courses which are chosen in the area of computer science. MOOC course should be completed within the duration of the MCA program. Students must produce the hardcopy of the registration details and confirmation details to the concerned proctor without fail. This course does not have SEE, only CIE marks will be considered for evaluation. A Committee comprising of HoD as Chairman, proctor and a senior faculty of the department will evaluate the progress of certification courses and declare the results as either PP or NP in 4th semester.

Basics of Programming:

Basics of Programming course is a non-credit course introduced to the students who admits into MCA program from non-computer science background. Students must secure eligibility by scoring 50% marks in aggregate (CIE and SEE).

Description	*Schedule*	*Duration (min)*	*Conducted for*	*Reduced to*	*Minimum for Eligibility*
Test-1	7th Week	90	50 marks	25 marks	
Test-2	14th Week	90	50 marks	25 marks	
CIE			100 marks	50 marks	25 marks
SEE		90	50 marks	50 marks	20 marks
Total			**150 marks**	**100 marks**	**50 marks**

Mini Project:

Students are expected to take up mini project with a team size not exceeding 3. The objective of this course is to develop real time mini projects using latest technologies.

Note:

1. Societal Project: Students will be working out solution for societal issues, present the seminar based on the societal project undertaken and submit report. Societal project may be hands-on practice**,** survey report, data collection and analysis, Coding, App development, Field visit, modeling of the System, Simulation, or Case study. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, and a senior faculty from the department. Work can be carried out in a team. The CIE marks are awarded based on the evaluation of Project report and Presentation skills. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of 04 weeks during the intervening vacation of II and III semester. The evaluation is done based on only CIE marks. CIE marks shall be awarded by a committee comprising of HoD as Chairman and a faculty from the department. Those, who do not take-up/complete the internship shall be declared as fail in internship course and must complete the same during the subsequent examinations after satisfying the internship requirements.

Credits for the Two year MCA Program Scheme 2023 - 2025						
Total Credits						
Semester	**Core**	**Elective**	**Lab**	**Project/ Industry/ Internship**	**Seminar**	**Total Credits**
I	23	00	03	-	-	**26**
II	15	06	05	-	-	**26**
III	11	06	05	04	-	**26**
IV	-	-	-	20	02	**22**
Total	**49**	**12**	**13**	**24**	**02**	**100**

Mathematical Foundations for Computer Applications

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N1MC01	Course	BSC	

Course Objectives:

This Course will enable students to:	
1.	Familiarize the logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions.
2.	Understand the concepts of vectors, matrices, and their operations.
3.	Understand the basics of data, Frequency Distributions, Central tendency measures and dispersion.
4.	Learn types of probability, axioms, and Bayes Theorem.

UNIT – I	08 Hours
Set Theory: Sets and Elements, Universal Set and Empty Set, Subsets, Venn diagrams, Set Operations, Algebra of Sets and Duality, Finite, Infinite sets & Counting Principle, The Inclusion-Exclusion Principle, Classes of Sets, Power Sets, Partitions.	

UNIT – II	08 Hours
Relations: Product Sets, Relations, Pictorial Representations of Relations, Composition of Relations, Types of Relations, Equivalence Relations. **Functions:** Functions, One-to-One,Onto, and Invertible Functions, Mathematical, Exponential and Logarithmic Functions, Recursively Defined Functions, Cardinality.	

UNIT – III	08 Hours
Vectors & Matrices: Vectors, Matrices, Matrix Addition and Scalar Multiplication, Matrix Multiplication, Transpose, Square Matrices, Invertible (Nonsingular) Matrices, Inverses, Determinants, Elementary Row Operations & Echelon Matrices.	

UNIT – IV	08 Hours
Statistical Methods: Collection of Data, Graphical Representation, Comparison of Frequency Distributions - Measures of Central Tendency and Measures of Dispersion.	

UNIT – V	08 Hours
Probability and Distributions: Introduction, Basic Terminology, Probability & SetNotations, Independent Events, Bayes Theorem.	

TEXT BOOKS:

1.	Seymour Lipschutz, Marc Lipson: Discrete Mathematics, Revised 3rd Edition, McGraw-Hill. (Chapters: 1, 2, 3, 5),2007
2.	B S Grewal: Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. (Chapters: 25, 26), 1965.

REFERENCE BOOKS:

1.	Ralph P Grimaldi, B V Ramana: Discrete and Combinatorial Mathematics, 5th Edition, PEARSON, 2004.
2.	Kenneth H Rosen: Discrete mathematics and Its Applications, 5th Edition, TATA McGRAW-HILL, 2003.

WEB LINKS:

1.	https://learn.careers360.com/maths/sets-relations-and-functions-chapter/
2.	https://byjus.com/jee/sets-relations-and-functions/
3.	https://www.javatpoint.com/discrete-mathematics-tutorial
4.	https://www.tutorialspoint.com/discrete_mathematics/index.htm

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	***Apply*** the fundamentals of set theory to perform various set operations to the real world problems.
CO2	***Apply*** the concept of relations and functions on sets to determine their types and compositions.
CO3	***Acquire*** ability to work with vectors and matrices.
CO4	***Acquire*** ability to represent the data and calculate the measures of central tendency and dispersion.
CO5	***Apply*** the concept of probability for uncertainty and real world problems.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	3	2	1					
	CO2	3	2	2					
	CO3	3	2	1					
	CO4	3	2	2					
	CO5	3	2	1					

1: Low, 2: Medium, 3: High

Data Structures and Algorithms

Contact Hours/Week	:	3+2(L+P)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Practical Hours	:	26	SEE Marks	:	50
Course Code	:	N1MCI01	Course	IPCC	

Course Objectives:

This Course will enable students to:	
1.	Differentiate the properties of various data structures such as stacks, queues, lists, trees and Graphs.
2.	Understand the working of various sorting and searching techniques.
3.	Understand the various Analysis and Design of Algorithm techniques.

UNIT – I	**08 Hours**
Classification of Data Structures: Primitive and Non- Primitive Data types, Linear and Nonlinear; Data structure Operations, Stack: Definition, Representation, Operations and Applications: Polish and reverse polish expressions, Infix to postfix conversion, evaluation of postfix expression, Recursion - Factorial, GCD, Fibonacci Sequence, product of two numbers. **Practical Component:** 1) Implementing stack using arrays. 2) Program to evaluate postfix expression. 3) Program to convert infix to postfix expression. 4) Program on recursion as applications of stack.	

UNIT – II	**08 Hours**
Queue: Definition, Representation, Queue Variants: Linear queue Circular Queue, Priority Queue, Double Ended Queue. Linked List: Types of linked list, Singly linked list basic operations: Inserting (at first, at last,) and removing nodes (at first, at last), search key in singly linked list. Stacks and queues using SLL and DLL. **Practical Component:** 1) Design to develop and implement simple Queue and circular QUEUE characters. 2) Implementing menu driven Stack using Singly Linked List. 3) Implementing menu driven Queue using Double Linked List.	

UNIT – III	**08 Hours**
Non-linear data structures Trees and Graphs: Binary Search tree, binary Expression tree, strictly and complete binary trees, Tree traversal methods and memory representation of binary trees, graph traversal using DFS and BFS. **Practical Component:** 1) Implementing Binary search tree of integers and demonstrate all traversal methods. 2) Implementing a program to demonstrate DFS and BFS graph traversal.	

UNIT – IV	**08 Hours**
Introduction, Fundamentals of the Analysis of Algorithm Efficiency Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Analysis Framework, Asymptotic Notations and Basic efficiency classes. Brute Force: Selection Sort, Sequential Search, Exhaustive search. Divide-and-Conquer: Merge sort, Binary Search. **Practical Component:**	

1) Sorting a given set of n integer elements using Merge sort and Quick sort and the measure of their time complexity. 2) Sorting a given set of n integer elements using selection sort and the measure of their time complexity. 3) Searching using Binary search

UNIT – V	08 Hours
Greedy Technique: Prim's and Dijkstra's Algorithm. Dynamic Programming: Warshalls and Floyds algorithms. Space and time tradeoffs : Sorting by counting, hashing(open and closed hashing) **Practical Component:** 1) All-Pairs Shortest Paths problem using Floyd's algorithm . 2) Program to Find the Transitive Closure of a Graph using Warshall's Algorithm	

TEXT BOOKS:

1.	Data Structures Using C and C++ by Yedidyah Langsam and Moshe J.Augenstein And Aaron M Tenanbanum, 2nd Edition, PHI, 2015
2.	Anany Levitin: Introduction to the Design and Analysis of Algorithms, 3rd edition, Pearson Education, 2017.

REFERENCE BOOKS:

1.	Algorithms in a Nutshell, O'Reilly Media, Inc., ISBN: 9780596516246, 2008
2.	Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2ndEdition, Pearson Education, 1997.
3.	Robert Kruse, C LTondo,Bruce Leung and Shashi Mogalla: Data Structures and Program Design in C 2ndEdition, Pearson Education, 2006
4.	Richard F Giberg and Behrouz AForouzan : Data Structures– A Pseudocode Approach with C, 2ndEdition,Cengage Learning,2007

WEB LINKS:

1.	https://www.javatpoint.com/data-structure-in-c
2.	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3.	https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
4.	https://www.geeksforgeeks.org/data-structures/
5.	https://www.programiz.com/dsa

Course Outcomes:

After the completion of this course, students will be able to:	
CO103.1	Interpret the basic data types, Stack operations and its applications.
CO103.2	Implement the linear data structure elements like Queue, Priority Queue & Linked List
CO103.3	Implement the non-linear data structure elements like Trees and Graphs
CO103.4	Elucidate the asymptotic notations to analyze the working of Brute force and Divide & Conquer algorithm techniques.
CO103.5	Analyze the working of Greedy and Dynamic Programming techniques, Space & Time Tradeoffs.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1	1	1	1			
	CO2	2	2	1	1	1			
	CO3	2	2	1	1	1			
	CO4	2	2	1	1	1			
	CO5	2	2	1	1	1			

1: Low, 2: Medium, 3: High

Operating System and UNIX

Contact Hours/Week	:	3+2(L +T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N1MC02	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Understand the basic operating system structure and concept of process scheduling.
2.	Visualize the intricate relationship between an operating system and its underlying Hardware.
3.	Learn CPU scheduling algorithms, deadlock detection algorithms and memory management.
4.	Learn the performance of memory management techniques, page replacement and disk scheduling algorithms.
5.	Understand UNIX file attributes, filters and Shell scripting.

UNIT – I	08 Hours

Introduction

What is an Operating System, Mainframe systems, Desktop systems, Multiprocessor system, Distributed system, clustered systems, Real Time systems, Handheld systems, Feature Migration, Computing environment, System Components, OS Services, System calls, System Programs, System Structure, Virtual Machines.

UNIT – II	08 Hours

Process Management and Synchronization

Process concept, Process Scheduling, operation on Processes, Cooperating Processes, Inter process Communication, CPU Scheduling-Basic concepts, Scheduling Criteria, Scheduling algorithms, Multiple processor scheduling, Real Time Scheduling.

The critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions.

UNIT – III	08 Hours

Deadlocks and Memory Management

Deadlocks, System model, Characterization, Methods for handling deadlocks, deadlock prevention, avoidance, detection and its recovery.

Memory Management: Background, Swapping, contiguous allocation, Paging, Segmentation, Segmentation with paging.

UNIT – IV	08 Hours

Storage Management

Virtual Memory – Background, Demand Paging, Copy - on-write, Page replacement algorithms, Thrashing

Mass Storage Structure – Disk Structure, Disk Scheduling, Disk Scheduling algorithms, Disk Management.

UNIT – V	08 Hours
Introduction to Unix: Introduction**,** Basic commands, File Permissions, simple filters: head, tail, cut, paste, sort, unique, tr. Advanced filter: grep global regular expression. Introduction to Shell Scripts and Command Line Arguments.	

TEXT BOOKS:

1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 8th Edition, Wiley – India, 2009
2.	Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006

REFERENCE BOOKS:

1.	UNIX: The Complete Reference: Kenneth Roson et al, Osborne/McGraw Hill, 2000.
2.	UNIX and Shell Programming: M G Venkateshmurthy, Pearson Education Asia, 2005
3.	D M Dhamdhere: Operating Systems – A Concept Based Approach, 2nd Edition, Tata McGraw – Hill, 2002.

WEB LINKS:

1.	**To Understand Operating System Basics:** https://nptel.ac.in/courses/106/105/106105214/ https://nptel.ac.in/courses/106/106/106106144/
2.	**To Understand Basics in Unix:** https://www.youtube.com/watch?v=1hf_0EeOYBY (NPTEL IIT Madras)
3.	**Shell Script:** https://www.youtube.com/watch?v=48zApVSX97s (NPTEL IIT Madras)

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Explicate the core structure and functionality of Operating Systems.
CO2	Interpret the various process management and synchronization mechanisms.
CO3	Analyze the knowledge of occurring deadlock concepts and apply wide range of problem solving methods to solve deadlocks.
CO4	Identify and analyze the performance of different memory management techniques, page replacement and disk scheduling algorithms.
CO5	Identify Unix commands, interpret file attributes, filters and write shell scripts.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	1	1			1			
	CO2	2	2	2		1			
	CO3	2	2	2		1			
	CO4	2	2	2		1			
	CO5	2	2	1	1	1			

1: Low, 2: Medium, 3: High

Professional Web Development – I

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N1MC03	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Interpret the basic concepts of Web environment, HTML, CSS and Http
2.	Implement simple web applications with the elements of JQueries and JavaScripts.
3.	Interpret and use the platform of Java Enterprise Edition, Web Development and the usage of Builder Tool.
4.	Interpret and use the XML based Web technologies
5.	Interpret to build projects infrastructure with the usage of management and Comprehension tools

UNIT– I	08Hours
How the Web Works: Web Applications in Comparison to Desktop Applications, Static Web sites versus Dynamic Web sites, Internet Protocols. **Http**:Hypertext Transfer Protocol, Headers, Request Methods, Response Codes. **HTML**: Structure of HTML Documents, DOCTYPE, HTML Tables and Forms **Front End Design:** Cascading Style Sheet (CSS): Introduction to CSS – Basic syntax and structure, Box Model, In-line Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, manipulating text, Positioning using CSS.	

UNIT– II	08Hours
Bootstrap: Getting Started with Bootstrap- Mobile-irst design ,Why Bootstrap, Including Bootstrap in your HTML file, The Bootstrap CDN, Overriding with custom CSS, Using the Bootstrap customizer, Deep customization of Bootstrap, Downloading the Bootstrap source code, ,using the Bootstrap Grid-using the Bootstrap Grid classes, Customizing the grid for small devices, Adding offsets to columns, Pulling and pushing columns, Nesting columns, Using LESS with Bootstrap, Customize and extend Bootstrap with LESS, a CSS preprocessor, to take advantage of the variables, mixins, and more used to build Bootstrap's CSS. Compiling LESS files, using SimpLESS to compile LESS files, using WinLess to compile LESS files, using the command line to compile LESS files, Putting it all together.	

UNIT– III	08Hours
JavaScript: Client-Side Scripting, The Client-Server Model, The Request-Response Loop, Asynchronous data requests. **Document Object Model** (DOM): Inner elements and modifying DOM element. **Advanced JavaScripts and JQuery**: Java Script Pseudo-Classes, Object literals, Emulate Classes through Functions, Using Prototypes, JQuery foundations: Including jQuery in the Javascript Page, JQuery selectors.	

UNIT– IV	08 Hours
XML and XSLT: An introduction to XML and XSLT: What isXML?, WhatisXSLT and how does it work?, The Document Type Definition (DTD) used in XML, The XML Schema Definition (XSD) ,Transforming XML to XHTML, using XSLT, Basic elements in XSLT, Generating loops with XSLT, Sorting XML data with XSLT, Using XSLT filtering and query features. **JSON**: Introducing JSON, JSON Grammar, JSON values, JSON tokens, JSON object.	

AJAX: Under standing AJAX ,XML and JSON for Ajax: The Character Decode**AJAX**: Under standing AJAX ,XML and JSON for Ajax: The Character Decode

UNIT– V	**08Hours**
MAVEN: Getting started with Maven, Setting up Maven, Maven Dependency Management, Using Repositories, Dependency identification. Maven Project basics, Understanding POM.XML. Properties in POM.XML. **Node.JS:** Setting Up for Node.js Development, Understanding Node.js, Node.js functions: anonymous functions	

TEXTBOOKS:

1.	Fundamentals of Web Development by Randy Connolly (Unit-I, Unit-II), Pearson Edition 2015, ISBN 10: 1292057092, ISBN 13: 978-1-29-205709-5
2.	Learn Java for Web Development, Authors: Vishal layka, Apress edition-2014, ISBN-13 (pbk): 978-1-4302-5983-1, ISBN-13 (electronic): 978-1-4302-5984-8 (Unit-III)
3.	BOOTSTRAPPING doing more with LESS,Publisher: Hachette Book Publishing India Pvt Ltd, ISBN: 9789380143125, 9789380143125
4.	Ajax on Java, Steven Douglas Olson, OReilly-2007, ISBN-10: **0-596-10187-2** (Unit-IV)
5.	Introducing Maven Apress: By BalajiWaranasi ,Apress release-2014, ISBN-13 (pbk): 978-1-4842-0842-7 (Unit-V)
6.	Begin Node.js by Basarat Ali syed, Apress release-2014, ISBN-13 (pbk): 978-1-4842-0188-6 (Unit-V)
7.	D3.js Quick Start Guide, Matthew Huntington, 2018 Packt Publishing, ISBN-13: 978-1789342383
8.	Web Programming Building Internet Applications, Chris Bates, Wiley India, 3rd Edition, 2020, ISBN: 9780470017753

REFERENCE BOOKS:

1.	Principles of web Design, JOELSKLAR,2000
2.	XML, Solomon.H,Simon Ph.D, McGrawHill, 2001

WEBLINKS:

1.	https://www.w3schools.com
2.	https://getbootstrap.com/2.0.1/less.html#compiling
3.	https://www.freecodecamp.org/
4.	https://www.javatpoint.com/
5.	https://www.json.org/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	***Design and develop*** simple web applications with the elements of HTML and CSS.
CO2	***Design and develop*** web applications with the usage of Bootstrap in HTML and CSS.
CO3	***Develop*** advanced Java Scripts using DOM and JQuery.
CO4	***Implement*** the usage of XML and its supportive components
CO5	***Interpret, setting up*** and ***implement*** the usage of package management tools such as Maven, NodeJs

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	2	1			
	CO4	2	2	2	2	1			
	CO5	2	2	2	2	1			

1: Low, 2: Medium, 3: High

Object Oriented Programming with Java

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N1MC04	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Comprehend the fundamental concepts of Java environment and Object oriented programming, interpretation of Classes, Objects and the various methods usage.
2.	Interpret and implement Java basic programming with the concepts such as packages, inheritance, interfaces and usage of exceptions and I/O streams.
3.	Interpret and implement of Thread life cycle methods, multi-threading, synchronization and running Applets.
4.	Interpret various Java class types and fundamentals of Networking with Java

UNIT – I	08 Hours
Java Programming Fundamentals: The Java Language, The Key Attributes of Object-Oriented Programming, The Java Development Kit, A First Simple Program, Handling Syntax Errors, The Java Keywords, Identifies in Java, The Java Class Libraries. Introducing Classes, Objects and Methods Class Fundamentals, How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, Parameterized Constructors, The new operator Revisited, Garbage Collection and Finalizers, The this Keyword.	

UNIT – II	08 Hours
A Closer Look at Methods and Classes: Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs: Variable-Length Arguments. Inheritance **Inheritance Basics**, Member Access and Inheritance, Constructors and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed, Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes, Using final, The Object Class.	

UNIT – III	08 Hours
Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces, Interfaces can be extended, Nested Interfaces, Final Thoughts on Interfaces. **Packages** : Package Fundamentals, Packages and Member Access, Importing Packages, Static Import. **The Exception Hierarchy:** Exception Handling Fundamentals, The Consequences of an Uncaught Exception, Exceptions Enable you to handle errors gracefully, using Multiple catch clauses, Catching subclass Exceptions, try blocks can be nested, Throwing an Exception, A Closer look at Throwable, using finally, using throws, Java's Built-in Exceptions, New Exception features added by JDK 7, Creating Exception Subclasses.	

UNIT – IV	08 Hours
Multithreading fundamentals The Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread Priorities, synchronization, using Synchronization Methods,The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads.	

UNIT – V	08 Hours
Auto boxing and Annotations Enumerations, Java Enumeration are class types, The Values () and Valueof() Methods, Constructors, methods, instance variables and enumerations, Auto boxing, Annotations(metadata) Networking with Java.net **Networking fundamentals** The Networking classes and Interfaces, The InetAddress class, The Socket Class, The URL class, The URLConnection Class, The HttpURL Connection Class.	

TEXT BOOKS:

1.	Jim Keogh, The complete Reference J2SE, Tata Mc_Graw Hill , 2002
2.	Herbert Schildt The Complete reference,7th Edition,TaTa McGraw Hill,2007

REFERENCE BOOKS:

1.	J2SE Architecture Book, B.V.Kumar, ISBN: 9780070621633,2007
2.	Programming with Java, E.Bala guru swamy, 6th Edition,2019

WEB LINKS:

1.	https://www.roseindia.net/
2.	https://javatpoint.com/
3.	https://tutorialspoint.com/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Interpret Java environment and object oriented programming with the usage of Classes, Objects and the various methods.
CO2	Interpret and implement Java basic programs with the concepts such as packages, inheritance,interfaces and usage of exceptions and I/O streams.
CO3	Interpret and implement Thread life cycle methods, multi-threading and synchronization.
CO4	Interpret and implement various Java class types and interface networking with Java.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	3	2	1	1	1			
	CO2	3	3	2	1	1			
	CO3	3	3	2	1	1			
	CO4	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Computer Networks

Contact Hours/Week	:	3+0 (L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N1MC05	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Understand computer networks by going through basic terminologies and concepts.
2.	implement aspects of network applications, including application layer protocols, clients, servers, processes and interfaces.
3.	Understand the principles as to how two entities can communicate reliably over a medium through series of complicated scenarios.
4.	Understand how forwarding and routing functions of the network layer.
5.	Understand different types of link layer channels, broadcast channels and HFCs, To get clear idea about wireless Internet devices, mobility related services.

UNIT – I	08 Hours
Introduction to Computer Networks, Protocol layers: Computer Networks and the Internet: What is Internet? The network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attacks.	

UNIT – II	08 Hours
Application Layer: Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, DNS- The Internet's Directory Service: Services provided by DNS, overview of how DNS works.	

UNIT – III	08 Hours
Transport Layer: Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP: TCP Connection, Segment structure, Round Trip Time estimation and Timeout.	

UNIT – IV	08 Hours
The Network Layer: Overview of Network Layer, What's inside a Router? The Internet Protocol (IP), Routing Algorithms: Link State Routing Algorithm, Distance-Vector Routing Algorithm.	

UNIT – V	08 Hours
The Link Layer: Introduction to the link layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols: Channel Partition, Random Access protocols, Taking-turns protocol, Link-layer addressing.	

TEXT BOOKS:

1.	James F Kurose and Keith W Ross "Computer Networking": A Top-Down Approach (7th Edition), Pearson Publication, 2017

REFERENCE BOOKS:

1.	Andrew S. Tanenbaum and David J. Wetherill, “Computer Networks”, 5th edition, Prentice Hall, 2014.
2.	Larry L Peterson and Bruce S. Davie, "Computer Networks”: A Systems Approach 6th Edition, Morgan Kaufmann. 2016.

WEB LINKS:

1.	https://gaia.cs.umass.edu/kurose_ross/lectures.php
2.	https://gaia.cs.umass.edu/kurose_ross/interactive/
3.	https://gaia.cs.umass.edu/kurose_ross/knowledgechecks/
4.	https://nptel.ac.in/courses/106105081
5.	https://archive.nptel.ac.in/courses/106/105/106105183/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Interpret the different network components and layers.
CO2.	Illustrate the functionalities of the predominant protocols of application layer.
CO3.	Analyse the functionalities and services of Transport layer.
CO4.	Interpret the functionalities of network layer.
CO5.	Illustrate various functionalities of link layer and its protocols.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO105.1	2	1	1		1			
	CO105.2	2	1	1		1			
	CO105.3	2	1	1		1			
	CO105.4	2	1	1		1			
	CO105.5	2	1	1		1			

1: Low, 2: Medium, 3: High

Professional Web Development – I Lab

Contact Hours/Week	:	3	Credits	:	1.5
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N1MCL1	Course	PCCL	

Course Objectives:

This Course will enable students to:	
1.	Implement the usage of Web environment and demonstrate the functionality of static and dynamic web elements such as HTML5,CSS,Http.
2.	Design and validate XML based web applications with the elements of DTD, XSD, XSLT, JQueries and Java Scripts.
3.	Use the platform of Java Enterprise Edition, Web Development, to develop web applications using JSON and web builder tools such as MAVEN.

Sl.no	Programs
1.	Develop HTML5 static web pages of an online Book store. The pages should resemble: www.amazon.com. The website should consist of the following pages. o Home page o Registration and user Login o User profile page o Books catalog
2.	Develop and demonstrate the usage of inline, internal and external style sheet using CSS. Aim: Design a web page using CSS which includes the following: i) Use different font styles ii) Control the repetition of image with background-repeat and no-repeat property iii) Define style for links as a: link, a: active, a: hover, a: visited iv) Add customized cursors for links.
3	Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
4	Develop and demonstrate, using javaScript script, a HTML5 document that collects the USN (the valid format is:[1AA11AAA11] A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by three upper-case characters followed by two digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.
5.	Design an XML document to store information about a student in a college. The information must include USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
6.	Write a JavaScript program to do the following a) Get the current date and time b) Reverse the given string c) Execute mouse events
7.	Write a program for implementing XML document for CUSTOMER DETAILS. Write a Document Type Definition (DTD) to validate XML for CUSTOMER DETAILS.
8.	Write a program to display contents of XML file in a table using Extensible Style Sheets.

WEB LINKS:

1.	https://www.w3schools.com/nodejs/
2.	https://www.w3schools.com/xml/
3.	https://javascript.info/
4.	https://www.javatpoint.com/
5.	https://www.w3schools.com/nodejs/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Design and develop web applications with the usage of the web elements HTML5, CSS and Bootstrap
CO2	Develop a dynamic web page using JavaScript (client-side programming)
CO3	Design and develop XML based applications with the usage of supportive elementsDTD, XSD, XSLT and JSON.
CO4	Setting up and implement the usage of package management tools such as Maven, Node.JS for Web applications.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Java lab

Contact Hours/Week	:	3	Credits	:	1.5
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N1MCL2	Course	PCCL	

Course Objectives:

This Course will enable students to:	
1.	Design and build Java applications with the implementation of basic Java object oriented methods dynamically.
2.	Implement the mutable and unmutable elements and console based implementation of Java String and Thread API .
3.	Design and build Java web applications and implement the usage of packages and enumerations.

Sl.no	Programs
1.	Program on object oriented concepts
2.	Program on this keyword
3	Programs on method overloading and overriding
4	Program on Varargs
5.	Programs on inheritance concepts
6.	Programs on packages
7.	Programs on abstract classes and interfaces
8.	Programs on Exception handling
9.	Programs on multithreading
10.	Programs on autoboxing and annotation

WEB LINKS:

1.	https://www.roseindia.net/
2.	https://javatpoint.com/
3.	https://tutorialspoint.com/
4.	https://w3schools.com/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Implement Java programming language features.
CO2	Design and develop Inheritance, interfaces and packages
CO3	Design and implement the usage of exception handling
CO4	Demonstrate the concept of multithreading, autoboxing and annotation

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1	1	1	1			
	CO2	2	1	1	1	1			
	CO3	2	1	1	1	1			
	CO4	2	1	1	1	1			

1: Low, 2: Medium, 3: High

Aptitude Related & Analytical Skill

Contact Hours/Week	:	36 Hours for the entire semester	Credits	:	0
Total Lecture Hours	:	-	CIE Marks	:	100
Total Tutorial Hours	:	-	SEE Marks	:	-
Course Code	:	N1ARAS	Course	AEC	

Modules Covered:

Sl. No.	Module covered	Duration (in hrs.)
1	Quantitative Aptitude	16
2	Verbal Reasoning	08
3	Logical Reasoning	08
4	Test taking strategies to crack recruiter tests	02
5	Post-Training Assessment along with debrief	02
	Total Course	**36**

Methodology: Instructor led – Concepts with guided question-solving, assignments and homework assessments

Sl.no	Programs
1.	**Quantitative Aptitude (with focus on questions from top recruiters) (16 Hours)** a) Number System • Classification of numbers • Divisibility tests • Power cycles and remainders • Factors and multiples • Applications of HCF and LCM b) Profit and Loss, Partnerships and Averages • Basic terminology in Profit and Loss • Partnerships • Averages and weighted averages • Mixtures and alligations c) Time and Work • Working with different efficiencies • Pipes and cisterns • Work equivalence • Division of wages d) Time, Speed and Distance • Basics of Time Speed and Distance • Relative Speed • Problems based on trains • Problems based on boats and streams • Problems based on Races e) Percentages, Simple and Compound Interest • Percentages as fractions and decimals • Percentage increase / decrease

	• Simple interest and compound interest • Relationship between simple and compound interest f) Permutation, Combination and Probability • Fundamental counting principle • Basics of permutation and combination • Computation of permutation • Circular permutation • Computation of combination • Probability g) Logarithms, Progressions, Geometry and Quadratic Equations • Logarithms • Progressions – Arithmetic, Geometric and Harmonic • Geometry • Mensuration • Quadratic equations
2.	**Verbal Reasoning (with focus on questions from top recruiters)– (8 Hours)** a) Reading Comprehension – • Eyespan • Speed reading techniques • Types of questions • Comprehension strategies b) Sentence Correction – • Subject-Verb Agreement • Parallelism • Modifiers • Pronoun Antecedent Agreement • Verb Time Sequence • Comparison • Determiners • Prepositions c) Vocabulary – • Etymology of words • Prefix and suffix • Memory techniques to remember words • Synonyms and antonyms • Analogy d) Sentence Completion and Para Jumbles – • entence completion – single blank and double blank questions • Parajumbles – Moving and anchored jumbles
3	**Logical Reasoning (with focus on questions from top recruiters) - (8 Hours)** a) Coding and Decoding, Series, Analogy, Odd Man Out and Visual Reasoning • Coding and decoding • Number and alphabet series

	• Analogy • Odd man out • Visual Reasoning b) Data Arrangements and Blood Relations • Linear, circular and distribution arrangements • Blood Relations c) Data interpretation and Data Sufficiency • Tables • Pie Charts • Bar Graphs • Data Sufficiency c) Clocks, Calendars, Direction sense and Cubes • Clocks • Calendars (Conventional and shortcut methods to find day of a date) • Cubes • Direction Sense
4	**Test taking strategies – (2 Hours)** Thismodule will focus on: • Understanding patterns of tests (Adaptive, non adaptive,navigation – intra sectional, inter sectional) • Best strategies to maximize scores and clear cut-offs • Shortcut strategies on Quantitative Aptitude, Logical Reasoning as well as Verbal Ability to ace sections
5.	**Post Training Assessment with debrief – (2 Hours)** An assessment that tests a student on all three sections of Aptitude, followed a detailed student-wise analysis based on: • Cut-off • Percentile w.r.t the batch • Percentile w.r.t. the college • Corrective measures to be taken to improve the score In class, there will be a debrief on how the test should have been takenby an ideal test taker to navigate through the difficulties and ace the cut-off.
6.	**Tests outside training schedule** An ideal aptitude training course is a mix of classroom learning / guided question solving, followed by self-practice. The 'training duration' focuses mainly on laying strong foundations on concepts and ability to solve questions on major aptitude topics. Significant amount of practice is also provided to students through online tests in the form of: 1. Pre-Assessment test 2. Full-length practice tests 3. Company specific tests (patterns and question types of major recruiters should be given exposure to)

Reference material –

1. 'Aptipedia', Wiley India
2. 'Quantitative Aptitude for Competitive Examinations' by R S Agarwal
3. 'The Pearson Guide to Verbal Ability' by Nisht K Sinha

Basic Programming

Contact Hours/Week	:	3	Credits	:	0
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N1MCBC	Course	BC	

Course Objectives:

This Course will enable students to:	
1.	Write algorithms and draw flowcharts.
2.	Learn the fundamental programming concepts and methodologies.
3.	Implement well-structured program using C.

UNIT – I	08 Hours

Algorithms and Flowcharts

The meaning of algorithms, Flowcharts and their need, Writing algorithms and drawing flowcharts for simple exercises like finding biggest of three numbers, to find roots of given quadratic equation, to find the biggest and smallest of given set of numbers and such other simple examples.

Constants, Variables, and Data Types

Character set, C tokens, keywords & identifiers, structure of C program, executing a C program. Constants, variables, data types, declaration of variables.

Operators

Arithmetic operators, relational operators, logical operators, assignment operator, increment and decrement operator, conditional operator.

UNIT – II	08 Hours

Managing Input and Output Operations:

The scanf() & printf() functions for input and output operations, reading a character, writing a character, (the getchar() & putchar() functions) , the address operator(&), formatted input and output using format specifiers, Writing simple complete C programs.

Decision Making and Branching

Decision making with if statement, simple if statement, the if..else statement, nesting of if..else statements, the switch statement, the ? : operator.

Decision Making and Looping

The while statement, the do- while statement, the for statement.

UNIT – III	08 Hours

Array:

The meaning of an array, one dimensional and two dimensional arrays, declaration and initialization of arrays, reading , writing and manipulation of above types of arrays, multidimensional arrays.

Strings:

Declaring and initialing string variables, reading string from terminal, writing string to screen, string handling functions.

UNIT – IV	08 Hours

User Defined Functions:

Need for user defined functions, a multi function program, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, category of functions, no arguments and no return values, arguments but no return values, arguments with

return values, no arguments with return value, functions that return multiple values, nesting of functions, recursion, passing arrays to functions.

UNIT – V	08 Hours
Structures: Defining a structure, declaring structure variables, accessing structure members, structure initialization, array of structures. **Pointers:** Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer.	

TEXT BOOKS:

1.	E Balagurusamy, Programming in ANSI C, 8th Edition 935316513X · 9789353165130, © 2019 | Published: March 15, 2019
2.	P B Kottur Computer Concepts and C Programming 23rd Edition, March 2013.

REFERENCE BOOKS:

1.	Kerningham Dennis Ritchie, The C programming language (ANSI C version), 2 nd Edition, PHI India,1988.
2.	Jeri R Hanly Elliot B Koffman, Problem solving and program design in C Person Addison Wesley 2006
3.	Yashwant Kanetkar, Let us C, 6th Edition , BPB publication,2018

WEB LINKS:

1.	https://assets.cambridge.org/97811087/82562/excerpt/9781108782562_excerpt.pdf
2.	https://egyankosh.ac.in/bitstream/123456789/9471/1/Unit-1.pdf
3.	https://www.programiz.com/c-programming
4.	https://www.geeksforgeeks.org/c-programming-language/
5.	https://www.mygreatlearning.com/academy/learn-for-free/courses/c-programming

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Apply Algorithms and Flowcharts while developing programs. .
CO2	Design and develop programs using Branching, looping,input and output statements.
CO3	Design programs using Arrays and Strings.
CO4	Analyze the use of User Defined Functions.
CO5	Design programs using Structures and Pointers

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	1	1				
	CO2	2	2	1	1				
	CO3	2	2	1	1				
	CO4	2	2	1	1				
	CO5	2	2	1	1				

1: Low, 2: Medium, 3: High

II Semester

Database Management Systems

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N2MC01	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Understand the different issues involved in the design and implementation of a database system.
2.	Study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3.	Understand and use data manipulation language to query, update, and manage a database
4.	Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
5.	Analyze relational and non-relational data model to check the performance of the data models with respect to design and manipulations

UNIT – I	**08 Hours**
Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.	

UNIT – II	**08 Hours**
Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two. **Relational Model and Relational Algebra:** Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.	

UNIT – III	**08 Hours**
Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, More Complex SQL Retrieval Queries, Views (Virtual Tables) in SQL, Schema Change Statements in SQL ,Discretionary Access Control Based on Granting and Revoking Privileges, Transaction Support in SQL (Commit, Rollback, Save point)	

UNIT – IV	08 Hours
Introduction to PL/SQL programming, PL/SQL blocks, Cursor types, Stored Procedures, Functions, Exception handling, Packages and Triggers. Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Cod Normal Form, Denormalization,	

UNIT – V	08 Hours
NoSQL, SQL versus NoSQL, Types of NoSQL Databases, CAP theorem, Getting Started with MongoDB – Documents, Collections, Databases, Getting and Starting MongoDB, MongoDB Shell, Data Types, Inserting and Saving Documents, Removing Documents, Updating Documents, Introduction to find, Query Criteria, Type Specific Queries and $where Queries	

TEXT BOOKS:

1.	Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Pearson Publishers, 2016 (Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 10,11)
2.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003. (Chapters 16, 17.1, 17.2, 18)
3.	Professional NOSQL, Shashank Tiwari, 2011, Inc.WROXPress, John Wiley & Sons, ISBN: 978-0-470-94224-6,
4.	MongoDB: The Definitive, Guide Kristina Chodorow and Michael Dirolf, 1st Edition, 2010 O'Reilly Media, ISBN: 978-1-449-38156-1.
5.	PL/SQL Programming: Develop Powerful PL/SQL Applications, - Scott Urman 5th Edition, 2010, TaTa McGraw –Hill Publications, ISBN: 0-07-048680-8.

REFERENCE BOOKS:

1.	Silberschatz, Korth and Sudharshan: Data base System Concepts, 5th Edition, Mc-GrawHill, 2006.
2.	C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education, 2006.
3.	Oracle PL/SQL Best Practices by Steven Feuerstein, O'Reilly Publications, 2nd Edition, ISBN – 10-81-8404-541-7, 2007

WEB LINKS:

1.	https://nptel.ac.in/courses/106/105/106105175/
2.	https://www.youtube.com/watch?v=T7AxM7Vqvaw&t=10s
3.	https://www.youtube.com/watch?v=BPHAr4QGGVE
4.	https://www.youtube.com/watch?v=uD3p_rZPBUQ
5.	https://www.youtube.com/watch?v=t4wPUQ5RElY

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	**Identify** the fundamentals of database technologies and its different architectures
CO2.	**Analyse** the Entity Relational model concepts and **Design** relational algebraic expressions for SQL queries
CO3.	**Illustrate** the various concepts of SQL and **Develop** Queries to perform CRUD (Create, Retrieve, Update and Delete) operations on database
CO4.	**Analyze** the fundamentals of PL/SQL Programming constructs and its relevance to the applications and **Apply** the database design process with Normalization concepts.
CO5.	**Implement** relational and non-relational data model for any given problem and analyze performance of the data models with respect to design and manipulations

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	1		1			
	CO2	2	2	1		1			
	CO3	3	2	2	1	1			
	CO4	2	2	2	1	1			
	CO5	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Advanced Java

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N2MC02	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Interpret and implement of Java Collection Framework elements.
2.	Design and build Java Swing GUI applications
3.	Implement event handling mechanism using swing components.
4.	Implement JDBC concepts and build applications integrating relational databases.
5.	Design and build Java web applications using Servlets and JSP integrating JDBC.

UNIT– I	08 Hours
Java Collection Framework: The Collections Framework: Collections overview, Recent changes to Collections, The Collection Interfaces, Java Collection API and framework, Collection Interface, List interface, Set interface, Queue interface, The Collection classes: ArrayList class, List, ArrayList, Queue,LinkedListclass,HashSetclass,TreeSetclass,AccessingaCollectionviaanIterator, Using an iterator, The For-Each alternative to iterators, User defined classes	

UNIT– II	08 Hours
Designing GUI using Swing Components: Introduction to Swings : Advantages of Swings over AWT, JLabel and ImageIcon, JTextField, JButton, JCheckBoxes, JRadioButtons, JList LayoutManagers: FlowLayout, BorderLayout. **Event Handling on Swing Components**: Introduction to EventHandling, Delegation Event Model mechanism, Event Classes: The ActionEvent Class, The MouseEvent Class, The WindowEvent Class, Event Listener Interfaces: The ActionListener Interface,The MouseListener Interface, The MouseMotionListener Interface, The WindowListener Interface.	

UNIT– III	08 Hours
JDBC Object The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of JDBC Process, Database Connection, Associating the JDBC/ODBC Bridge with the Database, Statement Objects, ResultSet, Transaction Processing, Metadata, Data Types, Exceptions. **JDBC and Embedded SQL** Model Programs, Tables, Indexing, Inserting Data into Tables, Selecting Data from a Table, Metadata, Updating Tables, Deleting Data from a Table, Joining Tables, Calculating Data, Grouping and Ordering.	

UNIT– IV	08 Hours
Servlets Introduction, Advantages of Servlets over CGI, Installing Servlets, Servlets Life Cycle, Servlet API, Handling HTTP GET Request, Handling HTTP POST Request, ServletContext, ServletConfig, Generic Servlet, HttpServlet. **Servlets – Cookies, Sessions -** Cookies: Creating and Reading a Cookie, Servlets Session Tracking, Designing dynamic GUI applications using Servlets.	

UNIT– V	08 Hours
Java Server Pages(JSP) Introduction to JSP, Advantages of JSP, JSP Architecture, Processing a JSP page, JSP access Models (Model1 & Model2), Developing FirstJSP, JSP Scripting Elements-(Directives, Declaratives, Scriplets, Expressions, Comments, Implicit Variables), PageDirectives, JSPActions, JSP accessing Database system	

TEXTBOOKS:

1.	JimKeogh,ThecompleteReferenceJ2EE,TataMc_Graw Hill,2002
2.	Herbert Schildt TheCompletereference,7thEdition,TaTa McGraw Hill, 2017
3.	Herbert Schildt The Complete Reference J2EE,Tata Mcgraw Hill, 7th Edition ,ISBN: 978-0-07-052912-0, 2017

REFERENCEBOOKS:

1.	J2SE Architecture Book, B.V.Kumar, ISBN:9780070621633, 2005
2.	Programming with Java ,E.Bala guruswamy, 6th Edition,2019
3.	J2EE Architecture Book, B.V.Kumar,ISBN:9780070621633.2005

WEBLINKS:

1.	https://www.roseindia.net/
2.	https://javatpoint.com/
3.	https://tutorialspoint.com/
4.	https://w3schools.com/
5.	https://www.roseindia.net/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Develop applications using Java Collection Framework API
CO2.	Develop Swing based application by adding event handling mechanism.
CO3.	Develop dynamic web applications using database connectivity and embedded SQL
CO4.	Design and Develop Client and Server side programs using servlets.
CO5.	Design and Develop web applications using JSP.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	1					
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			
	CO5	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Professional Web Development – II

Contact Hours/Week	:	3+2(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Practical Hours	:	26	SEE Marks	:	50
Course Code	:	N2MCI01	Course	IPCC	

Course Objectives:

This Course will enable students to:	
1.	Interpret and implement the services of Web services technologies: WSDL,SOAP
2.	Interpret TypeScript , Construct, compile TypeScript file and Interpretation of Angular 2
3.	Design and develop Angular web application which creates rich interactive Features with reducing code to build user interface applications.
4.	Interpret about what a Restful API for web development and how it is structured and the usage of Spring Boot and Deployment process.
5.	Discover the Spring MVC model and Architecture principles and how the components impact Application Development

UNIT– I	**08 Hours**

WSDL:
Web services Description Languages Inside WSDL,The WSDL document Type Element, Message Element, PortType Element, Binding Element, Port Element, Service element.
Simple Object Access Protocol(SOAP): SOAP one-way transmission primitive, SOAP request-response transmission primitive, SOAP binding element, SOAP operation element, SOAP body element, SOAP fault element, SOAP header element, SOAP address element, WSDL and HTTP binding
Practical Component:
1) Implement the service of Web Services Description Language (WSDL). Create and use your own function and execute it using WSDL.
2) Implement the service of Simple Object Access Protocol (SOAP). Create and use your own function and execute it using SOAP.

UNIT– II	**08 Hours**

Introduction to TypeScript: Understanding TypeScript, Installing TypeScript, Building first TypeScript file, Compiling TypeScript, Annotations, Interfaces, Classes and Running TypeScript web app.
Angular2:
Getting Started - What is Angular?, Angular applications: the essentials(Components, Templates, Dependency Injection, Angular CLI, First Party Libraries)
Understanding Angular: Overview, Components(Overview, Component Lifecycle, View Encapsulation, Component Interaction, Component Styles, Parent and Child Component Interaction, Content Projection, Dynamic Components, Angular Elements), Templates(Overview, Introduction, Text Interpolation, Template Statements, Binding(Understanding Binding, Attribute Binding, Class and Style Binding, Event Binding, Property Binding, Two-Way Binding), Dependency Injection(Dependency Injection in Angular, Understanding Dependency Injection, Creating an Injectable service, Defining dependency providers, Hierarchical injectors)
Practical Component:
1) Create a new project using AngularJs and implement the User Interface Service operations.
2) Design and develop Angular 2 application and implement the Event Binding operations

UNIT– III	08 Hours
Spring Framework: Basics of Spring architecture, environment setup, Inversion Of Control containers, First Spring Application, Spring Dependency Injection, Applying different configurations: Using Annotations and XML configuration **Spring Boot:** Pre requirements, Spring Boot, Running Spring Boot application, working with classes and dependencies, Spring Boot-Tomcat Deployment. Spring Boot servlet initializer, Update packaging JAR into WAR. **Practical Component:** 1) Design and build a web application using Spring Framework 2) Implement Dependency Injection using Annotations configuration process or XML Configuration process.	

UNIT– IV	08 Hours
RESTAPI: Introduction to RESTful webservices,, RESTful key elements, RESTful methods,RESTful Architecture, RESTful principles and constraints, creating first RESTful webservice, Running and testing first RESTful webservice, POSTMAN for API Testing. **Exposinga RESTAPI**: RESTful, Spring Data within Spring Application **Practical Component:** 1) Design and build RESTful Web Service with Nodejs or express. 2) Design and build RESTful Web Service to implement data operations.	

UNIT– V	08 Hours
Spring MVC: Model 1 architecture, Model2- MVC architecture, Model 2 with Front Controller, Controller without a view, with a view, with a view and using ModelMap, Controller for a simple form, simple form with validation **Practical Component:** 1) Design and build first web application using Spring Boot Framework. 2) Design and build a MVC Application using Spring Boot Framework and add some useful services.	

TEXTBOOKS:

1.	Understanding web services XML, WSDL, SOAP and UDDI, Eric New Comer, David chappell Series Editor, Pearson Education, ISBN 0-201-75081-3
2.	https://www.typescriptlang.org/docs/handbook/typescript-tooling-in-5-minutes.html Sridhar Rao : Web Development with Angular and Bootstrap, 3rd Edition, Packt, ISBN: 978-1-78883-810-8,2019
3.	Web Development with go,Building scalable web Apps and RESTful Services ShijuVarghese,Apress.ISBN-13 (pbk): 978-1-4842-1053-6, Felipe Gutierrez, 2015
4.	Spring Framework, Apress Edition, ISBN:9781430265337,2014
5.	Mastering Spring 5, RangaRaoKaranam, 2nd Edition, 2019, Packt Publishing, 1789618169, 9781789618167 –unit – 5
6.	Spring in action, Walls, Craig, and Ryan Breidenbach, 6th Edition, 2020, Dreamtech Press, ISBN – 9781617297571 – unit - 4

REFERENCEBOOKS:

1.	RESTful API Design, Matthias Biehl, API University Press, 2016
2.	Spring in Action,ISBN-13:978-1617294945, 2018
3.	ANGULAR, Lakshmi Kamala Thota, ISBN:9789389932072,9789389932072, 2020

WEBLINKS:

1.	https://www.soapui.org/docs/soap-and-wsdl/working-with-wsdls/ https://www.typescriptlang.org/docs/handbook/typescript-tooling-in-5-minutes.html
2.	https://angular.io/docs
3.	https://www.w3schools.com//CSS/
4.	https://restfulapi.net/
5.	https://spring.io/
6.	https://getbootstrap.com

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Create, Configure and deploy WSDL and SOAP for web services.
CO2.	Interpret and implement TypeScripts , interpret and implement the essential aspects of Angular 2 components, controllers and services.
CO3.	Interpret and implement the usage of Spring framework and Spring Boot framework concepts
CO4.	Implement RESTful API in accessing and using the data.
CO5.	Build, configure and develop Spring MVC model services.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			
	CO5	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Software Engineering and Project Management

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MC04	Course	PCC	

Course Objectives:

This Course will enable students to:	
1.	Define software engineering and explain its importance.
2.	Discuss the concepts of software products and software processes.
3.	Introduce the notion of professional responsibility.
4.	Deliver successful software projects that support organization's strategic goals.
5.	Plan and manage projects at each stage of the software development life cycle(SDLC).
6.	Create project plans that address real-world management challenges.

UNIT – I	08 Hours

Introduction to Professional Software Development and Ethics:
Professionalism in Software Engineering, Software Engineering Ethics, and IEEE/ACM Code of Ethics

Software Processes and Methodologies:
Overview of Software Processes, Waterfall, Incremental, and Plan-Driven Models, The Rational Unified Process (RUP), Extreme Programming (XP) and Scrum, Introduction to DevOps and DevOps vs. Agile, Case Study: Selecting Development Method for Real-world Problems.

UNIT – II	08 Hours

System Modeling and Architectural Design:
Context models; Structural models; Behavioral models; Model drivenengineering, Architectural Design: Architectural design decisions, Architectural patterns; Interaction Modeling: Use case models, Sequence diagrams; Structural modeling : Classdiagrams;

Agile Software Development and Project Management Overview:
Agile Methods and Principles; Plan- Driven and Agile Development; Agile Project Management; Scaling Agile Methods.

UNIT – III	08 Hours

Introduction to Project Management
Understanding the Importance of Software Project Management
Importance of software project management: What is a project? Problems with Software Projects What is Project Management? Stages of Project. The Feasibility Study Planning. Project Execution. The Stakeholder of Project. All parties of project. The Role of Project Manager. Project Management Framework Project Planning
Integration Management. What is Integration Management. Project Plan Development. Plan Execution. Scope Management. What is Scope Management? Methods for Selecting Projects. Project Charter. Scope Statement. Work Breakdown Structure. Stepwise Project Planning Overview. Main Steps in Project Planning.

UNIT – IV	08 Hours

Project Scheduling
Time Management. Importance of Project Schedules. Schedules and Activities. Sequencing and

Scheduling Activity. Project Network Diagrams. Network Planning Models. Duration Estimating and Schedule Development. Critical Path Analysis. Program Evaluation and Review Technique (PERT).

Project Quality Management

Quality of Information Technology Projects. Stages of Software Quality Management Quality Planning. Quality Assurance. Quality Control. Quality Standards. Tools and Techniques For Quality Control.

Project Communication Management

Communications Planning. Information Distribution. Performance Reporting. Administrative Closure. Suggestions for Improving Project Communications.

UNIT – V	**08 Hours**

Requirements Engineering and Quality Management

Requirements Engineering: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; the software requirements document, Requirements Specification, Characteristics and components of SRS, Structure of SRS (IEEE format)

Requirements Engineering Processes: Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

Software Quality Management

Software Quality, Software Standards, Software Measurement, Quality Management and Agile Development, Configuration Management, ISO 9001:2015 Standards

TEXT BOOKS:

1.	Ian Sommerville: Software Engineering, 9th Edition, Pearson Education Ltd., 2017. (Chapters-: 1, 2, 3, 4, 5, 8, 20, 21)
2.	Kathy Schwalbe, "Information Technology Project Management", International Student Edition, THOMSON Course Technology, 7th Edition 2014.

REFERENCE BOOKS:

1.	Guide to the Software Engineering Body Of Knowledge (SWEBOK Version 3) Library of Congress Online Catalog, 2014
2.	Roger.S.Pressman: Software Engineering-A Practitioners approach, 2009
3.	Waman S Jawadekar: Software Engineering Principles and Practice, 2004
4.	DevOps for Developers, Michael Huttermann, 2012, Apress, ISBN:978-1-4302-4569-8,
5.	Bob Hughes and Mike Cotterell, "Software Project Management", Fifth Edition, Tata McGraw-Hill, 2009

WEB LINKS:

1.	https://www.computer.org/education/bodies-of-knowledge/software-engineering
2.	The NATO Software Engineering Conferences (interesting historic material)
3.	*Software Engineering Code of Ethics and Professional Practice* established in a joint effort by IEEE-CS and ACM [copy at ACM]
4.	https://nptel.ac.in/courses/106/105/106105087/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Adopt software engineering principles for software development.
CO2	Identify the design and methods for application development.
CO3	Recognize the practices and methods for successful software project management
CO4	Demonstrate the activities involved in project scheduling, interpret the stages of project quality management, and achieve project communication strategies.
CO5	Analyze the functional and nonfunctional requirements.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1					1			
	CO2					1		1	
	CO3			1	2	1	3	1	
	CO4		2		2	1	3	1	
	CO5	2	2			1			

1: Low, 2: Medium, 3: High

Professional Elective – 1

C# and .Net

Contact Hours/Week	:	3	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	0	SEE Marks	:	50
Course Code	:	N2MCE14	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Understand the foundations of CLR execution.
2.	Learn the technologies of the .NET framework.
3.	Know the object oriented aspects of C#.
4.	Be aware of application development in .NET.

UNIT – I	08 Hours
Introduction to .NET: What is .NET, History of .NET, .NET Framework, Common Language Runtime (CLR), Common Language Infrastructure (CLI), Common Language Specification (CLS), Common Type System (CTS), Garbage Collector (GC), Just In-Time Compiler (JIT), Framework Class Library (FCL), and Framework Versions. Insights: CLR Services, Microsoft Intermediate Language (MSIL), Garbage Collector Generation, JIT Types, Types of Applications can be developed.	

UNIT – II	08 Hours
INTRODUCTION TO C#: What is C#, History of C#, C# v/s Java, Features of C#, VS IDE and Main Program: Solution Explorer Windows, Introduction on Project & Solution in Studio, Compiling and Building project, Command Line Args, Main method, Compilation using CommandLineUtility. Variables and Data types: Initialization of Variables, Variable Scope, Constants and Enums, Value Types and Reference Types, Anonymous and Dynamic Types, Implicit and Explicit Casting, Checked and Unchecked Blocks, Boxing and Unboxing, Static usage and benefits., Tuples, Operators, Statements, and Access Specifier: What is operator and expression, Types of Operator, Binary, Unary, Ternary, What is statement, Types of Statement, Declaration, Expression, Selection, Iteration, Jump, Using, Lock, Try and Catch, Checked and Unchecked, Access Specifier, Public, Private, Protected, Internal and Protected Internal, Functions/Methods: What is Function, Benefits and Usage, Syntax and Parts, Type of Function, Call by Value, Call By Reference, Call by Out, Call By Address, Async Methods, Extension Methods, Arrays and Strings: What is Array, Benefits and Usage, Declaring and defining Arrays, Multidimensional Arrays, Two-Dimensional, Three- Dimensional, Jagged Array, Resize Array, Access Array using Iterator Statements, String and uses of its operations.	

UNIT – III	08 Hours
OBJECT ORIENTED ASPECTS OF C#: Classes and Objects, What is Class and Object, Benefits and Usage, Types of Classes, Sealed, Abstract, Partial, Static, Nested, Constructor: Default /Parameterless Constructor, Parameterized Constructor, Private Constructor, Static Constructor, Copy Constructor, Using all types with example, Destructor/Finalizers, Instantiating class with new keyword to allocate memory, Use of this keyword, Property and Indexer: What is Property and Indexer, Benefits and Usage of them, Declaration and Definition, Types of Property, Read-Write Property, Read-Only Property, Static Property, What is indexer, Advantage of Indexer property, Comparison Between Properties and Indexers. Structure and Interfaces: What is structure?, Defining structure, Constructors for structure, Difference between Class and Structure, What is	

interface, Benefits of interface, Implicit and Explicit Implementation of interfaces, Derived Interfaces, Accessing Interfaces, Overriding Interfaces, Abstraction: What is Abstraction, Benefits and Usage, Abstract class and methods, Class v/s Abstract class, Abstract class v/s Interfaces

UNIT – IV	**08 Hours**
Inheritance, Polymorphism, Encapsulation: What is Inheritance, Benefits and Usage, Types of Inheritance, Multiple Inheritance using Interfaces, Inheritance with constructor and use of base constructor, Polymorphism: What is Polymorphism, Benefits and Usage, Types of Polymorphism, Compile Time, Run Time, Access modifier roles using Polymorphism, Data Hiding. Encapsulation: What is Encapsulation, Using encapsulation using different members, Boxing and Unboxing, Define Up - casting and Down – casting, Delegates and Events: What is Delegate, Benefit and use of Delegate, Delegate types: Named, Anonymous, Multicast, What is Event, Subscribe / Unsubscribe Events, Publish Events, Raise events in derived classes, Interface events, How to: Implement Custom Event Accessors	

UNIT – V	**08 Hours**
Collections and Generics, Exceptions Handling, MultiThreading: Introducing Collections, Benefits of Collection Classes, Understanding and using commonly used collections, Generics, Advantages of Generics, How Generics Work at Runtime, Constraint on Type Parameters, Generic Methods, Generic Collections, Selecting a Collection Class. Exceptions Handling: Defining Exception, Understandings try and catch keyword, Using "finally" block "using" statement, Throwing exceptions, Creating User defined/Custom Exception class, Exception v/s Error, MultiThreading: Threading Overview, Multithreading, Multiprocessing and Multitasking, Scheduling, Thread States, Programming Threads, Methods of Thread Class, Thread Pool, Thread Synchronization, Monitor, Mutex, Semaphore, Events, Parallel Programming using Task Parallel Library Asynchronous Programming using async and await keywords, Inter- Thread communication	

TEXT BOOKS:

1.	Herbert Schildt, "The Complete Reference: C# 4.0", Tata Mc Graw Hill, 2012.
2.	Christian Nagel et al. "Professional C# 2012 with .NET 4.5", Wiley India, 2012.

REFERENCE BOOKS:

1.	Andrew Troelsen , "Pro C# 2010 and the .NET 4 Platform, Fifth edition, A Press, 2010.
2.	Ian Griffiths, Matthew Adams, Jesse Liberty, "Programming C# 4.0", Sixth Edition, O"Reilly, 2010.

WEB LINKS:

1.	https://www.javatpoint.com/c-sharp-tutorial
2.	https://www.w3schools.com/cs/index.php
3.	https://www.tutorialsteacher.com/csharp

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Explicate the major elements of the .NET frame work
CO2	Elucidate Object Oriented Aspects of C#:
CO3	Analyze the basic structure of a C# application
CO4	Develop programs using C# on .NET

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	1	1		1	1			
	CO2	2	2		1	1			
	CO3	2	2		1	1			
	CO4	2	2		1	1			
	CO5	2	2		1	1			

1: Low, 2: Medium, 3: Highs

Software Testing

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MCE15	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Realize the principles of testing and need for testing
2.	Analyze various testing techniques and testing levels
3.	Gain knowledge on object oriented testing and fault based testing
4.	Prepare and execute test plan, mange defects and realize the use software matrix.

UNIT – I	**08 Hours**
Introduction to Software testing: Introduction to testing as an engineering activity, Testing fundamentals: why testing is necessary? What is testing? Software-testing principles, Software verification and validation, psychology of testing, the tester's role in a software development organization, **Test design Techniques: Static testing**- review, walkthrough, inspection testing types and techniques. **Dynamic testing**: Black box testing - boundary value analysis, equivalence partitioning (weak, strong and strong robust)	

UNIT – II	**08Hours**
Test design techniques: Dynamic testing- Black box testing: state transition, combinatorial testing types- decision table, cause effect graphing, White box testing: basis path testing, flow graph notation, cyclomatic complexity, code coverage testing: statement, condition, data flow, and branch.	

UNIT – III	**08 Hours**
Levels of testing: Unit Test, Integration tests - big-bang, top-down, bottom-up, sandwich; System Test; Regression Testing; Alpha, Beta and Acceptance Tests; Performance testing: load, stress, stability, scalability; Web testing: Introduction to web testing, web testing checklist.	

UNIT – IV	**08 Hours**
Object-Oriented Testing: Issues in Testing Object-Oriented Software, Object-Oriented Unit Testing, Object-Oriented Integration Testing, Object-Oriented System Testing. **Fault based testing:** Assumptions in fault-based testing, Mutation Analysis, Fault-based Adequacy Criteria; Variations on mutation Analysis.	

UNIT – V	**08 Hours**
Test Plan: Importance of Test Plan , steps to create a test plan **Test Execution:** Test Execution Process, Ways to Perform Test Execution, Test Execution Priorities, Test Execution States, Test Execution Report. **Defect/Bug Life Cycle in Software Testing**, Bug Report in Software Testing, **Software Testing Metrics**	

TEXT BOOKS:

1.	Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012
2.	Paul C Jorgensen, "Software Testing A Craftsman's Approach", Auerbach publications, 3rd edition, 2011.

REFERENCE BOOKS:

1.	Kshirasagara Naik, Priyadarshi Tripathy: Software Testing and Quality Assurance, Wiley India 2012 2. M.G.Limaye: Software Testing-Principles, Techniques and Tools – McGraw Hill, 2009
2.	Adithya P.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011
3.	Foundations of Software Testing ISTQB certification (Level I) by Dorothy graham, Erik van veenendaal, Rex black, Publisher : Cengage Publications, 3rd edition, 2015
4.	Ilene Burnstein, "Practical Software Testing", Springer international edition. Publisher : Springer; 1st edition , 2003

WEB LINKS:

1.	https://www.coursera.org/specializations/software-testing-automation
2.	https://www.udemy.com/course/everything-for-software-tester/
3.	https://www.udacity.com/course/software-testing--cs258
4.	https://www.greatlearning.in/academy/learn-for-free/courses/software-testing-fundamentals1
5.	https://www.guru99.com/software-testing.html
6.	https://onlinecourses.nptel.ac.in/noc19_cs71/preview
7.	https://testinginstitute.com/Free-Software-Testing-Training.php
8.	https://onlinecourses.nptel.ac.in/noc23_cs38/
9.	http://tryqa.com/what-is-software-testing/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Identify the importance of software testing as an engineering activity
CO2.	Apply software testing techniques for a given problem
CO3.	Distinguish the levels of software testing.
CO4.	Comprehend defect life cycle, importance of test plan and software testing metrics.
CO5.	Perform in a team to prepare a test report for a given scenario.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2							
	CO2	2	1	1		1			
	CO3	2				1			
	CO4	2	1			1			
	CO5	2	1		1	1			

1: Low, 2: Medium, 3: High

Introduction to Cyber Security

Contact Hours/Week	:	3(L)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Practical Hours	:		SEE Marks	:	50
Course Code	:	N2MCE16	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Familiarize cybercrime terminologies and perspectives
2.	Understand Cyber Offenses and Botnets
3.	Gain knowledge on tools and methods used in cybercrimes
4.	Understand phishing and computer forensics

UNIT – I	08 Hours

INTRODUCTION TO CYBERCRIME

CYBERCRIME

Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? Classifications of Cybercrimes, An Indian Perspective, Hacking and Indian Laws, Global Perspectives**.**

UNIT – II	08 Hours

CYBER OFFENSES

HOW CRIMINALS PLAN THEM

Introduction, How criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercaafe & cybercrimes.

BOTNETS

The fuel for cybercrime, Attack Vector.

UNIT – III	08 Hours

TOOLS AND METHODS USED IN CYBERCRIME

Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Spyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attackes, Attacks on Wireless networks.

UNIT – IV	08 Hours

UNDERSTANDING COMPUTER FORENSICS

Introduction, Historical Background of Cyber forensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics

UNIT – V	08 Hours

Setting up a Computer Forensics Laboratory:

Understanding the Requirements Computer Forensics. Forensics and Social Networking sites. The Security/Privacy Threats, Computer Forensics from Compliance. Perspective, Challenges in computer Forensics, special tools and Techniques, Forensics, Forensics Auditing, Anti Forensics.

TEXT BOOKS:

1.	Sunit Belapure and Nina Godbole, Cyber Security: Understanding Cyber Crime, Computer Forensic And Legal Perspectives, Wiley India Pvt Ltd, ISBN: 978-81-265-2179, 2013.

REFERENCE BOOKS:

1.	Cyber security: Managing Systems, Conducting Testing, and Investigating Intrusions ,Thomas J. Mowbray, John Wiley & Sons, 2013
2.	Cyber Security Essentials James Graham, Ryan Olson, Rick Howard CRC Press 2010

WEB LINKS:

1.	https://www.youtube.com/watch?v=yC_hFm0BX28&list=PLxApjaSnQGi6Jm7LLSxvmNQjS_rt9swsu
2.	https://www.youtube.com/watch?v=nzZkKoREEGo&list=PL9ooVrP1hQOGPQVeapGsJCktzIO4DtI4_
3.	https://www.youtube.com/watch?v=6wi5DI6du-4&list=PL_uaeekrhGzJlB8X QBxU3zhDwT95xlk

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Elucidate the cybercrime terminologies.
CO2	Describe Cyber offenses and Botnets
CO3	Illustrate Tools and Methods used on Cybercrime.
CO4	Elucidate Phishing and Identity Theft.
CO5	Justify the need of Computer Forensics.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2				1	1		
	CO2	2				1	1		
	CO3	2	1			1	1		
	CO4	2				1	1		
	CO5	2				1	1		

1: Low, 2: Medium, 3: High

Professional Elective – 2

Introduction to Internet of Things (IoT)

Contact Hours/Week	:	3	Credits	:	02
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MCE24	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Understand the fundamentals of Internet of Things and its building blocks along with their characteristics
2.	Understand the recent application domains of IoT in everyday life.
3.	Gain insights about the current trends of associated IoT technologies and IoT analytics.

UNIT – I	08 Hours
BASICS OF NETWORKING Introduction, Network Types, Layered network models EMERGENCE OF IoT Introduction, Evolution of IoT, Enabling IoT & the Complex Interdependence ofTechnologies, IoT Networking Components.	

UNIT – II	08 Hours
IoT SENSING AND ACTUATION Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.	

UNIT – III	08 Hours
IoT PROCESSING TOPOLOGIES AND TYPES Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading	

UNIT – IV	08 Hours
ASSOCIATED IOT TECHNOLOGIES Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. IoT Case Studies Agricultural IoT – Introduction and Case Studies	

UNIT – V	08 Hours
IoT CASE STUDIES AND FUTURE TRENDS Vehicular IoT – Introduction Healthcare IoT – Introduction IoT Analytics – Introduction	

TEXT BOOKS:

1.	Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT Cambridge University Press 2021
2.	S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press, 2020

REFERENCE BOOKS:

1.	Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition,VPT, 2014. (ISBN: 978-8173719547)
2.	Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, First Edition, 2013.

WEB LINKS:

1.	Introduction To Internet Of Things By Prof. Sudip Misra | IIT Kharagpur https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2.	https://www.edx.org/learn/iot-internet-of-things

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Identify IoT networking components and addressing strategies in IoT.
CO2	Classify various sensing devices and actuator types.
CO3	Demonstrate the processing in IoT.
CO4	Elucidate Associated IoT Technologies.
CO5	Illustrate architecture of IoT Applications.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1						1
	CO2	2	1						1
	CO3	2	1						1
	CO4	2	1						1
	CO5	2	1						1

1: Low, 2: Medium, 3: High

Entrepreneurship

Contact Hours/Week	:	3+0 (L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MCE25	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Gain knowledge about Entrepreneur, Intrapreneur, Entrepreneurship
2.	Get acquainted with different types of Entrepreneurship
3.	Get acquainted with Micro & Small and Medium Enterprise, Intellectual Property Rights, Project Management and Financing

UNIT – I	08 Hours
Entrepreneur: Introduction, Evolution, Characteristics of successful Entrepreneur, Charms of becoming an entrepreneur, entrepreneurial decision process, functions, need and types of entrepreneurs, Distinction between an Entrepreneur & a manager, Intrapreneur. Entrepreneurship: Concept, growth of Entrepreneurship in India, Role of Entrepreneurship in Economic Development.	

UNIT – II	08 Hours
Women Entrepreneurship: Concept, Functions, Growth, Problems, Developing and Limitation of Women Entrepreneurship. Rural Entrepreneurship: Meaning, need, problems of rural entrepreneurship, developing rural entrepreneurship, NGO & Rural Entrepreneurship. Challenges faced by women entrepreneurs, strategies for the development of women entrepreneurs Tourism Entrepreneurship: meaning, perspective, Tourism enterprise, entrepreneur, entrepreneurship, policy measures. Agri-prenuership: Introduction, need for developing agri-prenuership in India, Opportunities for developing agri-prenuership, Challenges involved in developing agri-prenuership, suggestions for developing agri-prenuership. Social Entrepreneurship: Introduction, meaning, perspective, Social Entrepreneurship inpractice, boundaries of Social Entrepreneurship	

UNIT – III	08 Hours
Micro & Small Enterprise: Small Enterprise: Meaning, Micro & Macro Units, Essentials, Features & Characteristics, Relationship between Micro & Macro Enterprises, Rationale behind Micro & small enterprises, Scope of Micro & small enterprises & objectives of Micro enterprises. Financing of Enterprise: Meaning & need of financial planning, sources of finance, capitalisation, term loans, sources of short term finance, Venture capital. Forms of business ownership: Sole proprietorship, partnership, company, cooperative, selection of appropriate form of ownership	

UNIT – IV	08 Hours
Identification of Business opportunities: Introduction, Mobility of Entrepreneurs, Business opportunities in India, Models for opportunity evaluation. Project Management and Financing: Introduction, Project Manager, Project Life Cycle, Project Scheduling: GANTT Charts, Network techniques, Project Management software: Microsoft	

Project, InstaPlan, Yojana, PRISM Project Manager, PRIMAVERA, Generating an investment project proposal: Project Analysis, Market Analysis, Technical Analysis, Financial Analysis, Economic Analysis, Ecological Analysis. Project Financing: Equity Financing, Angel Financing,

Debt Financing, Miscellaneous sources. Project Implementation Phase, capital structure and cost of capital, Detailed Project Report. Business Plan: Introduction, purpose, contents, presenting why do some plans fail? Procedure for setting up an enterprise. Institution supporting business enterprises: Introduction, central level institutions, state level institutions, other institutions, Institutions supporting women entrepreneurs

UNIT – V	**08 Hours**
UNDERSTANDING DESIGN THINKING: Meaning of Design Thinking, Definition of Design Thinking, Origins of Design Thinking, Features of Design Thinking, Stages of Design Thinking, Design Thinking as an Interconnected Iterative Process, Key Elements of Execution from Design Thinking, Impact of Design Thinking on Design, Manufacture and Delivery, Design Thinking's Importance in Entrepreneurship, Passion in Prototype Development, Role of Empathy, 3-D Approach to Empathy , From Empathy to Ideation, The Stages of Ideation and Prototyping in the Entrepreneurial Journey, What and How of Ideation, Competitive Advantage through Ideation and Prototyping Different Ideation Approaches.	

TEXT BOOKS:

1.	Entrepreneurial Development, Dr S S Khanaka, Revised edition, S Chand Publishing, 2006
2.	Entrepreneurship and Small Business Enterprises, Poornima M Charantimath, 2nd Edition, Pearson, 2009
3.	Handbook of Design Thinking Tips & Tools for how to design thinking, by Christian Mueller-Roterberg, Independently Published, 2018

REFERENCE BOOKS:

1.	Desai, Vasant, Project Management and Entrepreneurship', Himalayan Publishing House, Mumbai,2017
2.	Gupta and Srinivasan, 'Entrepreneurial Development', S Chand & Sons, New Delhi, 2020
3.	"Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School" by Idris Mootee, John Wiley & Sons 2013

WEB LINKS:

1.	https://nptel.ac.in/courses/110/106/110106141/
2.	https://onlinecourses.nptel.ac.in/noc19_mg55/preview
3.	https://teamtreehouse.com/library/how-to-start-a-business

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Comprehend entrepreneur, entrepreneurship and role of entrepreneurship in economic development.
CO2.	Explicate the need of women, rural, tourism and social entrepreneurships.
CO3.	Recognize features of micro and small enterprise, financing of enterprise and Forms of business ownership.
CO4.	Identify various business opportunities, significance of project management, project scheduling and financing.
CO5.	Identify the significance of Design thinking for Business Process Modeling.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1					1		1	
	CO2					1			
	CO3					1	2	1	
	CO4					1	2	1	
	CO5		2	2				1	2

1: Low, 2: Medium, 3: High

Foundations of Block Chain

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MCE26	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Comprehend the fundamentals of the Blockchain and its organization
2.	Describe the underlying concepts of working of a Blockchain.
3.	Infer the working principle of Bitcoin .
4.	Interpret the working of using Ethereum.
5.	Examine possible business applications of of Blockchain.

UNIT – I	**08 Hours**
Introduction to blockchain , back history of blockchain , what is blockchain?, centralized vs. Decentralized systems, layers of block chain, application layer, execution layer, semantic layer, propagation layer, consensus layer, why is blockchain important?, limitations of centralized systems, adoption so far, blockchain uses and use cases.	

UNIT – II	**08 Hours**
Laying the blockchain foundation, game theory, nash equilibrium, prisoner's dilemma, byzantine generals problem, zero-sum games, why to study game theory, computer science engineering. The blockchain , merkle trees, properties of solution, transaction, distributed consensus mechanisms, applications, scaling blockchain, off-chain computation, sharding state.	

UNIT – III	**08 Hours**
The history of money, what is bitcoin? Working with bitcoins, the bitcoin blockchain, block structure, the genesis block, the bitcoin network, network discovery for a new node, bitcoin transaction, consensus and block mining, block propagation, putting it all together, bitcoin scripts, bitcoin transaction revisited, scripts, full nodes , vs spys, full nodes, spys	

UNIT – IV	**08 Hours**
From bitcoin to ethereum, ethereum as next-gen blockchain, design philosophy of ethereum, ethereum blockchain, ethereum accounts, tie usage, merkle patricia tree, rlp encoding, ethereum transaction and message structure, ethereum state transaction function, gas and transaction cost, ethereum smart contract, contract creation, ethereum virtual machine and code execution, ethereum ecosystem, swarm whisper, dapp, development components	

UNIT – V	**08 Hours**
Propelling business with blockchain , recognizing types of market friction, information frictions, interaction frictions, innovation frictions, moving closer to friction-free business networks, reducing information friction, easing interaction friction, easing innovation friction, transforming ecosystems, through increased visibility. Blockchains in action: use cases of financial services, trade finance, post-trade clearing and settlement, cross-border transactions, trusted digital identity, multinational policy management, government, supply chain management, food safety, global trade, healthcare, electronic medical records, and healthcare payment preauthorization.	

TEXT BOOKS:

1.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain , Apress Media, 2018, ISBNL 9781484234433 (Chatper 1-4)
2.	Manav Gupta, Blockchain for Dummies, John Wiley & sons, 2nd IBM Limited Edition, ISBN: 9781119545934 (chapter 3 and 4), 2018

REFERENCE BOOKS:

1.	Peter Lypovonyav, Blockchain for Business 2019, Packt Publishing Limited, 2019, ISBN: 9781789956023
2.	Debajani Mohanty, Ehereum for Architects and Developers, Apress Media, 2018, ISBN 9781484240748

WEB LINKS:

1.	https://archive.nptel.ac.in/courses/106/105/106105235/
2.	https://archive.nptel.ac.in/courses/106/105/106105184/
3.	https://www.tutorialspoint.com/blockchain/index.htm
4.	https://www.guru99.com/blockchain-tutorial.html
5.	https://blockchain.cse.iitk.ac.in/slides-NPTEL-BlockchainTechnologyApplications.pdf

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Explicate the fundamentals of Blockchain and its structure.
CO2.	Outline the prerequisite concepts of Blockchain.
CO3.	Illustrate the working of Bitcoin cryptocurrency.
CO4.	Demonstrate the use of Ethereum in implementing Blockchain.
CO5.	Examine the potential business use cases of Blockchain.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2				1			
	CO2	2				1			
	CO3	2	2			1			
	CO4	2	2			1			
	CO5	2	2			1			

1: Low, 2: Medium, 3: High

DBMS Lab

Contact Hours/Week	:	3	Credits	:	1.5
Total Lecture Hours	:		CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N2MCL1	Course	PCCL	

Course Objectives:

This Course will enable students to:	
1.	Design and implement SQL queries in DBMS
2.	Design and implement NoSQL queries in DBMS
3.	Compare the performance of SQL and NoSQL queries

Sl.no	Programs
Part A: SQL Programming	
1.	**Practical – 1 :** Consider the following tables with their attributes Staff (StaffId, StaffName, JoinDate, Qualification, Designation, Salary, BranchId) Branch (BranchId, BranchName, Intake) Create the above tables by properly specifying the primary keys and the foreign keys. Enter atleast ten tuples (i.e. records) for each relation (i.e. table). Write the SQL Queries for the following requirements 1) List the staff details who hold the Ph. D degree and are working in a particular branch. 2) List the staff details who are drawing the salary in the range of 30000 to 50000. 3) List the staff name whose name starts with 'R' as first character and 'A' as the 3rd character. 4) List the staff details who have joined the institution in the month of January. 5) List the staff details who are working in a particular branch where number of intake is exceeding 60 students. 6) List the branch names along with number of staff members working in each branch, sum of their salaries and average of their salaries. 7) List the staff members who have finished their service by more than 100 months. 8) List the Branch name in which number of staff members working is exceeding by 4. 9) Update the salary of the staff members by increasing 25% who are working in a particular branch where intake is 60 students. 10) Delete the staff member who is drawing a highest salary in a particular branch.
2.	**Practical – 2 :** Consider the following relations for an order processing database application in a company. CUSTOMER (CustomerId, CustomerName, City, ContactNo) ITEM (ItemId, ItemName, Unitprice) CORDER (OrderId, OrderDate, CustomerId) ORDER-ITEM (OrderId, ItemId, Quantity) WAREHOUSE (WarehouseId, WarehouseName, Address) SHIPMENT (OrderId, WarehouseId, ShipDate)

	Create the above tables by properly specifying the primary keys and the foreign keys. Enter at least ten tuples for each relation. Execute SQL queries for the following requirements: 1) List the order details done by a particular customer belongs to a particular city. 2) List the item details purchased by a particular customer whose total quantity items are exceeding by 5. 3) List the Customer details belong to a particular city and whose contact no ends with "__222" **4)** List the customer name, number of orders they made, their total ordered amount and their average ordered amount for all the customers: 5) List all warehouses and number of orders they obtained from different customers. **6)** List the warehouse which has got number of orders more than 2. 1) List the warehouse which has received number of orders in the month of January
3	**Practical – 3 :** Consider the following database of student enrollment in courses and books adopted for each course. STUDENT (USN, StudentName, Dob, Gender, Class) COURSE (CourseNo, CourseName, Department) TEXT (BookId, BookTitle, Publisher, Author) ENROLL (USN, CourseNo, Semester, Marks) BOOK_ADOPTION (CourseNo, BookId, Semester) Create the above tables by properly specifying the primary keys and the foreign keys Enter at least 10 records to each table. Execute SQL queries for the following requirements: 1) List the student details and their course details for a particular semester. 2) List the student details under a particular department whose name is ordered in an ascending order. 3) List all the book details under a particular course. 4) List the courses in which number of students enrolled will be more than 2. 5) List the publisher who has published more than 2 books. 6) List the author details who has authored more than 2 books. 7) List the author details who have written book for I semester, computer science course. 8) List only the girls student details whose total number of months starting from their date of birth is more than 200. 9) Update the marks by giving grace marks of 15 % to the boys student who has scored lowest in his class of a particular course. 10) List the course to which maximum number of students have joined.
4	**Practical – 4.** Consider the following Employee database. Department (Deptno, Deptname, Location) Employee (EmpNo, EmpName, Job, Manager, HireDate, Salary, Commission, Deptno) SalaryGrade (Grade, LowSalary, HighSalary)

	Create the above tables by properly specifying the primary keys and the foreign keys Enter at least ten tuples for each relation. Execute SQL queries for the following requirements: 1) List employee names who have joined between the months July to December of the year 1981. 2) List employee details including department and their grade based on the salary of all the employees except clerks. 3) List the employees whose name should not start with a letter 'A' and should not end with a letter 'A' but it should be there in the name. 4) Find all the employees who have joined the company before their managers 5) List the name of employees who have finished their 25 years of experience in the company. 6) List the employee name, salary, PF, HRA, DA and gross; order the results in the ascending order of gross. (PF is 10%, HRA is 50%, DA is 30% of the salary and gross is sum of salary, PF, HRA & DA) 7) List the departments for which no employee is working. 8) List the department name, number of employees working, total salary, average salary, maximum salary and minimum salary in each of the department. 9) List year in which most of the employees have joined the organization (Display the year and no of employees). 10) List the department in which maximum number of employees working.
	Part B: PL/SQL Programming
5.	**Practical – 5 :** Consider the following table : Login (LoginId, LoginName, Password, FirstName, LastName) Write a stored procedure to validate Login name and password with following cases Case-1: Procedure has to check the existence of login name. Case-2: Procedure has to validate password with existing login name Case-3: Procedure has to rise the proper exceptions in both the cases.
6	Practical – 6 Consider the following table : Product (ProductId, ProductName, ProductType, PricePerUnit) Write a PL/SQL Package to auto generated product id and insert the values in to the above table by considering following cases. Case-1: Package has to check the existence of records. Case-2: Package has to generate the next number if there are records already exists. Case-3: Package has to rise the proper exceptions in both the cases.
7	Practical – 7 Consider the following table : Product (ProductId, ProductName, ProductType, PricePerUnit) Write appropriate triggers by considering following events based on the above table. Case-1: A trigger before insert / after insert Case-2: A trigger before update / after update Case-3: A trigger before delete / after delete

	Part C: NoSQL Programming
8	Create the below Collections, insert suitable tuples and perform the following operations using MongoDB Employee (SSN, Name, Job, Salary) Project (ProjectNo, ProjectName, Duration) Assigned_To (SSN, ProjectNo, NoofHours) a) List the employees who are working with a particular designation b) List the employees who are working in a particular project and drawing the salary greater than 35000 c) List the employees whose name starts with 'S' as first character. d) List the employees who are working as Analyst and drawing the salary in the range of 25000 and 40000. e) List the employees who are working for a particular project whose duration exceeds 100 days. f) Update the employee salary with a hike of 25% who have worked more than 100 hours. g) Remove the projects to which no employee is assigned.
9	Practical-9 Create the below Collections, insert suitable tuples and perform the following operations using MongoDB Part (PartNo, PartName, Price, Colour), Supplier (SupplierNo, SuplierName, Address) Part_Supplier(PartNo, SupplierNo, SupplyDate, Quantity) a) List the supplier name who are supplying particular parts b) List the SteelGrey colored Part names whose price greater than ₹ 1000 c) List the part names which are supplied by suppliers from a particular address. d) List the part names whose supplied quantity is exceeded by 25 on a particular date. e) List the part names whose price is greater than 500 and supplied quantity is more than 50. f) Update the price of the White colored parts with a new price of 25 % higher rate. g) Remove the suppliers who are supplying parts from a particular address.
10	Create the below Collections, insert suitable tuples and perform the following operations using MongoDB Book (ISBN, Title, Price, Author, Publisher) Student (Usn, StudentName, Class, Gender) Borrow (ISBN, Usn, BorrowedDate) a) List the book titles in which there is a particular keyword pattern "Computing". b) List the student names who have borrowed DBMS books. c) List only the girl student names belong to a particular class. d) List the books with a price greater than Rs.750 and title with a keyword "Fundamentals" or "Introduction". e) List the Author names who have authored more than 1 Book.

	f) List the Publisher names who have published more than 2 Books. g) List the student names who have borrowed more than 1 Book. h) Remove only the boys students from a particular class.

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	To familiarize the basic concepts, applications, data models, schemas and instances.
CO2	To design, develop and implement SQL queries for the given relational database schema requirements.
CO3	To implement PL/SQL programming constructs for the given database schema.
CO4	To apply NoSQL techniques to define non-relational database objects, load data and query data.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Advanced Java Lab

Contact Hours/Week	:	3	Credits	:	1.5
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N2MCL2	Course	PCCL	

Course Objectives:

This Course will enable students to:	
1.	Design and build Java Swing GUI applications with the implementation of event handling mechanism.
2.	Interpret and implement JDBC concepts and build applications integrating relational databases.
3.	Design and build Java web applications using Servlets, JSPs and integrating JDBC

Sl.no	Programs
1.	Programs on Collection Framework elements.
2.	Programs on designing GUI using Swing components.
3	Programs on handling events on swing GUI applications
4	Programs on Statement and Prepared Statement object using JDBC
5.	Programs on embedded sql statements
6.	Programs on Servlet Interface, GenericServlet and HttpServlet class
7.	Programs on Session Tracking using servlets.
8.	Programs on Scripting elements in JSP
9.	Programs on Action tags in JSP

WEB LINKS:

1.	https://www.javatpoint.com/java-swing
2.	https://www.tutorialspoint.com/jdbc/index.htm
3.	https://www.edureka.co/blog/servlet-and-jsp-tutorial/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Design and develop Java applications to demonstrate the usage of event handling mechanism andJDBC transactions over Embedded SQL queries using Java AWT, SWING and JDBC API.
CO2	Design and develop dynamic web based Java applications to demonstrate database transactions, using embedded SQL, HTML.
CO3	Design and develop dynamic web based Java applications to demonstrate Java sessions using embedded SQL, HTML, Servlet.
CO4	Design and develop dynamic web based Java applications using JSP.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	1	1	1			
	CO2	2	2	1	1	1			
	CO3	2	2	1	1	1			
	CO4	2	2	1	1	1			

1: Low, 2: Medium, 3: High

Cloud Computing Lab

Contact Hours/Week	:	4	Credits	:	02
Total Lecture Hours	:	-	CIE Marks	:	50
Total Practical Hours	:	26	SEE Marks	:	50
Course Code	:	N2MCL3	Course	PCCL	

Course Objectives:

This Course will enable students to:	
1.	Examine the use of Cloud Computing to solve given engineering problem.
2.	Use public cloud computing platforms.
3.	Use cloud native technologies to develop cloud agnostic solutions.

Exercise	Concepts	Projects
Creating EC2 instance and manually hosting website	EC2, Security Groups, ssh keypair, putty, WinSCP	
Creating EC2 instance and using user-data to automate the web server installation and static websitehosting	user-data	
Creating Security Groups in AWS	security-group	
Creating AMI of the EC2 Instance	EC2 AMI	
Assigning Elastic IP address to EC2 Instance	Elastic IP	
1. Creating VPC	VPC, public subnet, private subnet, RDS, multi-tier application	Project 1: (Two tier application deployment) Deploy a 2-tier application with following requirements - Create custom vpc with public and private subnet - Deploy the frontend UI application in public subnet. - Deploy the backend database (AWS RDS) in a private subnet. - Establish a connection between frontend and backend. - Demonstrate the database CRUD operationthrough frontend.
2. Creating Security Group in your VPC		
3. Fork the GitHub php-mysql project		
4. Creating a EC2 instance in a new VPC with user-data		
5. Setting up RDS MySQL DB instance		
6. Deleting DB Instance		
Creating S3 bucket and uploading objects	S3 bucket	
Providing Public Read Access to S3	S3 bucket policy	

Bucket		
Enabling Website Hosting on the S3 bucket	Static Website Hosting	
Creating DynamoDB table and exploring the dynamodb operations	DynamoDB	
1 - Creating IAM Policy and Role to Lambda 2- Creating DynamoDB Table 3 - Creating S3 bucket 4 - Creating Lambda function	IAM Policy and Roles, DynamoDB, S3 bucket, Lambda functions	Project 2: (AWS Serverless Project) Automatically populate employees details in DynamoDB using Lambda function when employees details are uploaded to S3 bucket in json format
1. Creating Target Groups and Application Load Balancer 2. Creating Launch Templates and Autoscaling Groups	AWS ALB, Autoscaling Launch Templates Autoscaling groups.	Project 3 (Autoscaling Project) Demonstrate the Scale-out and Scale-incapabilities of AWS Autoscaling
AWS Cloud Formation Hands on - S3 and EC2 instance	Cloud Formation template	

TEXT BOOKS:

1.	Cloud Computing: Concepts, Technology & Architecture By Thomas Erl, Ricardo Puttini, Zaigham Mahmood, illustrated ,Prentice Hall, 2013 ISBN 0133387526, 9780133387520
2.	Cloud Computing: Principles and Paradigms By Rajkumar Buyya, James Broberg, Andrzej Goscinski, Publisher : Wiley, Edition :1 ISBN-13: 978-8126541256

WEB LINKS:

1.	AWS Getting Started: https://aws.amazon.com/getting-started/
2.	AWS Free tier: https://aws.amazon.com/free
3.	AWS EC2 https://aws.amazon.com/ec2/
4.	AWS RDS https://aws.amazon.com/rds/
5.	AWS S3 https://aws.amazon.com/s3/
6.	AWS CloudFormation: https://aws.amazon.com/cloudformation/
7.	AWS Server less https://aws.amazon.com/serverless/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Analyze the trade-offs in cloud modules, services and cloud characteristics.
CO2.	Use AWS cloud with a core AWS services like EC2, VPC, RDS and IAM
CO3.	Perceive the serverless technologies and core AWS serverless services
CO4.	Use Infrastructure as a Code (IaC) concepts and AWS Cloud Formation
CO5.	Perceive the Cloud native technologies and Autoscaling.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1				1
	CO2	2	2	2	1				1
	CO3	2	2	2	1				1
	CO4	2	2	2	1				1
	CO5	2	2	2	1				1

1: Low, 2: Medium, 3: High

Soft Skills

Contact Hours/Week	:	3	Credits	:	0
Total Lecture Hours	:	3	CIE Marks	:	100
Total Tutorial Hours	:	-	SEE Marks	:	-
Course Code	:	HSS08	Course	NCMC	

Course Objectives:

This Course will enable students :	
1.	To make the students aware of the importance of soft skills in the present-day business world and work environment
2.	To learn the science behind picking up any skill quickly
3.	To help students realize as well as develop key soft skills interviewers look for – such as changemanagement, professionalism, inter- and intra-personal skills, adaptability etc.
4.	To develop effective resumes (paper-based as well as video)
5	To understand the importance of and create an effective digital footprint
6	To provide simulated Group Discussion and Personal Interview experience based on the models adopted by reputed companies.
7	To understand professional etiquette to be displayed in workplaces.

METHODOLOGY

Interactive instructor led session with audio-visual aids / case studies.

Day	#	**Topic**	**Sub-topics covered**	Duration (Hrs)
1.	1	How to pick up skills faster?	1. Knowledge vs skill 2. Skill introspection 3. Skill acquisition 4. "The 10,000 hours rule" and the converse	2
	2	Interpersonal and Intrapersonal skill building	Social Interaction 1.Interpersonal Communication2.Peer Communication 3.Bonding 4.Types of social interactionEmotional Management Responsibility 1. Types of responsibilities 2. Moral and personal responsibilities	2
	3.	Professional etiquette	Workplace etiquette - meeting room, pantry, cubicle Dining etiquette Telephone etiquette Email and business correspondence etiquette	2
2.	4	Change Management	Who moved my cheese? Tolerance of change and uncertaintyJoining the Bandwagon Adapting change for growth – overcoming inhibition Adapt to changes(tolerance of change and uncertainty) Adaptability Curve Survivor syndrome	2
	5	Creating a digital footprint	1.How what you post online / information online can affect people's and recruiter's perception about you 2. Usage of Linkedin to further one's career prospects	2

			3. Managing content that one posts on platforms like Twitter, Facebook, Instagram etc. to create positive footprint about oneself Why is it important to leave a digital footprint?	
	6	Time Management	Prioritization - Time Busters Procrastination Scheduling Multitasking Monitoring Working under pressure and adhering to deadlines	2
3	7	Group Discussion –Basics	1.Importance of GDroundSkills assessed in a GD How to ace a GD Dos and donts in a GD Idea generation techniques One mock GD involving participation from 12 volunteers, facitilated by the trainer	2
	8	Personal Interview - Basics	Self-introduction practice. Body language – especially grooming for personal interview.Personal interview – FAQs discussion.	2
	9	Building a resume from scratch	1. How to write a good and impressive Resume. 2. Important aspects of an impressive resume.3.Sample template and formatting ideas.	2
4	10	Group Discussion – Advanced	GD sample Video with analysis and discussion.GD Dos and Don'ts – Worksheet practice. Roleplays for Dos and Don'ts. Idea generation – worksheet practice.	3
	11	Personal Interview - Advanced	1.Extensive discussion on PI FAQs. 2.Interview questions from based onresume - discussion. 3. PI Videos – discussion and analysis. 4. Highlighting successful answers for PI:3 questions.5.Body language during a personal interview. 6.Unconventional types of interviews (Stress, panel, MR, guesstimation)	3
5	12	Resume Writing - Workshop (Drafting a paper-based as well as avideo resume)	1. Resume writing – Worksheet practice. 2. 3 stage Resume drafting. 3. Rough draft-1. 4. Rough draft -2. 5. Fair draft. 6. Discussion on specific aspects of an 7. impressive Resume. 8. Creating a video resume	3
	13	Setting andachieving Targets	Ambition, goal, passion and career objective - difference SMART goals and Action plans Obstacles -Failure management (case studies)	1.5
	14	Introspection	Identify your USP - Unique Selling Proposition Recognize your strengths and weakness (SWOT) Nurture strengths Fixing weakness Overcoming yourcomplex Confidence building	1.5
6	15	Group Discussion - Mock	1. Mock Group Discussions featuring groupsof 10people, with each GD lasting for 15 minutes. 2. Detailed feedback for each participant 3.Introspection by the audience to add value to the GD	3

	16	Personal Interview - Mock	1. Mock personal interview for a sampleset of candidates 2. Simulate the real personal interview experience. 3. Individual feedback and areas of improvements areshared.	3

ASSESSMENTS PROVIDED

The following assessments are integrated into the training programme to best judge a student's proficiency on soft skills.

1. Team building tasks (Inside training hours)
2. Participation in group activities (Inside training hours)
3. Psychometric test
4. Creating a resume

1.	Who moved my Cheese?' by Spencer Johnson
2.	'Outliers' by Malcolm Gladwell
3.	'Emotional Intelligence' by Daniel Goleman'Road Less Travelled' by Scott Peck M.
4.	'How to win friends and influence people' by Dale Carnegie
5.	Who moved my Cheese?' by Spencer Johnson

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Display key soft skills expected by recruiters
CO2	Apply scientific methods to learn any skill quickly
CO3	Participate in Group Discussions and Personal Interviews effectively
CO4	Create effective resumes that impress interviewers (paper-based as well as video)
CO5	Apply professional etiquette to be displayed in various workplace scenarios

Soft Skills (0 Credit)

Description	*Schedule*	*Conducted for*	*Reduced to*
Activity-1	In regular class	20 marks	20 marks
Activity-2	In regular class	20 marks	20 marks
Activity-3	In regular class	20 marks	20 marks
Activity-4	In regular class	20 marks	20 marks
Activity-5	In regular class	20 marks	20 marks
CIE		**100 marks**	**100 marks**

III Semester

Python Programming for Data Analytics

Contact Hours/Week	:	03+02(L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	26	SEE Marks	:	50
Course Code	:	N3MC01	Course	PCC	

Course Objectives:

This Course will enable the students to:	
1.	Learn the fundamentals of Python programming language.
2.	Understand the functions and object oriented concepts.
3.	Learn the Python's data structures, exception handling, and the data manipulation.
4.	Understand the concepts of data preprocessing and data wrangling.
5.	Learn how to visualize the data and scrap the web.

UNIT– I	08 Hours

Programming: Introduction, Writing a Simple Program, Reading Input from the Console, Identifiers, Variables, Assignment Statements, and Expressions, Simultaneous Assignments, Named Constants, Numeric Data Types and Operators, Evaluating Expressions and Operator Precedence, Augmented Assignment Operators, Type Conversions and Rounding.

Mathematical Functions, Strings, and Objects: Common Python Functions, Strings and Characters, Introduction to Objects and Methods, Formatting Numbers and Strings.

Selections: Boolean Types, Values, and Expressions, if-else Statements, Logical Operators, Operator Precedence and Associativity.

UNIT– II	08 Hours

Loops: The while Loop, The for Loop, Nested Loops, Keywords break and continue.

Functions: Defining & Calling a Function, Functions with/without Return Values, Positional and Keyword Arguments, Passing Arguments by Reference Values, The Scope of Variables, Default Arguments, Returning Multiple Values.

Objects & Classes: Defining Classes for Objects, Immutable Objects vs. Mutable Objects, Hiding Data Fields, Class Abstraction and Encapsulation.

Data structures: List Basics, Copying Lists, Passing Lists to Functions, Returning a List from a Function, Tuples, Sets, and Dictionaries.

UNIT– III	08 Hours

Inheritance & Polymorphism: Superclasses and Subclasses, Overriding Methods, The object Class, Polymorphism and Dynamic Binding.

Files: Text Input & Output (Reading, Writing, Appending)

Exception Handling, Raising Exceptions, Processing Exceptions Using Exception Objects, Defining Custom Exception Classes**.**

Data Manipulation with NumPy & Pandas:

NumPy: A Multidimensional Array Object, Universal Functions: Fast Element-Wise Array

Functions, Array-Oriented Programming with Arrays, **Pandas**: Introduction to pandas Data Structures, Essential Functionality,Summarizing and Computing Descriptive Statistics.

UNIT– IV	**08 Hours**
Data Loading, Storage, Cleaning and Preparation: Reading and Writing Data in Text Format - Reading Text Files in Pieces, Writing Data to Text Format, Working with Delimited Formats, Interacting with Databases. Handling Missing Data, Data Transformation(Removing Duplicates, Transforming Data using a Function or Mapping, Replacing Values, Detecting & Filtering Outliers) **Data Wrangling: Join, Combine, & Reshape:** Combining and Merging Data Sets, Reshaping and Pivoting	

UNIT– V	**08 Hours**
Plotting & Visualization with Matplotlib & seaborn: Figures and Subplots, Colors, Markers, and Line Styles, Ticks, Labels, and Legends, Annotations and Drawing on a Subplot, Saving Plots to File, matplotlib Configuration, **Plotting with pandas and seaborn**, Line Plots Bar Plots, Histograms and Density Plots, Scatter or Point Plots, Facet Grids and Categorical Data. **Web Scraping Using Beautiful Soup**: Parsing a page with BeautifulSoup, CSS Selectors, Extracting information from the web page, Combining the data into a Pandas Dataframe, Writing the data into a .csv file.	

TEXTBOOKS:

1.	Y Daniel Liang, “Introduction to Programming using Python”, Pearson, First Impression, 2017
2.	Wes McKinney, “Python for Data Analysis”, O'Reilly Media, 2017, Second Edition.

REFERENCEBOOKS:

1.	Allen Downey, “Think Python: How to Think Like a Computer Scientist”, Shroff/O'Reilly; Second edition (1 January 2016)
2.	Charles Severance, “Python for Everybody”, Shroff Publishers; First edition (10 October 2017)
3.	Jake Vanderplas, “Python Data Science Handbook”, O′Reilly; 1st edition (6 December 2016)
4.	Bharti Motwani, “Data Analytics using Python”, Wiley (25 June 2020);

WEBLINKS:

1.	https://www.freecodecamp.org/news/python-code-examples-sample-script-coding-tutorial-for-beginners/
2.	https://www.geeksforgeeks.org/python-programming-language/
3.	https://www.programiz.com/python-programming
4.	https://www.geeksforgeeks.org/data-analysis-with-python/
5.	https://www.simplilearn.com/tutorials/data-analytics-tutorial/data-analytics-with-python
6.	https://onlinecourses.nptel.ac.in/noc22_cs31/preview
7.	https://onlinecourses.nptel.ac.in/noc22_cs32/preview

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	***Interpret*** the Python language fundamentals.
CO2	***Develop*** the functions and ***apply*** the object oriented concepts to real world programming situations.
CO3	***Demonstrate file handling*** & exceptions handling and apply the data manipulation techniques.
CO4	***Demonstrate*** the techniques of data preprocessing and data wrangling.
CO5	***Develop*** the models to visualize the data and ***apply*** the web scraping techniques.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			
	CO5	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Mobile Application Development

Contact Hours/Week	:	3+2 (L+T)	Credits	:	04
Total Lecture Hours	:	40	CIE Marks	:	50
Total Practical Hours	:	26	SEE Marks	:	50
Course Code	:	N3MCI01	Course	IPCC	

Course Objectives:

This Course will enable students to:	
1.	Understanding the concepts of mobile and its platforms
2.	Explore the android tools and its applications
3.	Analyze the usage the UI design LBS
4.	Understand the messaging and network related

UNIT – I	08 Hours

Introduction to Android overview, Android Studio & Project Basic:
History, Operating System, Setup, Configuring Android Studio, Hardware Acceleration, Project Basics, Create an AVD, The IDE, Main Editor, Editing Layout Files, TODO Items, Project Tool Window and Android Application Overview.

Getting Started with Android Programming
What is Android – Obtaining the required tools– Anatomy of an Android Application – Components of Android Applications

Practical Components
1. Working with anatomy of android applications.

UNIT – II	08 Hours

Mobile Design, Event Handling, Fragments, Execution: Mobile Design: Mobile-Only Interactions, Interactions that are not possible on Mobile

Event Handling & Intents: Intro to Event Handling, Handling Long Clicks, What Intents are for, Implicit Intents

Introduction to Fragments Running in the Background: Basic Concepts, The UI Thread, Threads and Runnable

Activities and Layouts:
What Makes Up an Android Project, Application Entry Point, Activities, Intents, Activity, Layout File, View and View Group Objects, Containers, Activity Class

Practical Components
1. Implements different types of activities: start, pause, halt and exit
2. Design an application that displays Phone Contacts in desired format.
3. Create an application using Layout Managers and Event Listeners.
4. Develop a basic calculator.
5. Devise an application that implements Multi-threading.

UNIT – III	08 Hours

Debugging, Data Storage & Location Services: Debugging & Testing, Types of Errors Debugger, Types of Testing, Unit Testing, Instrumented Testing

Data Storage: Storing simple data, Read and write a text file to internal storage or external storage, Creating and using an SQLite database

Location and Geofencing:
How to get the device location, Creating and monitoring Geofencing.

Practical Components
1. Devise an application that draws basic graphical primitives (rectangle, circle) on the screen.

2. Build a mobile application to create, save, update and delete data in a database.
3. Develop a mobile application that uses GPS location information.
4. Devise a mobile application that creates alarm clock.

UNIT – IV	08 Hours

Introduction to PWAs and Tooling: Introduction to Progressive Web Apps, Tools to Measure Progressive Web Apps.

PWA Features: Service Workers, Caching and Offline Functionality with Service Workers, Background Sync for Offline Apps with Service Workers.

Practical Components

1. Implementation of PWA

UNIT – V	08 Hours

Android Messaging and Networking:

SMS Messaging, Sending Email, Networking and downloading Binary Data.

Location Data: Publishing and Deploying APK Files.

Binding activities to services.

Practical Components

1. Create an application that writes data to the SD card.
2. Implement an application that creates an alert upon receiving a message.

TEXT BOOKS:

1.	Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", 1st Edition, 2012, ISBN: 978-1-118-20390-3
2.	Wei-Meng Lee, "Beginning Android Application Development", Wiley 2011.
3.	Beginning Progressive Web App Development: Creating a Native App Experience on the Web, Dennis Sheppard, 2017, Apress Publishing, ISBN: 9781484230909

REFERENCE BOOKS:

1.	Reto Meier, "Professional Android 4 Application Development", Wrox Publications 2012
2.	Learn Android Studio 4: Efficient Java-Based Android Apps Development, Ted Hagos, 2 nd Edition, 2020, Apress Publishing, ISBN: 9781484259368 2.
3.	Development Cookbook, Rick Boyer, 3 rd Edition, 2018, Packt Publishing, ISBN – 13: 9781788622967
4.	Android 3. Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps (Usability), Cameron Banga and Josh Weinhold, 1 st Edition, 2014, Addison-Wesley Professional, ISBN-13 : 978-0321961570
5.	Learning Progressive Web Apps, John M Wago, 2020, Addison-Wesley, ISBN: 978-0136484226

WEB LINKS:

1.	https://www.youtube.com/watch?v=giVfVQlKBVM
2.	https://www.youtube.com/watch?v=aS 9RbCyHg
3.	https://www.tutorialspoint.com/android/index.htm
4.	https://developer.android.com/
5.	https://www.geeksforgeeks.org/android-tutorial/
6.	https://www.tutlane.com/tutorial/android
7.	https://www.w3schools.in/category/android-tutorial/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Analyse Android basics, Life cycle, Manifest, Intents, and using external resources
CO2.	Demonstrate Activities, Layouts, Views, Widgets, Menus and Notifications.
CO3.	Apply testing methods, data storage, geo-location and monitoring.
CO4.	Design and develop applications with PWA.
CO5.	Design and develop SMS and email facility.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2			1			
	CO2	2	2	2	2	1			
	CO3	2	2	2	2	1			
	CO4	2	2	2	2	1			
	CO5	2	2	2	2	1			

1: Low, 2: Medium, 3: High

Research Methodology and IPR

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MC02	Course	MCC	

Course Objectives:

This Course will enable students to:	
1.	Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.
2.	Carry out literature survey, define the problem statement and suggest suitable solution for the given problem and present in the format of the research paper (IEEE).
3.	Analyse the problem and conduct experimental design with the samplings.
4.	Perform the data collection from various sources segregate the primary and secondary data
5.	Understand some concepts/section of Copy Right Act /Patent Act /Cyber Law/ Trademark to the given case and develop –conclusions

UNIT – I	08 Hours
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.	

UNIT – II	08 Hours
Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.	

UNIT – III	08 Hours
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs	

UNIT – IV	08 Hours
Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	

UNIT – V	08 Hours
Intellectual Property (IP) Acts:Introduction to IP: Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, Patent Acts: Indian patent acts 1970.Design Act: Industrial Design act 2000. Copy right acts: Copyright Act 1957. Trade Mark Act, 1999	

TEXT BOOKS:

1.	Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg New Age International 4th Edition, 2018.
2.	Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011 Study Material.
3.	Intelectual property, Debirag E. Bouchoux, Cengage learning, 2013.

REFERENCE BOOKS:

1.	Research Methods: the concise knowledge base Trochim, Atomic Dog Publishing, 2005.
2.	Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

WEB LINKS:

1.	https://onlinecourses.nptel.ac.in/noc22_ge08/preview
2.	https://www.youtube.com/watch?v=XEMyDu_VoeQ
3.	https://www.youtube.com/watch?v=GSeeyJVD0JU

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Identify the suitable research methods to articulate the research steps
CO2.	Conduct literature survey to define research problem.
CO3.	Analyze and conduct experimental design with the samplings.
CO4.	Perform data collection and report writing
CO5.	Identify the Intellectual Property (IP) Acts

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1		1			1			
	CO2		1			1		2	
	CO3		1	1		1			
	CO4		1			1			
	CO5							2	

1: Low, 2: Medium, 3: High

Professional Elective – 3

Machine Learning

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:		SEE Marks	:	50
Course Code	:	N2MCE34	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Learn the basic concepts of Machine learning and Concept Learning.
2.	Understand working of Decision Trees & Artificial neural networks.
3.	Get acquainted the working of Bayesian classifiers and Instance based learning.
4.	Understand the Support Vector Machines, Regression techniques & Model Evaluation.
5.	Get acquainted with the Clustering methods.

UNIT – I	08 Hours
Introduction: Well posed learning problems, Designing a Learning system, Perspectives and Issues in Machine Learning. **Concept Learning:** A Concept learning task, Concept learning as search, Find-S: Finding a maximally specific hypothesis, Version spaces and the Candidate Elimination algorithm.	

UNIT – II	08 Hours
Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, The Basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Issues in decision tree learning. **Artificial Neural Networks:** Introduction, Biological Motivation, Neural Network representations, Appropriate problems for Neural network Learning, Perceptrons, Multilayer Networks and the Backpropogation algorithm, A Differentiable Threshold Unit, The Backpropagation Algorithm.	

UNIT – III	08 Hours
Bayesian Learning: Introduction, Bayes theorem, An example, Naïve Bayes classifier, An Illustrative Example, Bayesian belief networks, Conditional Independence, Representation, Inference. **Instance based Learning**: Introduction, k-nearest neighbor learning, Distance-Weighted Nearest Neighbor Algorithm, and Remarks on k- Nearest Neighbor Algorithm.	

UNIT – IV	08 Hours
Support Vector Machines: for Linearly Separable & Inseparable data. **Prediction:** Linear Regression, Nonlinear Regression. **Accuracy & Error Measures:** Classifier Accuracy Measures, Predictor Error Measures, Evaluating the accuracy of a Classifier or Predictor, ROC Curves.	

UNIT – V	08 Hours
Cluster analysis: What is Cluster analysis? Euclidean, Manhattan & Minkowski distances, Partitioning Methods: The k-Means Method, The k-Medoids Method, Hierarchical Methods: Agglomerative & Divisive Hierarchical Clustering, BIRCH, Density-Based Methods: DBSCAN.	

TEXT BOOKS:

1.	Tom M Mitchell , Machine Learning, McGraw Hill Education (India) Edition 2013. (1 to 3 Units)
2.	Jiawei Han, MK, Data Mining, Concepts & Techniques, 2nd Edition, Morgan Kaufmann Publishers (4th & 5th Units), 2006

REFERENCE BOOKS:

1.	Ethem Alpaydin, Introduction to Machine Learning, 3rd Edition, EEE, MIT Press, 2018.
2.	SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Machine Learning, Pearson Publications, 4thimpression, 2019, ISBN 978-93-530-6669-7

WEB LINKS:

1.	https://www.geeksforgeeks.org/machine-learning/
2.	https://machinelearningmastery.com/
3.	https://www.ibm.com/in-en/cloud/learn/machine-learning
4.	https://www.sas.com/en_in/insights/analytics/machine-learning.html
5.	https://ai.google/
6.	http://ndl.iitkgp.ac.in/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	***Interpret*** the basics of machine learning and apply the concept learning algorithm to real world problems.
CO2.	***Perform*** classification/labeling of data objects using the various techniques of supervised learning.
CO3.	***Apply*** the various techniques of supervised learning to perform regression.
CO4.	***Evaluate*** the machine learning models using the various accuracy metrics.
CO5.	***Apply*** the various techniques of unsupervised learning to perform the clustering of real world problems.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1						
	CO2	3	1		1	1			
	CO3	3	1		1	1			
	CO4	3	1		1	1			
	CO5	3	1		1	1			

Big Data

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCE35	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Gain knowledge of various technologies supporting Big DATA
2.	Get acquainted with Hadoop Ecosystem : YARN, MapReduce, Spark
3.	Get acquainted with HIVE and PIG

UNIT – I	08 Hours

Getting an Overview of Big Data: What is Big Data? Types of Data, Elements of Big Data, Careers in Big data.

Introducing Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Cloud Computing and Big Data, and In-Memory Computing Technology for Big Data.

The Hadoop Distributed Filesystem: Design of HDFS,HDFS Concepts, Blocks, Namenodes and Datanodes, Block Caching, HDFS Federation ,HDFS High Availability , Hadoop file system, Data Flow: Anatomy of a File Read , Anatomy of a File Write, Coherency Model, Parallel Copying with distcp, Keeping an HDFS Cluster Balanced

UNIT – II	08 Hours

YARN: Anatomy of a YARN Application Run, Resource Requests, Application Lifespan, Building YARN Applications , YARN Compared to MapReduce 1, Scheduling in YARN, Scheduler Options ,Capacity Scheduler Configuration , Fair Scheduler Configuration , Delay Scheduling, Dominant Resource Fairness.

Spark: Introduction to Spark, Difference between Hadoop and Spark.

UNIT – III	08 Hours

How MapReduce Works: Anatomy of a MapReduce Job Run :Job Submission, Job initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion. Failures: Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure. Shuffle and Sort: The Map Side, The Reduce Side, Configuration Tuning. Task Execution: The Task Execution Environment, Speculative Execution, Output Committers MapReduce Types and Formats: the Default MapReduce Job, Input Formats: Input Splits and Records, Text Input, Binary Input, Multiple Inputs, Database Input (and Output). Output Formats: Text Output, Binary Output

UNIT – IV	08 Hours

Exploring Hive: Introducing Hive, Hive Variables, Hive Properties, Hive Queries, Data Types in Hive, Built-In Functions in Hive, Hive DDL, Creating Databases, Viewing a Database, Dropping a Database, Altering Databases, Creating Tables, Creating a Table Using the Existing Schema, Dropping Tables, Altering Tables, Using Hive DDL Statements, Data Manipulation in Hive, Loading Files into Tables, Inserting Data into Tables, Update in Hive, Delete in Hive, Using Hive DML Statements, Data Retrieval Queries, Using the SELECT Command, Using the WHERE Clause, Using the GROUP BY Clause, Using the HAVING Clause, Using the LIMIT Clause, Executing HiveQL Queries, Using JOINS in Hive, Inner Joins, Outer Joins, Cartesian Product Joins, Map-Side Joins, Joining Tables.

UNIT – V	08 Hours

Pig :Execution Types

Comparison with Databases, Pig Latin : Structure, Statements, Expressions , Types, Schemas , Functions, Macros. User-Defined Functions: A Filter UDF, An Eval UDF, A Load UDF. Data Processing Operators Loading and Storing Data, Filtering Data, Grouping and Joining Data , Sorting Data, Combining and Splitting Data. Pig in Practice: Parallelism, Anonymous Relations, Parameter Substitution

TEXT BOOKS:

1.	Hadoop – The Definitive Guide; Storage and Analysis at Internet scale, Tom White, 4th Edition, 2015, O'Reilly, Shroff Publishers & Distributers Pvt. Ltd., ISBN – 978-93-5213-067-2
2.	Big Data – Black Book, DT Editorial Services, Edition – 2015, Dreamtech Press, ISBN - 978-93-511-9-757-7

REFERENCE BOOKS:

1.	Big Data and Hadoop, V.K Jain, Khanna Book Publishing, Edition 2017, ISBN: 9789382609131.
2.	Big Data Analytics with Hadoop 3, Sridhar Alla, Packt Publisher, Pages 482, ISBN 978178862884. 2018

WEB LINKS:

1.	https://nptel.ac.in/courses/106/104/106104189/
2.	https://www.youtube.com/watch?v=1vbXmCrkT3Y
3.	https://www.guru99.com/nosql-tutorial.html
4.	https://www.youtube.com/watch?v=2yQ9TGFpDuM
5.	https://www.w3schools.in/mongodb/introduction-to-nosql/
6.	https://www.tutorialspoint.com/hive/hive_installation.htm

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Comprehend various technologies supporting Big Data
CO2.	Analyze the working of YARN and SPARK
CO3.	Analyze and apply MapReduce for real time problems
CO4.	Apply Hive Query for real time problems
CO5.	Apply PIG Latin for real time problems

Big Data Analytics Assignment component:

1. Students should form a team of not more than 3, and deliver a presentation covering Hive, Pig, Map reduce and Tableau.
2. Each team must submit the report of the presentation
3. No two teams are allowed to use the same database for presentation.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2				1			
	CO2	2				1			
	CO3	2				1			
	CO4	2	1		1	1			
	CO5	2	1		1	1			

1: Low, 2: Medium, 3: High

Digital Marketing

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCE36	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Identify the role and importance of digital marketing in a rapidly changing business landscape
2.	Discuss the concepts of Display Advertising
3.	Discuss the concepts of Social Media Marketing
4.	Demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM
5.	Get acquainted with digital marketing methodologies, tools and technologies.

UNIT – I	08 Hours
Digital Marketing, Introduction To Digital Marketing , Origin And Development Of Digital Marketing, Internet Users, Digital Marketing Strategy, The Consumer Decision Journey, Principles Of DMI's 3i Methodology, The P.O.E.M. Framework, IMC In Digital Marketing, Digital Landscape, Digital Advertising Market , Digital Marketing Plan, Ethical And Legal Framework Of Digital Marketing, Skills Required In Digital Marketing, Careers In Digital Marketing.	

UNIT – II	08 Hours
Concept Of Display Advertising, Digital Metrics, Types Of Display Ads, What Makes A GoodAd, How To Make A Good Ad, Display Plan, Targeting In Digital Marketing, Content Targeting, Placement Targeting, Remarketing, Interest Categories, Custom Intent Targeting, Geographic And Language Tagging, Demographics, CRM, Lookalike Targeting, Other Targeting Methods, Ad Scheduling, Frequency Capping, Ad Server, Ad Exchange, Challenges Faced By Display Advertising.	

UNIT – III	08 Hours
Social Media Marketing, The Social Media Model By Mckinsey, Marketing With Networks, Social Media Analytics, Social Media Tools, Google Analytics, Social Crawlytic, Social Web, Listen, Benefits Of Listening, Facebook Marketing, Introduction, Organic Marketing, Edgerank Algorithm, 3E Strategy For Organic Content, Content With Human Touch, Emotions And Content Virality, Linkedin Marketing, Introduction, Why It Is Important To Have Linkedin Presence, Linkedin Strategy, Content Strategy, Linkedin Analystics, Ad Campaign, TwitterMarketing, Twitter Building Blocks, Building A Content Strategy, Twitter Usage, Twitter Ads, Twitter Analytics	

UNIT – IV	08 Hours
Introduction To SEO, Search Engine Marketing(SEM), Web Analytics, Mobile Marketing, Online Campaign Management, Optimization, How To Organize Your Site: Hub And SpokeModel, SEO Phases, Website Audit, SEO Techniques, How Do You Measure SEO, SEO For Visibility, SEO Vs SEM, SEO Best Practices, Search Engine Result Page(SERP), On-Page Optimization, Off-Page Optimization, Types Of SEO, Techniques Of SEO, Importance Of SEO	

UNIT – V	08 Hours
Digital Analytics, Data Collection, Weblogs, Challenges With Weblogs, Key Metrics, Behaviour Analysis, Methods To Calculate Unique Visitors, Outcome Analysis, Experience Analysis, UsabilityTesting, A/B Testing, Multivariate Testing, Types Of Tracking Codes	

Text Books:

1.	Seema Gupta "Digital Marketing", Mc-Graw Hill, Second Edition,2020
2.	Ian Dodson "The Art of Digital Marketing", Wiley publications, 2017
3.	Vandana Ahuja "Digital Marketing", Oxford university press,2015

Reference Books:

1.	Ryan Deiss, Russ Henneberry ,"Digital Marketing For Dummies", 2017
2.	Dave Chaffey ,Fiona Ellis-Chadwick, "Digital Marketing Strategy Implementation And Practice", Sixth Edition, Pearson, 2016
3.	Puneet Singh Bhatia, "Fundamentals Of Digital Marketing" Pearson, First Edition, 2017
4.	Tracy L Tuten, Michael R Solomon, Social Media Marketing, Sage Publications, Third Edition,2020

Web Links:

1.	https://swayam.gov.in/explorer
2.	https://www.linkedin.com/learning/
3.	https://learndigital.withgoogle.com/digitalunlocked/
4.	https://digitalskills.fb.com/en-in/
5.	https://www.hubspot.com/digital-marketing
6.	https://www.tutorialspoint.com/digital_marketing/index.htm
7.	https://klientboost.com/seo/technical-seo/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Analyze the role and importance of digital marketing
CO2.	Identify the importance of Display Advertising
CO3.	Interpret the importance of Social Media Marketing
CO4.	Demonstrate the importance of Search Engine Optimization
CO5.	Identify the importance of Digital Analytics

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2			1			
	CO2	2	2			1			
	CO3	2	2			1			
	CO4	2	2			1			
	CO5	2	2			1			

1: Low, 2: Medium, 3: High

Professional Elective – 4

Artificial Intelligence

Contact Hours/Week	:	3+0(L+T)	Credits	:	3.0
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCE44			PEC

Course Objectives:

This Course will enable students to:	
1.	Know the representations and algorithms used to build artificial intelligence systems
2.	Understand the role of the knowledge representation and reasoning.
3.	Gain the knowledge in building the simple knowledge-based systems.
4.	Apply knowledge representation, reasoning, and machine learning techniques to real-world problems.

UNIT – I	08 Hours
Introduction: What is AI? Intelligent Agents: Agents and environment ; Rationality ; The nature of environment ; the structure of agents . Problem solving: Problem-solving agents ; Example problems ; Searching for solution; Uninformed search strategies.	

UNIT – II	08 Hours
Informed Search: Informed search strategies ; Heuristic functions ; Adversial search: Games ; Optimal decisions in games; Alpha-Beta pruning Constraint satisfaction problems: Defining Constraint satisfaction problems.	

UNIT – III	08 Hours
Logical Agents: Knowledge-based agents; The wumpus world ; Logic; propositional logic: A very simple logic; First-Order Logic: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic.	

UNIT – IV	08 Hours
Inference In First-Order Logic: Propositional versus first-order inference; Unification and lifting; Forward chaining; Backward chaining. Classical Planning: Definition of Classical planning;	

UNIT – V	08 Hours
Quantifying Uncertainty: Acting under certainty, Probabilistic Reasoning: Representing knowledge in an uncertain domain; Learning: Forms of learning ; Supervised learning; AI: The Present and Future: Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?	

TEXT BOOK:

1.	Stuart Russel and Peter Norvig : Artificial Intelligence A Modern Approach, 3rd Edition, Pearson India Education limited, 2015, (1.1,2.1to2.4,3.1 to 3.6,5.1 to 5.3, 6.1, 7.1 to 7.4, 8.1 to 8.3, 9.1 to 9.4.2, 10.1, 13.1, 14.1, 18.1,18.2 and 27th full chapter)

REFERENCE BOOKS:

1.	Elaine Rich, Kevin Knight: Artificial Intelligence, 2nd Edition, Tata McGraw Hill, 1991.
2.	Nils J. Nilsson: Principles of Artificial Intelligence, Elsevier, 1980.

WEB LINKS:

1.	https://www.javatpoint.com/agents-in-ai
2.	https://www.javatpoint.com/ai-informed-search-algorithms
3.	https://www.cs.jhu.edu/~phi/ai/slides/lecture-logical-agents.pdf
4.	https://www.youtube.com/watch?v=-Rf2hOyjZB8
5.	https://www.youtube.com/watch?v=sdx6E2w9Td0
6.	https://www.youtube.com/watch?v=RFdZMGJHrTc
7.	https://www.youtube.com/watch?v=1BRIjhX4JdU

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Elucidate what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
CO2.	Apply basic principles of AI in problem solving, inference, perception, knowledge representation, and learning.
CO3.	Analyze and find appropriate ideation for converting real world problems into AI solution by using appropriate algorithm and method.
CO4.	Establish awareness and a fundamental understanding of various applications of AI techniques.

Assignment (Self-study) component:

1. Integrate artificial intelligence techniques into any of the app development.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1	1	1				1
	CO2	2	1	1	1				1
	CO3	2	1	1	1				1
	CO4	2	1	1	1				1

1: Low, 2: Medium, 3: High

Agile Software Process

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCE45	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Understand the basic concepts of Agile Software Process
2.	Gain knowledge in the area of various Agile Methodologies.
3.	Understand the Principles of Agile Testing

UNIT – I	08 Hours

Introduction

Software is new product development –Iterative development: Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skillful analysis – Evolutionary and adaptive planning –Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

UNIT – II	08 Hours

Agile and Its Significance

Agile development: Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback –Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. Motivation: The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Evidence: Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT – III	08 Hours

Agile Methodology

Scrum: Method overview – Lifecycle – Work products, Roles and Practices values –Common mistakes and misunderstandings – Sample projects – Process mixtures– Adoption strategies – Fact versus fantasy –Strengths versus "Other" history.

UNIT – IV	08 Hours

Agile Methodology: Agile – Motivation – Evidence – Scrum – Extreme Programming – Unified Process –Evo– Practice Tips.

UNIT – V	08 Hours

Agile Practicing and Testing

Practice: Project management – Environment – Requirements – Test – The agile alliances –The manifesto – Supporting the values – Agile testing: Nine principles and six concrete practices for testing on agile teams.

Text Books:

1.	Craig Larman "Agile and Iterative Development – A Manager's Guide" Pearson Education – 2004.
2.	Elisabeth Hendrickson, "Agile Testing" Quality Tree Software Inc 2008.

Reference Books:

1.	Alistair Cockburn, "Agile Software Development Series", Addison-Wesley Professional, 2001.
2.	Robert C. Martin, "Agile Software Development Principles, Patterns and Practices", Prentice Hall, 2002.

Web Links:

1.	https://www.geeksforgeeks.org/software-engineering-agile-software-development/
2.	https://www.atlassian.com/agile
3.	https://www.agilealliance.org/agile101/the-agile-manifesto/
4.	https://www.cprime.com/resources/what-is-agile-what-is-scrum/
5.	https://www.digite.com/agile/agile-methodology/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Explore the basics of agile and its significance.
CO2.	Interpret the methodology of agile through various case studies.
CO3.	Summarize the concepts of Agile Practicing and Testing.
CO4.	Apply agile principles and values to a given situation.

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	1			1		1	1
	CO2	2	1			1		1	1
	CO3	2	1			1		1	1
	CO4	2	1			1		1	1

1: Low, 2: Medium, 3: High

Augmented Reality and Virtual Reality

Contact Hours/Week	:	3+0(L+T)	Credits	:	03
Total Lecture Hours	:	40	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCE46	Course	PEC	

Course Objectives:

This Course will enable students to:	
1.	Gain the knowledge of Virtual Reality concepts and its implication.
2.	Understand the Input-Output interactions in Virtual Reality
3.	Understand role of Computer Graphics in Virtual reality
4.	Gain the knowledge of Architecture of Augmented Reality

UNIT – I	08 Hours
Introduction to Virtual Reality: History of Virtual Reality, Types of Virtual Reality, Three I's of Virtual Reality, Architecture / Components of Virtual Reality, Applications of Virtual Reality Common Issues of Human Communication Media	

UNIT – II	08 Hours
Input Devices: Trackers: Three Dimensional Position Trackers: Tracker Performance Parameters, Mechanical Trackers, Magnetic Trackers, Optical Trackers, Gesture Interfaces – The Pinch Glove, The 5DT Data Glove, The Cyber glove.	

UNIT – III	08 Hours
Output Devices: Graphic Displays The human visual system, Personal Graphics Displays, Sound Displays The human auditory system, Haptic Feedback – The Human Haptic System, Tactile Feedback Interfaces, Force Feedback Interfaces. **Programming with Unity**: Unity Basics, Manipulating the Scene, Code blocks and Methods, Debugging Conditional and looping statements. Working with objects, Working with Scripts, Player movement, Camera Movement **Further Learning for Unity**: The Asset Store	

UNIT – IV	08 Hours
Computing Architectures for VR: The Rendering Pipeline – The Graphics Rendering Pipeline, The Haptics Rendering Pipeline **Modeling:** Geometric Modeling – Visual Object Shape, Object Visual Appearance; Kinematics Modeling – Homogeneous Transformation Matrices, Object Position; Physical Modeling – Collision Detection, Surface Deformation, Force Smoothing and Mapping, Haptic Texturing; Behavior Modeling; Principles of touch feedback and force feedback;	

UNIT – V	08 Hours
Introduction to Augmented Reality: Definition and scope, technology and features of augmented reality, difference between AR and VR, Challenges with AR, Augmented reality methods, Mixed Reality, Applications of AR & MR **Computer Vision for Augmented Reality :** Marker-based tracking, Marker-less tracking	

TEXT BOOKS:

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

REFERENCE BOOKS:

1.	Sherman, William R. and Alan B. Craig. Understanding Virtual Reality – Interface, Application, and Design, Morgan Kaufmann, 2002.
2.	Fei GAO. Design and Development of Virtual Reality Application System, Tsinghua Press, March 2012.
3.	"Understanding Virtual Reality", William R. Sherman, Alan B. Craig, 2003, Morgan Kaufmann Publishers.
4.	"Augmented Reality Principles and Practice", Dieter Schmalstieg Tobias Höllerer,2016Pearson Education, Inc.
5.	"Game Programming with Unity and C#", Casey Hardman, 2020. https://doi.org/10.1007/978-1-4842-5656-5

WEB LINKS:

1.	https://www.youtube.com/watch?v=HRzobEK03mY
2.	https://www.youtube.com/watch?v=h3rKvsFTfPA
3.	https://www.youtube.com/watch?v=zLMgdYI82IE
4.	https://www.youtube.com/watch?v=Nq3mPFgpREE
5.	https://freevideolectures.com/course/3693/virtual-reality
6.	https://docs.unity3d.com/Manual/index.html
7.	https://youtu.be/XLP4YTpUpBI

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Apply Virtual Reality concepts and its implications.
CO2.	Illustrate the Input-Output interactions in Virtual Reality
CO3.	Utilize UNITY tool to build applications.
CO4.	Illustrate the role of modeling in Virtual Reality
CO5.	Exemplify the Architecture of Augmented Reality

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	3	1			1			
	CO2	2	1			1			
	CO3	2	1		1	1			
	CO4	2	1			1			
	CO5	2	1			1			

1: Low, 2: Medium, 3: High

Societal Project

Contact Hours/Week	:	-	Credits	:	02
Total Lecture Hours	:	-	CIE Marks	:	100
Total Practical Hours	:	4	SEE Marks	:	-
Course Code	:	N3MCSP1	Course	SP	

Course Objectives:

This Course will enable students to:	
1.	Identify the topic relevant to the societal needs by meeting stakeholders
2.	Design and develop potential solutions to societal needs
3.	Demonstrate or present the solution in a team

Instructions to Students:
Students will be working out solution for societal issues, present the seminar based on the societal project undertaken and submit report. Societal project may be hands-on practice**,** survey report, data collection and analysis, Coding, App development, Field visit, modeling of the System, Simulation, or Case study. CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, and a senior faculty from the department. Work can be carried out in a team. The CIE marks are awarded based on the evaluation of Project report and Presentation skills. There is no SEE for this course.

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Identify the problems related to societal issues.
CO2.	Identify the potential solutions for the societal issues
CO3.	Implement / simulate the solution using relevant technologies.
CO4.	Prepare and present a concise report using ICT efficiently.
CO5.	Develop mindset to work in a team by adopting professional ethics.

Break up of CIE marks

Rubrics	**Marks**
Identification of societal issues.	30
Data collection and analysis/ App development/ Field visit report/ Modeling of the System, Simulation, or Case study	40
Presentation Skills	20
Viva- Voce	10
Total	**100**

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	1				1	1	1	
	CO2	1	1	1		1	1	1	
	CO3	1		1		1	1	1	
	CO4	1				1	1	1	
	CO5	1				1	1	1	1

1: Low, 2: Medium, 3: High

Python and Data Analytics Lab

Contact Hours/Week	:	03	Credits	:	1.5
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCL1	Course	PCCL	

Course Objectives:

This Course will enable the students to:	
1.	Implement Python programs using Python language constructs.
2.	Understand various data structures provided by Python language.
3.	Use different libraries for scientific and data intensive applications.
4.	Build real-world applications using OOP, files and exception handling provided by Python.
5.	Apply Bar graph, Histogram, Pie chart, scatter plot and Line Graph for Data Visualization.

Sl. No	Programs
Part – A	
1.	Programs on functions, strings.
2.	Programs on Selection Statements.
3	Programs on Loops and user defined functions.
4	Programs on OOP concepts such as Abstraction, Encapsulation, Inheritance & Polymorphism
5.	Programs on Data structures, files, Exception handling.
Part – B	
1.	Programs on data manipulation using NumPy and pandas.
2.	Programs on data preprocessing.
3.	Programs on data wrangling.
4.	Programs on data visualization.
5.	Programs on data web scraping.
Students must execute one program from Part-A and another from Part-B. Students are allowed to select the programs based on lots.	

WEBLINKS:

1.	https://www.guru99.com/python-tutorials.html
2.	https://www.javatpoint.com/python-programs
3.	https://www.geeksforgeeks.org/python-programming-examples/#file
4.	https://www.sanfoundry.com/python-problems-solutions/
5.	https://www.includehelp.com/python/programs.aspx
6.	https://www.geeksforgeeks.org/data-science-tutorial/

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Develop Python programs using various programming constructs.
CO2	Develop Python programs using files, exception handling and OOP concepts.
CO3	Develop Python programs for data manipulation, preprocessing & data wrangling.
CO4	Develop Python programs for data visualization and Web scraping.

COURSE ARTICULATION MATRIX (Correlation between CO's and PO's)

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2	2	1	1			
	CO2	2	2	2	1	1			
	CO3	2	2	2	1	1			
	CO4	2	2	2	1	1			

1: Low, 2: Medium, 3: High

Mini Project

Contact Hours/Week	:	03	Credits	:	1.5
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N3MCL2	Course	MP	

Course Objectives:

This Course will enable students to:	
1.	Identify the problem statement befitting the domain of interest
2.	Identify design methodologies and tools to develop solution for the identified problem.
3.	Understand significance of the professional ethics, report writing and team work

Course Outcomes:

After the completion of this course, students will be able to:		
CO1.	Identify the relevant domain and apply the computing knowledge for the problem.	PO1(3)
CO2.	Analyse the defined problem and identify the corresponding requirements / objectives by conducting literature survey.	PO2(3)
CO3.	Design and develop a model / procedure / algorithm.	PO3(2)
CO4.	Implement the developed model using appropriate software tools / technologies.	PO4(2)
CO5.	Apply the management principles for managing projects.	PO6(1)
CO6.	Adhere to professional ethics and norms of computing practices.	PO7(2)
CO7.	Work effectively as an individual and as a team member to prepare report and demonstrate the project work.	PO5(3)

Break up of CIE marks

Rubrics	Marks
Problem Identification.	05
Analysis and Design	10
Implementation	20
Demonstration and Viva voce	10
Report submission	05
Total	**50**

Break up of SEE marks for Mini Project

Rubrics	Marks
Write Up	05 Marks
Demonstration	30 Marks
Viva-voce	10 Marks
Report	05 Marks
Total	**50 marks**

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	3							
	CO2		3						
	CO3			2					
	CO4				2				
	CO5						1		
	CO6							2	
	CO7					3			

1: Low, 2: Medium, 3: High

Internship

Contact Hours/Week	:	04 Weeks internship during vacation between 2nd and 3rd semester	Credits	:	04
Total Lecture Hours	:	-	CIE Marks	:	100
Total Tutorial Hours	:	-	SEE Marks	:	-
Course Code	:	N3MCINT	Course	INT	

Course Objectives:

This Course will enable students to:	
1.	Understand the real-time industry/research work environment
2.	Learn to develop applications using modern tools and technologies
3.	Gain knowledge by self-learning.

Instructions to Students:

1	All the students must undergo mandatory internship of 4 weeks during intervening the vacation of 2nd semester and 3rd semester.
2	A student or team of students can present the progress about the internship to the guide.
3	CIE marks shall be evaluated with a weightage of Internship presentation for 50 marks and reports for 50 marks. The marks can be awarded to the student based on the criteria/rubrics formulated by the department.
4	The student has to submit a report about the outcome of the internship.
5	The internship report submitted by the student has to be evaluated by the guide concerned / a committee constituted by the head of the department.
6	After satisfying the internship requirements the degree will be awarded.
7	Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent semesters.
8	However, student can carry out 4th semester project without completing the internship.

Course Outcomes:

After the completion of this course, students will be able to:	
CO1	Analyse the real-time industry/research work environment with emphasis on organizational structure/job process/different departments and functions / tools / technology
CO2	Develop applications using modern tools and technologies.
CO3	Prepare Report & detailed presentation.
CO4	Demonstrate self-learning capabilities

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	2	2			1	1	1	1
	CO2	2	2		1	1	1	1	1
	CO3	2				1	1	1	1
	CO4					1		1	1

1: Low, 2: Medium, 3: High

IV Semester

Major Project

Hours/Week	:	-	Credits	:	20
Total Lecture Hours	:	-	CIE Marks	:	50
Total Tutorial Hours	:	-	SEE Marks	:	50
Course Code	:	N4MCMP	Course	PROJ	

Major project Regulations	
1	The project is to be carried out by individual student.
2	The major project is to be carried out for 14-16 week duration and evaluated at the end of the semester for the assigned credits.
3	The project may be carried out covering either of following • Design of a system. • Theoretical/Analytical modeling. • Computer simulation. • Developing working software • Interdisciplinary computer application/modeling.
4	The project may be part of the research activity carried out in the department or outside the institute in a recognized industry/research lab.
5	The literature survey should be one of the components of the project.
6	All the project work should be approved by DPEC
7	The DPEC allocate guides for the major project.

Table 1. Break up of CIE marks for major project

Seminar-1	20 marks
Seminar-2	40 marks
Seminar-3	40 marks
Total	**100 marks**

*CIE is evaluated for 100 marks, **which is reduced to 50**.

Rubrics:

Seminar-1

1. Relevance of the project topic & related literature survey –5M
2. Identification of requirements, problem analysis and framing objectives and preparing Abstract-5M
3. Degree of understanding the domain to adopt methodology to design the model- 10M

Seminar-2

1. Project Design -10M
   - Low level design
   - High level design
2. Project Implementation, Testing -15M
   - Implementation of project using appropriate tools/ technologies
   - Preparing test plan (as per project requirement)
3. Commitment to professional ethics and practices -5M
4. Lifelong learning to adopt new tools/technologies -5M
5. Adopt Project management principles while developing project -5M

Seminar-3

1. Project demonstration and project report submission (with similarity index <=25%) - 25M
2. Degree of innovative content / degree to which the project addresses societal/ environmental needs. - 08M
3. Work effectively on the project individually or as a member in a team. -5M
4. Identify business model to convert project work into a product.-2M

SEE for the major project

SEE is conducted by an external examiner and the Project guide. The breakup of marks is given in Table 2.

SEE is done for a total of 100 marks, ***which shall be reduced to 50.***

Table 2. Break up of SEE marks for major project

Evaluation of the Dissertation report by external examiner and the guide(average of independent evaluations)	50 marks
Presentation, Demonstration and viva-voce	50 marks
Total	**100 marks**

Course Outcomes:

After the completion of this course, students will be able to:		
CO1.	Identify the relevant domain and apply the computing knowledge for the problem.	PO1(3)
CO2.	Analyse the defined problem and identify the corresponding requirements / objectives by conducting literature survey.	PO2(3)
CO3.	Design and develop a model / procedure / algorithm incorporating ESG/SDG goals.	PO3(2)
CO4.	Implement the developed model using appropriate software tools / technologies.	PO4(3)
CO5.	Apply the management principles for managing projects.	PO6(2)
CO6.	Adhere to professional ethics and norms of computing practices.	PO7(2)
CO7.	Effectively engage in lifelong learning.	PO8(1)
CO8.	Prepare a report and demonstrate the project work.	PO5(3)

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	3							
	CO2		3						
	CO3			2					
	CO4				3				
	CO5					3			
	CO6						2		
	CO7							2	
	CO8								1

Degree of compliance **1**: Low **2**: Medium **3**: High

Technical Seminar

Hours/Week	:	-	Credits	:	2
Total Lecture Hours	:	-	CIE Marks	:	100
Total Tutorial Hours	:	-	SEE Marks	:	-
Course Code	:	N4MCTS	Course	SEM	

Course Objectives:

This Course will enable students to:	
1.	Identify the topic of the seminar appropriate to the IT domain
2.	Perform literature survey
3.	Prepare Presentation slides and Dissertation Report.

Instructions to Students:	
1.	Select the seminar topics from recent and reputed publications (last 5 years Scopus Journals/Conferences, Web of Science, IEEE explore or ACM digital library, etc.).
2.	Students must prepare and submit a report to their respective guides which is evaluated by Guide and DSEC(Dept Seminar Evaluation Committee).
3.	The students must publish a research article. Students will be awarded 10 marks if the article is published in the Scopus / web of science Journals/Conference else 5 marks will be awarded, if the article is published in peer-reviewed Journals/Conference

Course Outcomes:

After the completion of this course, students will be able to:	
CO1.	Develop a thought process for technical presentation
CO2.	Perform the literature survey through standard referrals and select the relevant topic that is in synchrony with recent trends by adhering ethics.
CO3.	Prepare a concise article using ICT efficiently.
CO4.	Communicate professionally and develop the spirit of lifelong learning.

Scheme for Continuous Internal Evaluation (CIE):

The evaluation will be done by one senior faculty / Internal Guide from the department and one External member from Academia / Industry / Research Organization.

Break up of CIE marks

Rubrics	Marks
Topic Relevance	05
Literature Review	10
Technical relevance, Sustainability and Societal Concerns	10
Presentation Skills	10
Viva- Voce	05
Paper Published (Scopus Indexed / Non- Scopus Indexed)	10

Course Articulation Matrix (Mapping between COs and POs):

		Program Outcomes							
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
Course Outcomes	CO1	1	1			1		1	1
	CO2	1	1			3		1	1
	CO3	1	1			3		1	1
	CO4	1	1			3		1	1
	CO5								
	CO6								
	CO7								
	CO8								

1: Low, 2: Medium, 3: High