Credit Framework for Master of Computer Applications (NEP-2020)
School of Computer Applications, BBD University, Lucknow

Semester	Discipline Specific Core (DSC) (Major)	Discipline Specific Elective (DSE) (Major)	Generic Elective (GE)(Minor)	Co-Curricular (CC)	Vocational Course(VC)	Survey/Seminar/MOOC/Community Outreach (SSMC)	GP	Total Credit
1	6 Subjects 28 Credits (6+6+4+4+4+4 Credits)						1 Credit	29
2	6 Subjects 26 Credits (6+6+4+4+4+2 Credits)	1 Subject 4 Credits					1 Credit	31
3	4 Subjects 18 Credits (6+6+4+2+8 Credits) Dissertation 8 Credits	1 Subject 4 Credits					1 Credit	31
4	Project 28 Credits						1 Credit	29

Babu Banarasi Das University, Lucknow
School of Computer Applications
Master of Computer Applications
Evaluation Scheme (w. e. f. Academic Session 2025-26)

SEMESTER I

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN21101	Fundamentals of Information Technology	3	1	0	40	60	100	4
DSC	MCAN21102	Computer Organization	3	1	0	40	60	100	4
DSC	MCAN21103	Relational Database Management System	3	1	0	40	60	100	4
DSC	MCAN21104	Object Oriented Programming Using Java	3	1	0	40	60	100	4
DSC	MCAN21105	Discrete Mathematics	3	1	0	40	60	100	4
DSC	MCAN21106	Principles of Management	3	1	0	40	60	100	4
DSC	MCAN21151	Relational Database Management System Lab	0	0	4	40	60	100	2
DSC	MCAN21152	Object Oriented Programming Using Java Lab	0	0	4	40	60	100	2
	GP2101	General Proficiency	0	0	0	100	0	100	1
Total			**18**	**6**	**8**	**420**	**480**	**900**	**29**

SEMESTER II

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN22101	Operating System	3	1	0	40	60	100	4
DSC	MCAN22102	Computer Network	3	1	0	40	60	100	4
DSC	MCAN22103	Web Technology and Application Development	3	1	0	40	60	100	4
DSC	MCAN22104	Data Structures Using Java	3	1	0	40	60	100	4
DSC	MCAN22105	Software Engineering	3	1	0	40	60	100	4
DSC	MCAN22106	Research Methodology	2	0	0	40	60	100	2
DSE		Discipline Specific Elective-I	3	1	0	40	60	100	4
DSC	MCAN22151	Web Technology and Application Development Lab	0	0	4	40	60	100	2
DSC	MCAN22152	Data Structures Using Java Lab	0	0	4	40	60	100	2
	GPN2201	General Proficiency	0	0	0	100	0	100	1
Total			**20**	**6**	**8**	**460**	**540**	**1000**	**31**

SEMESTER III

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN23201	Python Programming Concepts	3	1	0	40	60	100	4
DSC	MCAN23202	Mobile Application Development	3	1	0	40	60	100	4
DSC	MCAN23203	Design & Analysis of Algorithms	3	1	0	40	60	100	4
DSC	MCAN23204	Simulation & Modelling	2	0	0	40	60	100	2
DSE		Discipline Specific Elective-II	3	1	0	40	60	100	4
DSC	MCAN23251	Python Programming Concepts Lab	0	0	4	40	60	100	2
DSC	MCAN23252	Mobile Application Development Lab	0	0	4	40	60	100	2
DSC	MCAN23253	Dissertation	0	0	0	80	120	200	8

	GPN2301	General Proficiency	0	0	0	100	0	100	1
Total			**14**	**4**	**8**	**460**	**540**	**1000**	**31**

SEMESTER IV

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN24251	Project	0	0	0	320	480	800	28
	GPN2401	General Proficiency	0	0	0	100	0	100	1
Total			**4**	**0**	**0**	**420**	**480**	**900**	**29**
Discipline Specific Elective-I									
1	MCAN22121	Artificial Intelligence							
2	MCAN22122	Cloud Computing							
3	MCAN22123	Data Warehousing and Data Mining							
Discipline Specific Elective-II									
1	MCAN23221	Generative AI and Prompt Engineering							
2	MCAN23222	Internet Of Things(IoT)							
3	MCAN23223	Big Data and concepts of Hadoop							

DSC	Discipline Specific Core
DSE	Discipline Specific Elective
GE	Generic Elective
CC	Co-Curricular
VOC	Vocational Course
GP	General Proficiency
L	Lecture
T	Tutorial
P	Practical

Master of Computer Applications

FIRST SEMESTER

Program	Master of Computer Applications				
Year	I	Semester	I		
Course Name	Fundamentals of Information Technology				
Code	MCAN21101				
Course Type	DSC	L	T	P	Credit
Pre-Requisite		3	1	0	4
Course Objectives	The Subject provides the fundamental concepts of Computer, its functional and hardware components, Computer Networks, Operating System, and Modern Technologies.				

Course Outcomes	
CO1	To Understand the Functional Components of Computers, History of Computers, Hardware, and Software Components of Computer.
CO2	To Understand the Concept of Operating Systems, Computer Security Systems, Computer Viruses.
CO3	Understand the Concept of Computer Networking and How to Use Internet Technology and Their Various Applications.
CO4	Understanding about the Modern Technologies.

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Computers:** Introduction to Computer; Basics of Computers and its Operation; History of Computer; Generations of Computer; Capabilities and limitations of Computers; Types of Computers; Hardware: CPU (Architecture & Related Technology) and introduction to Microprocessors; Storage Devices: Primary & Secondary; Auxiliary Storage Devices; Cache Memory; Memory Hierarchy; Types of Software: System Software, Application Software; Input Devices; Output Devices; Booting and POST.	15	CO1
2	**Operating System:** Types of Operating System; MS-DOS: Internal and External Commands; MS-Windows; Functions of Operating System: Process Management (Job Scheduling), Memory Management, File Management, I/O Management, Security; Introduction to Programming Languages, Language Processing: Translator, Assembler, Compiler, Interpreter, Cross Compiler, Security threats: Virus & Anti-Virus and Worms .	15	CO2
3	**Computer Networks & Internet:** Data Communication: Signaling & Transmission; Network Devices: HUB, Switch, Router, Gateways, etc.; Types of Networks: LAN, MAN, WAN, PAN; Topology: Types of Topologies; Transmission Mode & Media; Switching Techniques, OSI Reference Model; TCP/IP Reference Model; Internet and Protocol, Internet: Services, Internet Security, Uses of Internet, Virus–Antivirus, Cloud System, Cloud Technologies.	15	CO3

4	**Introduction to Modern Technologies:** Open Source Software: benefits, comparison between OSS and license software; Mobile Application Development: android , emulator; Data Science & Analysis: need of Data Science, components; Artificial Intelligence: application, types, goals; Soft Computing: need, elements, difference between hard and soft computing; Cloud Computing: types, advantages and disadvantages, applications; IOT: features, advantages and disadvantages; Digital Marketing: components; Blockchain: areas of blockchain, concept of bitcoin; Edge Computing: applications, challenges; Extended Reality (XR): applications, AR, VR, MR.	15	CO4

Suggested Readings

1. E. Balagurusamy, "Fundamentals of Computers", Tata McGraw Hill Education, 2nd Edition, 2010.
2. Peter Norton's., "Introduction to Computers", McGraw Hill Education, 7th Edition, 2017.
3. Raja Raman,V. "Fundamentals of Computers", PHI Publications, 6th Edition, 2014.
4. A. K. Sharma, "Computer Fundamentals & Programming in C". The Orient Blackswan; Second Edition, 2018.

Online Resources

1. https://nptel.ac.in/courses/106106092
2. http://www.iitk.ac.in/esc101/current/lectures.html

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2				2	1	2		1		1	2	1	
CO2	2				3	2	2		1		1	2	2	
CO3	3	1			2	2	2		1	1	1	2	2	
CO4	2	1			2	2	2		1	1	1	2	2	

Program	Master of Computer Applications				
Year	I	**Semester**	I		
Course Name	Computer Organization				
Code	MCAN21102				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	Enhance understanding of Computer Organization, its design, and implementation, enabling students to articulate design issues in developing processors and components that meet specific requirements.				
Course Outcomes					
CO1	Develop familiarity with Digital Electronics terminology and principles for effective analysis and application of digital circuits and systems.				
CO2	Gain familiarity with Computer Processor terminology and principles to analyze and design efficient and high-performance processor architectures.				
CO3	Understand the principles of communication between I/O devices and Processors, facilitating the design of effective I/O subsystems.				
CO4	Gain an understanding of concepts related to data storage and retrieval from memory systems, enabling the design and optimization of memory hierarchies.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Digital Electronics:** Number System, Boolean Algebra**,** Minimization of Boolean Expressions using K-Map; Logic Gates: Implementations of Logic Functions using Gates. **Combinational Circuits:** Introduction to combinational circuits, Adders & Subtractors; Multiplexer & De-Multiplexer; Decoder. **Sequential Circuit:** Introduction to Flip Flops, Types of Flip flop, Excitation table of Flip flop, Introduction of Registers; Classification of Registers, Introduction of Counter; Synchronous and Asynchronous counter.	15	CO1
2	**Register Transfer and Micro-operation:** Register Transfer Language: Bus and Memory Transfer; Micro operations: Arithmetic, Logical, Shift micro- operations; Arithmetic logic shift unit; Timing and control; Computer instructions, Instruction codes, Instructions Format., Instruction Cycle, Flow Chart of Instruction Cycle. **Central Processing Unit:** Accumulator based organization; General register organization; Stack organization; Addressing Modes; RISC vs. CISC, Hard wired & Micro Programmed control Unit**.**	15	CO2
3	**I/O Organizations:** Introduction to system buses; Input/ output interface; Interrupt and Interrupt handling: S/W Interrupt, H/W Interrupt, Vectored Interrupt, Daisy Chaining, Priority Interrupt; Device Polling; Serial Vs Parallel communications; I/O Processor; Synchronous Data Transfer; Asynchronous Data Transfer methods: Strobe Control, handshaking; Modes of Data Transfer: Programmed I/O, Interrupt initiated I/O. DMA; DMA: DMA Controller, DMA Transfer; CPU-IOP Communication.	15	CO2 & CO3
4	**Memory organizations**: Memory hierarchy; Main Memory: RAM Chips, ROM Chips; Concept of address space & Memory Space; Address Mapping; Auxiliary Memory; Cache memory: Mapping Techniques: Direct mapping, Associative mapping, Set associative mapping; Associative memory, Cache Basics-Measuring and improving Cache performances.	15	CO4

	Concepts of Parallel Processing: Definition of Parallel Processing, Characteristics of parallelism, Parallelism in Uniprocessor and Multi-Processor System, Introduction to multithreading, Concept of Multiprocessor and Shared memory microprocessor.		

Suggested Readings:

1. M. Morris Mano "Digital Logic and Computer Design", 2nd Edition, PHI.
2. P. Raja, "Switching Theory", Fourth Edition, Umesh Publication.
3. M. Morris Mano, "Computer System Architecture", PHI
4. B. Ram, "Fundamental of Micro Computer and Micro Processor", Dhanpat Rai Publication, 3rd Edition
5. William Stalling, "Computer Organization & Architecture", Pearson Education Asia.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105163/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	3	2	2				2	1	1	3	1
CO2	2	2	2	2	2	3				3	2	1	3	2
CO3	2	2	1	1	1	1				2	2	2	3	
CO4	2	2	2	2	3	2				2	2	1	3	2

Program	Master of Computer Applications				
Year	I	**Semester**		**I**	
Course Name	Relational Database Management System				
Code	MCAN21103				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The objective of this course is to introduce the fundamental concepts of DBMS, terminologies of database management system, E-R Modeling, PL/SQL concept, database transactions and concurrency control techniques.				
Course Outcomes					
CO1	Understand the basic concepts of the database and data models.				
CO2	Understand the fundaments concepts ER diagrams and map ER diagrams into Relations.				
CO3	Evaluate the alternative database designs to determine which one is better according to selected criteria.				
CO4	Understand the basic concepts/features of database transactions and concurrency control techniques.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction:** Data and information, Concepts of persistent data, File system , Basic File Operations, File Structure and Organization, Types of File Organization: Sequential, Heap, Hash, B+,Cluster, Indexed sequential access method; **Database Management System:** Introduction of DBMS, Characteristics of the Database Approach, Components of Database System, Database Management System vs. File Management System, Advantages and Disadvantages of DBMS, DBMS Users , DBMS Architecture: 1-Tier, 2-Tier, 3-Tier ; Capabilities of good DBMS, Database Schemas and Instances, Classification of Database Management Systems, Database Languages; **Data Models:** Introduction of Data Models, Relational , Entity Relationship, Object Based , Semi-Structure.	15	CO1
2	**Relational Database Management System & Data Modelling:** Introduction to Relational database, Structure of Relational Database, Relational model terminology: Relations , Domains, Attributes, Tuples, Relational Constraints, Codd Rule, Entity-Relationship Model: Entity Sets, Entity Types, Attributes, Attributes Types, Relationships, Relationship Types ,Keys, Constraints, Entity-Relationship Model: E-R Model Concepts, Notation for E-R Diagram, Mapping Constraints, Extended E-R Features, Reduction of E-R Diagram to Relation; **Relational Algebra:** Concepts of Relational Algebra, Fundamentals Operations: Select, Project, Rename, Union, Set difference, division, Cartesian Product, Additional Relational-Algebra Operations: Set Intersection, Natural Join And Outer join	15	CO1 & CO2
3	**SQL and Database Design Theory:** Introduction on SQL: Characteristics of SQL, Advantage of SQL, SQL Data Type and Literals, Types of SQL Commands, SQL Operators and their Procedure, Queries and Sub Queries, Aggregate Functions, Insert, Update and Delete Operations, Joins, Unions,	15	CO3

	Intersection, Minus, View, Cursors Triggers and PL/SQL.; **Functional Dependencies and Normalization:** Informal Design Guidelines for Relation Schemas, Database Anomalies, Functional Dependencies, Armstrong's axioms, Closure of Attribute sets, Normalization, Need of Normalization, Normal Forms, First, Second, Third, Boyce-Codd, Fourth and Fifth Normal Form.		
4	**Transaction Processing & Concurrency Control:** Basic concept; Introduction to Transaction, ACID properties; transaction state; Basic idea of serializability, view and conflict serializability, Recovery and, Recovery Techniques: Log Based Recovery, Shadow Paging, deferred database modification, immediate database modification, checkpoints; **Concurrency Control:** Definition of concurrency, lost update, dirty read, and incorrect summary problems due to concurrency. Deadlock Handling: Deadlock Concepts, Deadlock Prevention, Deadlock Detection and Recovery, Concurrency Control Techniques: Lock Based Protocol, Timestamp-Ordering Protocol, Validation-Based Protocols**.**	15	CO3 & CO4

Suggested Readings

1. Korth, Silbertz, Sudarshan, Database Concepts, McGraw Hill, Seventh Edition-2019
2. Elmasri, Navathe, Fundamentals of Database Systems, Addison Wesley, Seventh Edition-2017
3. Date C J, An Introduction to Database Systems, Addison Wesley, Eight Edition-2017
4. Bipin C. Desai, An Introduction to Database Systems, Galgotia Publications, Sixth Edition-2013
5. Ramkrishnan, Gehrke, Database Management System, McGraw Hill, Third Edition-2002
6. Ivan Bayross -- SQL, PL/SQL: The Programming Language of Oracle, BPP Publication, Fourth Edition-2010
7. R. S. Despandey --SQL/PL SQL for Oracle, 2011.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					1			1		1	2	2	1
CO2	1	2	3	1	3	2	1		3	2	2	2	2	2
CO3	1	1	2	3	2	2	2		3	2	2	2	2	3
CO4	2	2	1	2		2	1		1	1		2	1	2

Program	Master of Computer Applications				
Year	I	**Semester**	I		
Course Name	Object Oriented Programming Using Java				
Code	MCAN21104				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The main objective of this subject is to introduce the fundamental concepts of object oriented Programming, show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard and to familiarize the concepts of packages and interfaces, handling exceptions, and demonstrate the concept of event handling using swing.				
Course Outcomes					
CO1	Understand the concept of object oriented programming and implement it in Java.				
CO2	Comprehend building blocks of OOPs language, class, objects and method etc.				
CO3	Understand inheritance, package and interfaces.				
CO4	Implement multithreading in object oriented programs and designing GUI using AWT Control and event handling using swing				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Java:** OOPS principles, Evolution of Java, Features of Java, Byte Code and Java virtual machine, JDK, Structure of Simple Java Program, Compiling and Interpreting Applications; Java Tokens: Java Character set, Keyword and Identifiers; Data Types, Operators and Expression; Control Statements, Looping; **Array and String:** Single and Multidimensional Arrays, String Class, String Buffer Class, Operations on String, Command Line Argument, and Use of Wrapper Class.	15	CO1
2	**Classes, Objects & Methods:** Class, Object, Object Reference, Methods in Java, Method Overloading, Constructor, Constructor Overloading, Passing and Returning Object from method; new Operator; this & Static Keyword; finalize() method; Visibility modifiers; Nested Class, Inner Class.	15	CO2
3	**Inheritance and Polymorphism:** Inheritance in Java, Types of Inheritance, Member Access Rule, Use of this and Super Keyword, Abstract class, Dynamic Method Dispatch, Use of final Keyword; **Package & Interface:** Defining and Importing Packages, Defining and Implementing Interfaces, Extending Interfaces; **I/O STREAM:** Concept of Streams Streams Classes: Byte and Character Stream, Reading Console input & Writing Console output.	15	CO3

4	**Exception Handling:** Exception Type, Usage of try, catch, throw, throws and finally Keywords, Creating Own Exception Classes; **Multi-Threading:** Concept of Thread, Thread Life Cycle, Creating Thread Using Thread Class and Runnable Interface, Thread Priority; **AWT Control:** The AWT Class Hierarchy, User Interface Components: Labels, Button, Text Components, Check Box, Check Box group, Choice, List Box, Panels, Working with Frame Class, Fonts and Layout Manager; **Event Handling:** Events, Event Sources, Event Listeners, EDM, Handling Mouse and Keyboard Events. **Swing:** Introduction of swing, difference between swing & AWT, Swing components: JComponent, JLabel, JCheckBox, JButton, JTextField, etc.	15	CO4

Suggested Readings

1. Herbert Schild, "The Complete Reference, Java 2 (Fourth Edition),", TMH
2. E.Balaguruswamy, Programming with Java A Primer, Mc Grawhill
3. Head First Java, O'rielly publications
4. Udit Agrawal, "Internet and Java Programming," Dhanpat Rai & Co.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105191/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	2	1	2	1	2		3	1	2	2	2	2
CO2	2	1	1	1	2	3	3		1			2	2	2
CO3	1	2	2	2	2	2	2	1	2	1	1	1	2	2
CO4	2	3	1	2	1	3	2	1	2		2	1	2	2

Program	Master of Computer Applications				
Year	I	**Semester**		I	
Course Name	Discrete Mathematics				
Code	MCAN21105				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The objective is that students will be able to distinguish between the notion of discrete and continuous mathematical structures & will be able to apply fundamental counting algorithms to solve applied problems in the area of computer science.				
Course Outcomes					
CO1	To Perform operations on discrete structures such as sets, functions, relations, and sequences.				
CO2	To Solve problems of recurrence relations and generating functions.				
CO3	To Verify the correctness of an argument using propositional and predicate logic and truth tables.				
CO4	To understand the concept of graph theory.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Set Theory, Relation & Function**: **Set Theory:** Definition of Sets, Type of Sets, Venn Diagrams, Operation on Sets, Subsets, Power Set, Cartesian Product, Principle of Inclusion and Exclusion, Multisets; **Relation**: Definition of Relation, Binary Relations, Inverse Relations, Composition of Relations, Properties of Relations, Equivalence Relations, Partial Order Relations, Partial Ordered Set, Hasse Diagram of Poset; **Function**: Definition & Type of Functions, One-to-One Function, Onto Function, Inverse Function, Compositions of Functions .	15	CO1
2	**Discrete Numeric Function and Recurrence Relation**: Numeric Function, Generating Function, Recurrence Relation, Linear Recurrence, Relation with Constant Coefficients, Homogeneous and Particular Solution, Solution by Method of Generating Function.	15	CO2
3	**Fundamentals of Logics:** Proposition, First order Logic, Logical Operation, Truth Values, Compound Proposition, Tautologies & Contradiction, Logical Equivalences, De-Morgan's laws. Predicates, Universal and Existential Quantifiers.	15	CO3
4	**Graph Theory:** Graph: Graph Terminology, Types of Graph: Simple Graph, Complete Graph, Bipartite, Regular and Planar Graph, Euler Graphs, Directed Graph, Hamiltonian Path and Circuits, Graph Coloring, Chromatic Number; **Tree**: Definition of Tree, Spanning Tree, Minimal Spanning Tree, Kruskal's Algorithms, Prim's Algorithms.	15	CO4

Suggested Readings

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH, New Delhi, 2000.
2. Kolman, Busby and Ross "Discrete Mathematical Structures" PHI/Pearson., 6th Ed., 2009.
3. Kenneth H. Rosen, "Discrete Mathematics & Applications", TMH, 6th Ed., 2007.
4. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Book Company, 2nd Ed., 1985.
5. Narsingh Deo, "Graph Theory", PHI, 24th Indian Print, 2003.

Online Resources

1. https://archive.nptel.ac.in/courses/106/108/106108227/
2. https://archive.nptel.ac.in/courses/106/103/106103205/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	1	1	1					1	1	2	1
CO2	2	2	1	1	1	1					1		2	1
CO3	2	2	2	2	1	1				1	1		2	2
CO4	3	3	2	2	2	2				1	1	1	2	2

Program	Master of Computer Applications				
Year	I	**Semester**	I		
Course Name	Principles of Management				
Code	MCAN21106				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	Principles of management is a comprehensive introductory course on the management process from a manager's perspective, with particular emphasis on the skills, competencies, techniques, and knowledge needed to successfully manage an organization				
Course Outcomes					
CO1	Understand how managers manage business organizations in the dynamic global environment.				
CO2	Get an understanding of the basic principles of staffing and leadership.				
CO3	Understand contemporary management concepts and skills and put these concepts and skills into practice.				
CO4	Apply conceptual tools and techniques in analyzing, evaluating, and addressing management issues.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction:** Concept, nature, process, and significance of management. Managerial levels, skills, functions, and roles. Management Vs. Administration. Coordination is the essence of management. Development of management thought: classical, neo-classical & behavioral approach.	15	CO1
2	**Planning and Organizing I:** Planning: Nature, scope and objectives of planning, Types of plans, Business forecasting. MBO, Concept, types, process of decision-making. **Organizing:** Concept, nature, process, and significance. Principles of an organization, Span of Control.	15	CO2
3	**Staffing and Motivation:** Staffing: Concept, Nature, and Importance of Staffing; Motivating and Leading: Nature and Importance of motivation, Types of motivation, Theories of motivation: Maslow, Herzberg, X, Y and Z. **Leadership:** meaning and importance, Leadership Styles: Autocratic, Democratic & Laissez-faire.	15	CO3
4	**Controlling:** Nature and Scope of control, Types of Control, Control process, **Control techniques:** traditional and modern, Effective Control System.	15	CO4

Suggested Readings

1. Stoner, Freeman and Gilbert Jr., Management, Prentice Hall of India, New Delhi, 2003.
2. Gupta, C.B., Management Concepts and Practices, Sultan Chand and Sons, New Delhi, 2003.
3. Koontz. O Donnel and Weirich, Management, Tata McGraw Hill Publishing Company, New Delhi, 2001.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc23_mg33/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1					1		2		1			1		1
CO2			1			1				2			2	1
CO3			1		2		1		1	3	1	2	1	2
CO4		1				2	2		2				3	

Program	Master of Computer Applications				
Year	I	**Semester**		I	
Course Name	Relational Database Management System Lab				
Code	MCAN21151				
Course Type	DSC-Lab	**L**	**T**	**P**	**Credit**
Pre-Requisite		0	0	4	2
Course Objectives	The main objective is students gain knowledge about databases for storing the data and to share the data among different kinds of users for their business operations				
Course Outcomes					
CO1	Develop database modeling for a problem and normalization.				
CO2	Design a database using PL/SQL.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	1. Creating and Managing Tables a. Creating and Managing Tables b. Including Constraints 2. Manipulating Data a. Using INSERT statement. b. Using DELETE statement. c. Using UPDATE statement. 3. SQL Statements – 1 a. Writing Basic SQL SELECT Statements b. Restricting and Sorting Data c. Single-Row Functions 4. SQL Statements – 2 a. Displaying Data from Multiple Tables b. Aggregating Data Using Group Functions c. Subqueries 5.. Using SET operators, Date/Time Functions, GROUP BY clause a. Using SET Operators b. Datetime Functions c. Enhancements to the GROUP BY Clause d. Advanced Subqueries 6. Creating and Managing other database objects a. Creating Views b. Other Database Objects c. Controlling User Access 7. Using DCL commands a. creating users. b. Authenticating users c. c. Roll back command **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1 & CO2
2	1. Creating and Operation on Sequenced 2. Creating and Performing operation on Index 3. Creating a Simple Program of PL/SQL 4. Creating and Using Stored Procedure through PL/SQL 5. Creating and Using Function through PL/SQL 6. Creating Implicit and Explicit Cursor Program 7. Creating Triggers and Firing it **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1 & CO2

Suggested Readings

1. Ivan Bayross , “SQL, PL/SQL: The Programming Language of Oracle”, BPP Publication
2. Connolly & Begg, “Database Systems: A Practical Approach to Design, Implementation and Management”, Pearson Education

Online Resources

1. https://www.youtube.com/watch?v=TB5T2O8Hwm8

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2			1	2	1	1		2		1	1	1	
CO2	1	1	1	1	2	2	2		2		1	2	1	1

Program	Master of Computer Applications				
Year	I	**Semester**	I		
Course Name	Object Oriented Programming Using Java Lab				
Code	MCAN21152				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		0	0	4	2
Course Objectives	The main objective of this subject is to introduce the fundamental concepts of object oriented Programming, show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard and to familiarize the concepts of packages and interfaces, handling exceptions, and demonstrate the concept of event handling using swing.				
Course Outcomes					
CO1	Use the syntax and semantics of java programming language and basic concepts of OOP using the concepts of inheritance, polymorphism, interfaces and packages.				
CO2	Apply the concepts of Multithreading, Exception handling & swing to develop efficient and error free codes and to design event driven GUI and web related applications which mimic the real word scenarios.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	1. Implementation of a simple Java Program, Interpreting & Compiling. 2. Implementation of control, such as Loops etc. 3. Implementation of Single and Multidimensional Array. 4. Implementation of String class and String Operations. 5. Implementation of Classes and Objects. 6. Implementation of Method in Java. 7. Implementation of Constructors and Constructor Overloading. 8. Implementation of Access Modifier. 9. Implementation of static and this keyword. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1
2	1. Implementation of Inheritance in Java 2. Implementation of Super Keyword. 3. Implementation of Abstract class and final Keyword. 4. Defining and Importing Packages. 5. Defining and Implementing Interface. 6. Implementation of I/O Stream. 7. Implementation of Exception Handling 8. Handling of Multiple Threads. 9. Implementation of AWT Control. 10. Implementation of Event Handling. 11. Implementation of JComponent, JLabel, JCheckBox, JButton, JTextField by using Swing. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO2

Suggested Readings

1. Herbert Schild, “The Complete Reference, Java 2 (Fourth Edition),”, TMH
2. E.Balaguruswamy, Programming with Java A Primer, Mc Grawhill
3. Head First Java, O’rielly publications

4. Udit Agrawal, “Internet and Java Programming,” Dhanpat Rai & Co.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105191/

						Course Articulation Matrix								
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1			2	1	1					1	2	1
CO2	2	2	1	1	2	1	2		2	2	1	3	2	2

SECOND SEMESTER

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Operating System				
Code	MCAN22101				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	Provide basic knowledge of computer operating system structures and functioning, comparing several different approaches to memory management, file management and process management and understanding various problems related to concurrent operations and their solutions.				
Course Outcomes					
CO1	Outline the basic concept of operating systems and Analyse the working of operating system.				
CO2	Understand the mechanisms used for process synchronization & handling deadlock.				
CO3	Examine the working of various scheduling/allocation approaches				
CO4	Understand the file system structure and storage management.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Operating System:** System Components, System Calls and its types; System Programs; System Boot;Types of Operating System; Operating System Structure: Simple Structure, Layered Approach, Microkernels, Exokernels; Virtual machine; **Introduction to Process Management:** Process States, Process Control Block; Process Scheduling: Scheduling Queues, Schedulers, Context Switch, Scheduling Objectives, Scheduling Criteria; Scheduling Algorithms: First Come First Serve, Shortest Job First, Round Robin, Priority; Multiple- Processor Scheduling; Real-Time Scheduling; Multilevel Feedback Queue Scheduling; Threads; **Process Management Commands:** fg, bg, jobs ps, kill, nice, renice commands.	15	CO1
2	**Deadlocks:** System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock; **Process Management and Synchronization:** The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors Inter process Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory; **Process Synchronization Commands :** top, htop**,** pipes(|),ipcs –s-q-a-p-l-t	15	CO1 & CO2

3	**Memory Management and Virtual Memory :**Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Virtual Memory, Demand Paging, Page Replacement; **Page Replacement Policies:** FIFO, LRU, Optimal, Counting Based; Allocation of Frames: Minimum Number of Frames, Allocation Algorithm, Global Versus Local Allocation; Thrashing: Cause of Thrashing, Working Set Model; **Memory Management Techniques :** Virtual Address Space, Page Tables, free, vmstat commands, Swap Space.	15	CO2 & CO3
4	**File system interface:** File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management; **Storage Management:** Secondary Storage Structure: Disk Structure**,** Disk Scheduling Algorithms **System Protection:** Goals, Principles, Domain of Protection, Access Matrix, Access Control; **Linux Security:** User and Group Management, Permissions,Changing Permissions chmod, Changing Ownership: chown, chgrp ; SELinux/AppArmor (Introduction), Basic Firewall Configuration (ufw, firewalld).	15	CO3 & CO4

Suggested Readings

1. Abraham Silberschatz and Peter Baer Galvin, “Operating System Concepts”, Addison-Wesley.
2. Andrew S. Tanenbaum , Herbert Bos “Modern Operating Systems” 5th Edition 2024, Pearson
3. William Stallings, “Operating Systems: Internal and Design Principles”, PHI.
4. D M Dhamdhere, “Operating System- a Concept based Approach”, McGraw Hill Education.
5. Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.
6. Operating Systems, Internals and Design Principles, Stallings, Seventh Edition, Pearson.
7. Sumitabha Das, "Your Unix/Linux - The Ultimate Guide," McGraw Hill.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105214/
2. https://onlinecourses.nptel.ac.in

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2				1		3	2	
CO2	2	3	1	2	1	1	1			2		3	2	3
CO3	3	2	1	3		1	1			2	1	3	2	2
CO4	2	2		2	2	2			1	2	1	3	2	2

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Computer Networks				
Code	MCAN22102				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To study the different aspects of data communication service integrated over the IP networks, focusing on protocol.				
Course Outcomes					
CO1	Understand concepts of data communica0tion, signal transmission and different networking elements along with protocols in each layer of references				
CO2	Understand the fundamentals of Data Link Layers, Multiple Access Protocols, Wired, and Wireless LAN.				
CO3	Gain basic knowledge of Network layer with routing protocols.				
CO4	Gain basic knowledge of Transport layer and Application Layer with protocols.				

Module	Course Contents	Contact	Mapped CO
1	**Data Communications**: Definition, Effectiveness (Delivery, Accuracy, Timeliness, Jitter), Components (Sender, Receiver, Message,Transmission Medium, Protocol), Data Representation (Text, Number, Image, Audio, Video), Data Flow (Simplex, Half-Duplex, Full-Duplex), Guided and Unguided Media, Switching Techniques (Circuit Switching, Packet Switching), Signals and Transmission Media: Analog and Digital, Bandwidth and Throughput; Transmission Modes, **Introduction to Computer Network:** Definition, Applications, Key Devices (Modem, Switch, Router), Network Protocols and Standards, Reference Models (OSI, TCP/IP), Address Types (Unicast, Multicast, Broadcast), Introduction to Physical Layer.	15	CO1
2	**Data Link Layer and Multiple Access:** Basic Function of Data Link Layer: Framing (Flow and Error control), Error Detection and Error Correction (Checksum, Hamming Distance), HDLC, Two Sub Layers (Data Link Control, Media Access Control); **Multiple Access Protocols:** ALOHA, CSMA/CD, CSMA/CA, Polling, FDMA, TDMA, CDMA; **Wired and Wireless LAN's:** IEEE Standards, Standard-Ethernet, Gigabit Ethernet, IEEE 802.11; Frame Relay and ATM.	15	CO2
3	**Network Layer:** Basic Function of Network Layer; Logical Addressing: IPv4, IPv6; **Address Mapping:** ARP, RARP, DHCP; Routing Protocols: Delivery, Forwarding Techniques, Routing Table,Shortest path Algorithm, Distance Vector Routing, Link State Routing, Flooding; Internet, Tunneling, Fragmentation, OSPF, BGP; Congestion Control, Open and Closed loop, Congestion Control Techniques.	15	CO3
4	**Transport Layer and User Defined Layer**: Basic Function of Transport Layer; Process-to-Process Delivery: TCP, UDP; QoS; Basic Function of Presentation and Session Layer with protocols**; Application Layer:** Namespace, Domain Namespace, Distribution and Resolution of Namespace;	15	CO4

	TELNET, E-Mail, SMTP, SNMP, POP, IMAP, FTP, WWW and HTTP.		

Suggested Readings

1. Andrew S Tanenbaum, David. J. Wetherall, "Computer Networks", Pearson Education,5th Edition, 2011.
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition, 2001.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open-Source Approach", Mc Graw Hill Publisher, 2011.
4. Dayanand Ambawade, Dr. Deven shah, Prof. Mahendra Mehra, "Advance Computer Network", Wiley India, 2017.
5. Todd Lammle, "CCNA Intro – Study Guide", Sybex, 2015.

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105183/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	**2**				**2**		**2**			**1**		**2**	**1**	**2**
CO2	**2**	**1**	**1**	**2**	**2**		**1**			**2**		**2**	**3**	**2**
CO3	**2**	**1**		**2**	**2**	**2**	**2**			**2**		**2**	**2**	**2**
CO4	**2**	**1**	**1**	**2**	**2**		**3**			**2**		**2**	**3**	**2**

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Web Technology & Application Development				
Code	MCAN22103				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To focus on the process of Web Development. To build sound concepts of several languages used in Web Technology and create a dynamic, interactive website quickly, confidently, and successfully				
Course Outcomes					
CO1	Understand the basic concept of HTML , DHTML and CSS using Tailwind.				
CO2	Understanding the basic concept of Java Script and its application.				
CO3	Understanding the basic concept of PHP and its application.				
CO4	Student able to develop personal and professional websites using React.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**HTML:** Introduction to HTML5; Introduction to Text Formatting tags; **Types of Lists:** Ordered, Unordered, Definition lists; **Table tags:** Methods to Create Tables , Attributes of Table tag, colspan and rowspan; Block level and Inline elements; Classes; Entities; frameset tags and its Attributes; **Form tag:** Creation of Forms, Textbox, Radio Button, Hidden etc.; **DHTML**: Style Sheets, Need of CSS, position, display: **Types of Style Sheet:** Inline, Internal and External; **Tailwind:** Introduction, working with tailwind	15	CO1
2	**JAVA SCRIPT:** Introduction, Advantages and disadvantages; Basic Programming Techniques: Data Types, Constants, Variables, Array; Operators and Expressions; **JavaScript Programming Constructs:** Conditional statements, Loops; Functions in JavaScript: Built in Functions and User Defined Functions; Dialog Boxes; **JavaScript DOM:** Object hierarchy in DOM, Event Handling; **Form Object:** Form Object's Methods and Properties, Text Element, Button Element, etc.; Other Built in Objects: String, Math and Date; Writing Client Side Validations HTML Form Elements	15	CO2
3	**Basics of PHP:** Introduction, Features , Data Types, Variables, Constants, Operators, Arrays; Conditional Statements and Iterations; **Functions in PHP:** User Defined and Built in Functions; String Functions; **Forms in PHP:** Adding elements to a form, uploading files to the web server; Debugging and Errors: Types of Errors and Error handling; Database Connectivity with MySQL	15	CO3
4	**Introduction to React:** File structure of react project, Impor and export, JSX Introduction, npm, Components, Virtual DOM Props in React, Prop Drilling, Context API; **React Hooks** Introduction, useState, useEffect, useRef, useContext; React DOM Events, Routing in react	15	CO4

Suggested Readings

1. Burdman Jessica, “Collaborative Web Development”, Addison Wesley. 2002.
2. Bayross Ivan,”HTML, DHTML. JavaScript, and PHP”, BPB Publications, 4th Edition, 2001.
3. Xavier, C,”Web Technology and Design”, New Age International, 2000.
4. Shah Dhruti “Node.JS Quickbook” BPB Publication. 2018.
5. Achyut S Godbole and Atul Kahate, “Web Technologies”, Tata McGraw Hill.
6. James L Mohler and Jon Duff, “Designing interactive web sites”, Delmar Thomson Learning.
7. Nicholas C. Zakas, Jeremy McPeak, Joe Fawcett, “Professional Ajax, 2nd Edition”, Wrox.
8. Narang, Robin Wieruch, "The Road to React: Your journey to master plain yet pragmatic React.js", Leanpub. 2019.
9. Holmes, Shelley, "What is React?", O'Reilly Media. 2020.

Online Resources

1. https://onlinecourses.swayam2.ac.in/nou20_cs05/preview
2. React Tutorial | GeeksforGeeks

Course Articulation Matrix

PO-PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	2	2		2	1	3	1	2	2
CO2	2		3		2	2	2	1	2		1	3	3	3
CO3		2	2	2	2	2	1		3		2	2	3	3
CO4	2		3		2	2	3		2	2	3	1	3	3

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Data Structures Using Java				
Code	MCAN22104				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The course objective is to make the student learn fundamental data structures algorithms and implements various data structure operation algorithms on Array, stacks, Queue linked list, tree and graph.				

Course Outcomes	
CO1	To understand the basic concepts in data structure and Design and implement abstract data types such as linked list.
CO2	Designing and Implements linear data structure like stack Queue by using java language.
CO3	Student will be able to design implement nonlinear data structure Tree and graph by using java language.
CO4	Student applies appropriate searching and sorting techniques java application development.

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Data Structures:** Need, Importance, and Classification, Abstract Data Types (ADT), Algorithm Analysis: Time and Space Complexity; **Arrays and Strings:** One-Dimensional and Multi-Dimensional Arrays, Operations: Insert, Delete, Search, Update, Strings in Java: String class, StringBuilder; **Linked Lists:** Singly Linked List: Creation, Insertion, Deletion, Traversal, Doubly Linked List, Circular Linked List.	15	CO1
2	**Stacks:** Concepts and Applications (e.g., undo, expression parsing), Implementation using Arrays and Linked Lists, Infix to Postfix, Postfix Evaluation; **Queues:** Simple Queue, Circular Queue, Deque, Priority Queue, Queue interface; **Recursion:** Basics and Use Cases, Recursion vs. Iteration, Stack Memory in Recursion (Factorial of a number, Fibonacci)	15	CO2
3	**Trees:** Definitions and Terminology, Binary Trees and Traversals (Recursive & Iterative), Binary Search Tree (BST): Insertion, Deletion, Searching, Balanced Trees: AVL Trees (Concept and Rotations), **Graphs:** Representation: Adjacency Matrix and List Graph Traversal: BFS and DFS, Directed vs Undirected Graphs Applications: Path Finding, Topological Sort	15	CO3
4	**Searching Algorithms:** Linear Search, Binary Search (Iterative and Recursive), **Sorting Algorithms:** Bubble, Insertion, Selection Merge Sort, Quick Sort, **Hashing:** Hash Tables, Hash Function.	15	CO4

Suggested Readings

1. Steve Holzner, “Java black book”, Paraglyph Press; Second Edit ion (July 1, 2002).
2. Duncan A Buell, “Data Structures Using Java”, Jones & Bartlett Learning, January 2012.
3. Narasimha Karumanchi “Data Structures and Algorithms Made Easy in Java”; Fifth Edition 2022.
4. Robert Lafore, “Data Structures and Algorithms in Java”, Second Edition, SAMS, Second Edition, 2003.
5. Goodrich, “Data Structures & Algorithms in Java”, Sixth Edition, (January 2014).

Online Resources

https://archive.nptel.ac.in/courses/106/102/106102064/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	2	2	3	1		1	2	1	3	3	3
CO2	3	2	2	3	2	3	1		1	2	1	3	3	3
CO3	3	2	2	3	2	3	1		1	2	1	3	3	3
CO4	3	2	2	3	2	3	1		1	2	1	3	3	3

Program	Master of Computer Applications				
Year	I	Semester	II		
Course Name	Software Engineering				
Code	MCAN22105				
Course Type	DSC	L	T	P	Credit
Pre-Requisite		3	1	0	4
Course Objectives	Student will be successful professionals in the field with fundamental knowledge of software engineering and apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles, and processes				
Course Outcomes					
CO1	Develop the understanding of Software Development Life Cycle.				
CO2	Preparation of SRS, High-Level, Low-Level Design and Test Cases.				
CO3	Aware of the various types of software design approaches.				
CO4	Knowledge of software testing and maintenance.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Fundamental Concept of Software Engineering & Models:** Introduction to Software Engineering, Software Crisis, Software Engineering Problems Characteristics of Software, types of software SDLC. **Software Development Models**; Waterfall Model, Prototyping Model, Interactive Enhancement Model, Spiral Model, Iterative Models, Evolutionary Process Models, Rapid Application Development, Agile software development, Rational unified process, Role of Management in Software Development and	15	CO1
2	**Software Requirement Analysis and Project Planning:** Requirement Analysis and Requirement Specification Documents, Software Requirement Specification (SRS), Characteristics of SRS, Components of SRS, IEEE Standard of **SRS**; Project Planning: Project Scheduling Staffing and Personal Planning, Software Cost Estimation: Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Coupling and Cohesion.	15	CO2
3	**Software Designing Approach:** Design Concepts, Design model Top Down and Bottom-Up Approach, Structure Design Methodology, Functional Oriented Approach: Structured Analysis, Data Flow Diagram, Structured Design, Functional Modeling; Object Oriented Approach; classes and objects , inheritance and types of inheritance, instance variables, polymorphism, organizing classes into inheritance hierarchies, UML, essentials of UML class diagram, Use Case diagram, Activity Diagram-class diagram with association and multiplicity ,interaction diagrams ,State Diagrams, Activity diagrams.	15	CO3
4	**Software Coding, Testing & Maintenance:** Introduction to Software Coding: Coding Standards and Guidelines, Code Walkthrough, Code Inspection, Testing; Testing Fundamentals, Functional Testing, Structural Testing, Test Cases and Test Criteria, Software Testing Strategies, Testing Levels, Unit Testing, Integration Testing and System Testing, Alpha and Beta Testing, Test Plan, Test Case Specification, Test Case Execution and Analysis. Introduction to Software Maintenance, Need of maintenance, Types of Software Maintenance, Software Quality Assurance (SQA), Software	15	CO4

	Engineering, Reverse Engineering, Software Configuration Management Activities;		

Suggested Readings

1. Pankaj Jalote, "Software Engineering", Wiley Publications, 2010, USA, New Jersey.
2. Rajib Mall, "Fundamental of Software Engineering", PHI, 2014, India, New Delhi.
3. Roger S. Pressman, Bruce Maxim, "Software Engineering: A practitioner's Approach", 7th edition, TMH, 2014, India, New Delhi.
4. K.K. Agarwal, Yogesh Singh, "Software Engineering", New Age International Publishers, 2008, India, Rampur.

Online Resources

1. https://onlinecourses.nptel.ac.in/noc20_cs68/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	3	2	1	1	2	3		2	2	1	2	1	1
CO2		1	1	1	2	2	2	1	3	3	2	2	2	2
CO3	1		3	2	2	3	2		3	3	1	3	2	2
CO4	1	1			2	3	2		3	2	2	3	2	2

Program	Master of Computer Applications				
Year	I	**Semester**		**II**	
Course Name	Research Methodology				
Code	MCAN22106				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		2	0	0	2
Course Objectives	The course aims to develop research aptitude skills among the learners and to enable them to prepare a research report. To identify the relevance and role of research and differentiating between different kinds of research available, data models, data handling and analysis.				
Course Outcomes					
CO1	To Understand the basic concepts of research and Outlining the significance of research and research methodology.				
CO2	To Formulate research process for solving the business related problems. To develop ability to determine qualitative and quantitative methods of collection of data and sampling. Able to prepare and present an effective research report				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Research Methodology:** Scope, Purpose, Need, Functions and Application of research; Types of research, Criteria of research; **Process of Research:** Steps of research process, Unit of Analysis- Individual, and organizational, Group and data series; Concept, Construct, Attributes, Variable and Hypotheses; **Research Design:** Various Methods of Research Design, Review of literature, Planning research, Preparing the Research Proposal, Elements of Research Proposal, Evaluating Research Proposal; Problem identification and formulation; Research design; Applications of Research	15	CO1
2	**Data Collection:** Primary and Secondary source of data, Qualitative vs Quantitative data, Methods of Data Collection; **Research Modelling:** Field study, laboratory study, survey method, observational method, existing data based research; Scaling techniques;**Report/ Thesis writing:** Pre writing consideration, Formulation of research projects/ proposals; Format of Report, Presentation of Research report, Research / review articles, bibliography norm & plagiarism.	15	CO2

Suggested Readings

1. Cooper, Donald R and Schindler, Business Research Methods, 9th Edition, Tata McGraw Hill.
2. Chawla, Deepak & Sondhi, Neena, Research Methodology- Concepts and Cases, Vikas Publication House.
3. Kothari C R, Research Methodology Methods &Techniques, 2nd Edition, New Age International Publishers.
4. Naresh Malhotra, Market Research, Pearson Education.
5. Kumar, Ranjit, Methodology: A Step by Step guide for Beginners, Pearson Education

Online Resources:

1. https://study.sagepub.com/onlineresearchmethods2e
2. https://laverne.libguides.com/c.php?g=34939&p=5114220

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	1	2	1	2	2	-	1	2	1	2	-	1
CO2	1	1	1	1	1	2	2	-	1	2	1	1	-	3
CO3	1	1	1	1	1	2	1	-	1	2	1	1	-	3
CO4	2	3	3	2	2	2	2	-	3	3	1	2	1	2

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Artificial Intelligence				
Code	MCAN22121				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The course is proposed to teach concepts of Artificial Intelligence. The subject will provide the foundations for AI problem solving techniques and knowledge representation formalisms.				

Course Outcomes	
CO1	Ability to identify and formulate appropriate AI methods for solving a problem.
CO2	Ability to implement AI based Game Playing techniques.
CO3	Able to Solve Analytical based problems.
CO4	Students will be able to use the concepts of AI for real world problem solving.

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction:** Definition of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Problem Solving: Solving Problems by Searching, Uninformed search, BFS, DFS, Iterative deepening, Bidirectional search, Hill climbing, Informed search techniques: heuristic, Greedy search, A* search, AO* search, Constraint Satisfaction problems.	15	CO1
2	**Game Playing:** Minimax, Alpha-Beta pruning, Water Jug problem, Chess problem, Tiles problem, Wampus Problem, N-Queen Problem, Travelling Salesman Problem.	15	CO2
3	**Knowledge Representation:** Introduction, Approaches and Issues in Knowledge Representation, Propositional Logic and Inference, First-Order Logic and Inference, Unification and Resolution, Expert Systems; **Reasoning:** Introduction, Types of Reasoning, Probabilistic Reasoning, Probabilistic Graphical Models, Certainty factors and Rule Based Systems, Introduction to Fuzzy Reasoning.	15	CO3
4	**Planning and Learning:** Planning, Types- Conditional, Continuous, Multi-Agent. Introduction to Learning, Overview of different forms of learning, Categories of Learning: Inductive Learning, Supervised base learning: Learning Decision Trees, SVM, Unsupervised based learning & Reinforcement Learning, Basic Introduction to Neural Net Learning. Introduction to Natural Language Processing: Different issue involved in NLP Expert System, Robotics.	15	CO4

Suggested Readings

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, Third Edition, Latest Edition.
2. Elaine Rich, Kevin Knight, and Shivashankar B. Nair, “Artificial Intelligence”, Tata McGraw-Hill, Latest Edition.
3. Nils J. Nilsson, “Artificial Intelligence - A New Synthesis", Harcourt Asia Pvt. Ltd., Morgan Kaufmann, Latest Edition.
4. Ivan Bratko, “Prolog Programming for Artificial Intelligence”, Pearson Education Asia, Latest Edition.
5. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, PHI Learning, Latest Edition.

Online Resources

1. https://nptel.ac.in/courses/106105077

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2		2	2	2	1		1	2		2	2	1
CO2	2	2		2	2	2	1	1	2	3		2	3	3
CO3	2	1		2	3	3	2	1	1	3	1	3	1	2
CO4	2	2		2	3	3	2	1	1	3	1	3	2	3

Program	Master of Computer Applications				
Year	I	**Semester**		II	
Course Name	Cloud Computing				
Code	MCAN22122				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To provide skills and knowledge in cloud technology operations to implement large-scale systems and provide expertise for creating appropriate cloud infrastructure that fulfils the needs of business services and customers.				
Course Outcomes					
CO1	To understand basic concepts, principles and paradigm of cloud computing and deployment model basics.				
CO2	To examine existing cloud infrastructures and determine an acceptable architecture that fulfils business goals. To interpret various cloud computing models, services and also identify the significance of implementing virtualization techniques.				
CO3	Interpret alternative service delivery and deployment methods to find a model that best fits the company's needs and apply the tools, techniques, and skills acquired to develop projects.				
CO4	Identify cloud computing security and privacy risks and develop appropriate security.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Cloud Computing Basics:** Introduction, History, Need, Advantages and Disadvantages, Issues and Challenges; Cloud Characteristics: Elasticity, Resource Pooling, Scalability, On-demand Service s, Pay as per Usage Pricing; **Cloud Deployment Models:** Public, Private, Hybrid, Community; Impact of Cloud Computing: Business Perspective; Grid vs. Parallel Computing.	15	CO1
2	**Cloud Architecture**: Introduction, NIST Cloud Computing Reference Architecture; Cloud Service Models: Software as a Service, Platform as a Service, Infrastructure as a Service; **Virtualization:** Introduction, Need, Pros and Cons, Types of Virtualizations: Software, Memory, Storage, Server and Network; **Hardware Virtualization:** Introduction, Full, Partial and Para Virtualization, Hypervisor, Type 1 and Type 2.	15	CO2
3	**Cloud Service Providers:** Google Cloud-Introduction, Microsoft Azure-Core Concept, and Amazon Web Services (AWS)-Compute, Storage and Communication Services; **Cloud Applications:** Healthcare-ECG Analysis in the Cloud, Biology-Protein Structure Prediction and Gene Expression Data Analysis for Cancer Diagnosis, Geoscience-Satellite Image Processing, Social Networking.	15	CO3
4	**Overview of Cloud Security:** Cloud Security Fundamentals: Confidentiality, Integrity, Availability, Cloud Security Threat, Vulnerability, Risk; Security Governance, Security Standards; **Securing Data:** Encryption, Hashing, Digital Signature, Steganography, Cryptography, Authentication: 1FA, 2FA, MFA, Access Control and Security Mechanism.	15	CO4

Suggested Readings:

1. Rajkumar Buyya, Christian Vecchiola, S. T. Selvi, " Mastering Cloud Compu^ng", McGraw-Hill.

2. Barrie Sosinsky, “Cloud Compu^ng Bible”, Wiley India.
3. Nikos Antonopoulos, Lee Gillam, “Cloud Compu^ng: Principles, Systems and Applica^ons”, Springer.
4. Ronald L. Krutz, Russel lDeanVines ,“Cloud Security: A Comprehensive Guide to Secure Cloud Compu^ng”,Wiley-India.

Online Resources:

1. https://nptel.ac.in/courses/106105167
2. https://onlinecourses.nptel.ac.in/noc22_cs20/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	1				1		1		1	1		1
CO2	2	1	1	1	1		1		1	1	1	1	1	2
CO3	2	1	2	1	2	1	2		2	2	2	2	1	3
CO4	1	2	2	2	2	1	2		2	3	2	2	2	3

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Data Warehousing & Data Mining				
Code	MCAN22123				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To understand the principles of Data warehousing and Data Mining and familiar with the Data warehouse architecture and its Implementation. It also focuses on architecture of a Data Mining system, data pre-processing methods and Classification of the data for the prediction and analysis.				
Course Outcomes					
CO1	Understand the concepts and techniques used in Data Warehouse development and Deployment.				
CO2	Apply the exploratory analysis for data mining.				
CO3	Apply pattern analysis techniques.				
CO4	Design the models for classification and clustering using algorithms and Tools				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Data Warehousing:** Introduction of Data Warehousing, Types of Data Warehouse, General stages, Components, Architecture, Tools, Database vs Data Warehouse, Characteristics of Data Warehouse, Applications of Data Warehousing, Query Tools, Data Warehouse, Bus Architecture; ETL; Types of Data models, Advantages and Disadvantages of Data Model; **OLAP:** Introduction, Cube, Basic Analytical Operations, System types, Benefits of using OLAP services; ROLAP: Introduction, Architecture, Advantages, Tools; **MOLAP:** Introduction, Architecture, Advantages, Tools, OLTP vs. OLAP, Benefits of OLTP method; **Schemas:** Star and SnowFlake Schema in data warehousing, Multidimensional schemas, Galaxy schema, Star Cluster schema; **Data Mart:** Type of Data Mart, Steps in implementing a Data mart; **Data Lake:** Architecture, concepts, Maturity stages, Difference between Data lakes and Data Warehouse.	15	CO1
2	**Introduction to Data Mining:** Data Mining, Steps in Data Mining Major issues in data mining, Techniques of Data Mining - an overview of techniques and examples for each technique; **Preparing to Model the Data:** Supervised Versus Unsupervised Methods; **Data Preprocessing:** Key steps in Data preprocessing-Data Cleaning, Handling Missing Data, identifying misclassifications, Identifying Outliers; **Data Visualization:** Meaning and common techniques, Integrating various aspect of visualization with Data Mining like Exploratory Data Analysis, Clustering , Pictorial representation of Data Visualization; **Dimension-Reduction Methods:** Need for Dimension- Reduction in Data Mining, Principal Components Analysis, Profiling the Principal Components, Communalities, Validation of the Principal Components, Factor Analysis.	15	CO2

3	**Frequent Pattern Analysis:** Frequent pattern Data Mining: Frequent Itemset, Frequent Pattern, support, Confidence, Association Rules, Apriori Algorithm, FP tree, Frequent Pattern Base, Conditional FP Tree, FP growth with numerical examples for finding association rules in Frequent pattern Data Mining, Pattern Mining in Multilevel, Multidimensional Space, Application of Multilevel, Multidimensional Space Data Mining, Constraint based Frequent Pattern Mining, Challenges and consideration, Recent advance in Constraint based Frequent Pattern Mining.	15	CO3
4	**Classification:** k-Nearest Neighbor Algorithm, Classification Task, k-Nearest Neighbor Algorithm, Distance Function, Decision Tree induction in Data Mining, Decision Tree working ID3 Algorithm, Decision Rules, Advantages and Disadvantages of decision tree, Rule-Based Classification in Data Mining, working of rule based classification, Advantages and Application; **Clustering:** Key objectives of clustering, *k*-Means Clustering, *k*-Means Clustering Algorithm and its application. hierarchal clustering and its type; **WEKA TOOLS :** Introduction to WEKA TOOLS, The Explorer – Getting started, Exploring the explorer, Learning Algorithms, Clustering algorithms, Association–rule learners using WEKA.	15	CO4

Suggested Readings

1. Daniel T Larose, Chantel D.Larose,"Data Mining and Predictive analysis",Wiley2015.
2. Paul rajponniah "Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals," Wiley, 2013.
3. Jiawei Han and Micheline Kamber,"Data Mining Concepts and Techniques"Elsevier.
4. Max Bramer, "Principles of Data Mining", Springer.

Online Resources

1. "https://www.youtube.com/@datamining-iitkgp625",IITKharagpur,NPTEL2018.

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	2	1	1	1	1	1	1	1	1	2	1	1	2
CO2	2	2	2	2	2		1	1	1	1	1	1	2	2
CO3	2	2	3	3	2	2	1		1				3	3
CO4	3	2	2	2	3	2							3	3

Program	Master of Computer Applications				
Year	I	Semester	II		
Course Name	Web Technology & Application Development Lab				
Code	MCAN22151				
Course Type	DSC-Lab	L	T	P	Credit
Pre-Requisite		0	0	4	2
Course Objectives	To focus on the process of Web Development. To build sound concepts of several languages used in Web Technology and create a dynamic, interactive website quickly, confidently, and successfully.				
Course Outcomes					
CO1	Gradually build a static website using HTML, DHTML and CSS. Move this skill upward by creating some degree of user interactivity using JavaScript.				
CO2	Server-side data processing by creating PHP scripts technologies using react framework.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	1. Implementation of List Tags in HTML. 2. Implementation of Table Tag in HTML. 3. Implementation of Frameset Tag in HTML. 4. Implementation of different Form Tags in HTML. 5. Implementation of CSS in Web Pages. 6. Implementation of Tailwind classes in Web Pages. 7. Implementation of control structure in Java Script. 8. Implementation of Looping structure in Java Script 9. Implementation of form validate in Java Script. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1
2	1. Installation, configuration and working with XAMPP Web Server. 2. Implementation of PHP tags, variables, and conditional construct. 3. Implementation of looping structure in PHP 4. Implementation of functions in PHP 5. Implementation of string functions in PHP 6. Implementation of database connectivity using MySQL. 7. Writing simple applications with Technologies like HTML,JavaScript, PHP. 8. Building website using React framework. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1

Suggested Readings

1. Burdman Jessica, “Collaborative Web Development”, Addison Wesley. 2002.
2. Bayross Ivan,”HTML, DHTML. JavaScript, and PHP”, BPB Publications, 4th Edition, 2001.
3. Xavier, C,”Web Technology and Design”, New Age International, 2000.
4. Shah Dhruti “Node.JS Quickbook” BPB Publication. 2018.
5. Achyut S Godbole and Atul Kahate, “Web Technologies”, Tata McGraw Hill.
6. James L Mohler and Jon Duff, “Designing interactive web sites”, Delmar Thomson Learning.
7. Nicholas C. Zakas, Jeremy McPeak, Joe Fawcett, “Professional Ajax, 2nd Edition”, Wrox.
8. Narang, Robin Wieruch, "The Road to React: Your journey to master plain yet pragmatic React.js", Leanpub. 2019.
9. Holmes, Shelley, "What is React?", O'Reilly Media. 2020.

Online Resources

1. https://html-iitd.vlabs.ac.in/
2. https://www.cybrary.it/practice-lab/introduction-to-programming-using-java-script

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	2	1		1	1		3	1	1	3	3	3
CO2	2	2	3	3	2	3	2		3	2	3	3	3	3

Program	Master of Computer Applications				
Year	I	**Semester**	II		
Course Name	Data Structure Using 'Java' Lab				
Code	MCAN22152				
Course Type	DSC-Lab	**L**	**T**	**P**	**Credit**
Pre-Requisite		0	0	4	2
Course Objectives	To understand Java Programming language and various concepts of Data Structures, Their usage and implement them using 'Java' programming language.				

Course Outcomes	
CO1	Design and implement abstract data types such as linked list, stack, and queue using Java as the programming language.
CO2	Design and implement tree, graph by using Java as the programming language.

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1.	1.Implementation of Arrays (Single & Double Dimension). 2.Implementation of String. 3. Implementation of Recursive Procedure(Factorial, Fibonacci) 4. Implementation of Stack, Queue, Circular Queue using array. 5. Implementation of infix to postfix and infix to prefix conversion using stack. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1
2	1. Implementation of Tree Traversals (preorder, inorder, postorder). 2. Implementation of B-Tree. 3. Implementation of AVL Tree. 4. Implementation of Searching techniques: Linear Search, Binary Search. 5. Implementation of Sorting techniques: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort. 6. Implementation of graph traversal (BFS, DFS). 7. Implementation of B-Tree. 8. Implementation of sorting techniques: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort. **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO2

Suggested Readings

1. Duncan A Buell, "Data Structures Using Java", Jones & Bartlett Learning, January 2012.
2. Narasimha Karumanchi , "Data Structures and Algorithms Made Easy in Java"; Fifth Edition 2022.
3. Robert Lafore, "Data Structures and Algorithms in Java", Second Edition, SAMS, Second Edition, 2003.
4. Goodrich, "Data Structures & Algorithms in Java", Sixth Edition, (January 2014).

Online Resources

1. https://python-iitk.vlabs.ac.in/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	2	1		1	1		3	1	1	2	2	3
CO2	2	2	2	3	2	3	2		3	2	2	3	2	3

THIRD SEMESTER

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Python Programming Concepts				
Code	MCAN23201				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To Understand the basic and advanced features of core language , using data structures like lists, tuples, sets and dictionaries, using file handling concepts, and developing programs using object oriented concepts like class, objects, method overriding and method overloading.				
Course Outcomes					
CO1	Acquire programming skills in basic concepts of python.				
CO2	Understand and learn the concepts of the functions and strings.				
CO3	Understand the data structure and file handling through the python functions.				
CO4	Acquire object-oriented skills using class, objects and polymorphism concepts				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Introduction to Python**: Features of python, History of python, Executing python programs, Comments, reserved words, Indentation, Python character set, Tokens; **Core Data Types:** Integer, Floating Point Number, Complex Number, Boolean Type, String Type; print(), Assigning values to a variable, Multiple Assignments, input(), eval(), Formatting Number & String, Python inbuilt mathematical function, ord and chr Functions; **Python Operators & Expression:** Types of operators; Operator Precedence & Associativity; **Decision Statement:** if, if-else, nested if, multiway if-elif- else statement, conditional expression. **Loop Control Statement**: while Loop, for loop, range(), Nested Loops, break, continue, pass.	15	CO1
2	**Functions:** Syntax, use of function, return statement, parameters & arguments: Required argument, Default argument, Keyword Arguments, Variable length argument; Scope of a variable, Recursive function, Lambda function, Python Modules, Built-in Modules in Python: math, random, time & date module; **Strings:** str class, index [] operator, Traversing: for & while loop, Immutable strings, string operators: slicing, +, *; String operations: comparison, format (), split(), Built-in method: Testing string, search a substring, convert string from one to another, stripping string, Formatting string	15	CO2
3	**Lists:** Creation, list(), Accessing Elements in List, Negative List Indices , List Slicing, Built-in list class Methods, List operators, List Comprehension, List & Strings, Passing list to a function and returning from a function; **Tuple:** Creation, tuple(), Built-in tuple class methods, Indexing & slicing,	15	CO3

	Operations on tuple, Variable length tuple to functions, List & Tuple, Sort, Traverse, zip(), Inverse zip(*); **Sets**: Creation, set(), set operator, Built-in set class methods, Set operations: union(), intersection(), difference(), symmetric_difference(); **Dictionary**: Creation, dict(), Adding values, Replacing values, Retrieving Values, Formatting, Deleting items, Comparing, Built-in dict class methods, Traversing, Nested Dictionary; **File Handling:** Types of files, opening and closing files, reading and writing files, file positions, renaming and deleting files, directory methods		
4	**Object Oriented Programming:** Introduction to OOPs Concepts; Defining Classes: Adding Attributes, Assigning values to an attribute; Self parameters and adding methods to a class, Displaying class attributes and methods, special class attributes, Accessibility, Defining Objects; Polymorphism; init_() (Constructor), _del_() (Destructor), Passing object as a parameter to a method, Class Membership Test, Method overloading, Operator Overloading: Special Methods: Arithmetic Operations, comparing types; Reference Equality and Object Equality, Inbuilt Overloading Method	15	CO4

Suggested Readings

1. Ashok N. Kamthane & Amit A. Kamthane, "Programming and Problem Solving with Python", McGraw Hill Educations, 2018
2. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2022
3. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning
4. Jake VanderPlas "Python Data Science Handbook" O'Reilly Publications.
5. David Beazley, "Python Essential Reference (4th Edition) "Addison Wesley

Online Resources

1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1			2	1	1					1	2	1
CO2	2	2	1	1	2	1	2		2	2	1	3	2	2
CO3	2	2	2	2	2	2	3		3	3	2	3	3	3
CO4	2	2	3	3	2	2	3		3	3	3	3	3	3

Program	Master of Computer Applications				
Year	II	Semester	III		
Course Name	Mobile Application Development				
Code	MCAN23202				
Course Type	DSC	L	T	P	Credit
Pre-Requisite		3	1	0	4
Course Objectives	The capabilities and limitations of mobile platforms that affect application development and deployment. The technology and business trends impacting mobile application development. The characterization and architecture of mobile applications. The techniques for deploying and testing mobile applications, and for enhancing their performance and scalability.				
Course Outcomes					
CO1	To understand the basic concepts of Mobile application development				
CO2	Able to design and develop user interfaces for the Android platforms.				
CO3	Able to design and develop mobile applications using Components.				
CO4	Able to design and develop mobile applications using a chosen application development framework.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction:** introduction to android, history and versions of android, android API, Various mobile platforms, android architecture, android runtime, Dalvik virtual machine, features of android, introduction and installation of eclipse and ADT plugin and/or introduction and installation of android studio, requirements and installation of android SDK, SDK manager, emulator, AVD, android virtual device manager, Google play account, installing android app from google play, APK file.	10	CO1
2	**Development Environment**: Setting up Development Environment, Installing Packages using SDK Manager, Android Project Structure, Creating Hello Android App, deploy it on USB-connected Android device, setting up an Emulator, Android Tool Repository, Manifest File, Activity Life Cycle and its methods, Logcat, Components of an Android App: Activity, Service, Broadcast Receiver, Content Provider.	10	CO2
3	**Layout**: Constraint Layout ,Linear Layout, Relative Layout, Scroll View: Vertical, Horizontal Layout, Table Layout, Frame Layout, **Views**: Text view, Edit Text, Button, Check Box, Radio Button, Image View, Grid View, Web View, Video View, Toast, Rating Bar, Seek Bar, Date Picker.	12	CO3
4	**Intent**, Types of Intents**; Fragments**: Lifecycle, Methods **Service**: Features of Service, Android platform service, Defining new service, Service Lifecycle, Permission, example of service. **Android Menu:** Option, context, popup Menu; Data persistence using SQLite. Internal and External Storage.	13	CO4

Suggested Readings:

1. Michael Burton, Donn Felker, "Android Application Development for Dummies", Dummies.
2. Pradeep Kothari, " Android Application Development (with Kitkat Support)", Kogent Learning Solutions Inc.
3. W. Frank Ableson, Robi Sen, Et. Al., " Android in Action", Manning.
4. Charlie Collins, Michael Galpin, Et. Al., " Android in Practice", Manning.

Online Resources:

1. https://archive.nptel.ac.in/courses/106/106/106106156/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2		2		2	1	2		1			2	1	1
CO2	2		2		2	2	2		1			2	1	1
CO3	2	2	2	2	3	2	3		2	2	2	2	2	2
CO4	2	2	3	2	2	2	3		3	2	2	2	3	3

Program	Master of Computer Applications				
Year	II	Semester	III		
Course Name	Design & Analysis of Algorithms				
Code	MCAN23203				
Course Type	DSC	L	T	P	Credit
Pre-Requisite		3	1	0	4
Course Objectives	To know the importance of studying the complexity of a given algorithm and various design techniques. Utilizing data structures and/or algorithmic design techniques in solving new problems. Understanding basic computability concepts and the complexity.				
Course Outcomes					
CO1	Able to Argue the correctness of algorithms using inductive proofs and analyze worst-case running times of algorithms using asymptotic analysis.				
CO2	Able to explain advanced data structures used in problem solving.				
CO3	Able to explain important algorithmic design paradigms, divide-and-conquer, greedy method, dynamic-programming and Backtracking and apply when an algorithmic design situation calls for it.				
CO4	Able to Explain the major graph algorithms and Employ graphs to model engineering problems, when appropriate. Also to gain the understanding of P, NP class problems.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Basic Concepts of Algorithms**: Definitions, Explanation & Scope, Time and Space Complexity; Asymptotic Notations, Growth of Functions; Pseudo Codes & Time Complexity of Basic Control Structures; Recursive Algorithms Complexity.	15	CO1
2	**Analysis of Data Structures**: Elementary Data Structure; Dictionaries & Hash Tables; Binary Search Tree; AVL Trees; Red Black tree; B-Trees; Binomial Heaps; Fibonacci Heaps; Data Structures for Disjoint Sets; Augmenting Data Structures.	15	CO2
3	**Advanced Design & Analysis Techniques: Dynamic Programming**:Assembly Line Scheduling, Matrix Chain Multiplications, Longest Common Subsequence; **Greedy Algorithms:** Optimal Binary Search Tree, Activity Selection Problem, Knapsack Problem, Huffman Codes, An Activity Selection Problem, Task Scheduling Problem, Traveling salesman problem; **Back Tracking**: Hamiltonian Circuit Problem, Subset Sum Problem, N-Queens Problem; **Branch & Bound**: FIFO Branch-and-Bound Algorithm, Knapsack Problem, Assignment Problem, Traveling Salesman Problem.	15	CO3
4	**Analysis of Graph Algorithms**: Breadth First Search, Depth First Search, Minimum Spanning Trees: Kruskal's and Prim's; Single Source Shortest Path: The Bellman-Ford Algorithm, Dijkstra's Algorithm; All Pairs Shortest Path: The Floyd Warshall Algorithm; Maximum Flow: Ford-Fulkerson Method; Introduction to NP Completeness; String Matching; Approximation Algorithms; Randomized Algorithms.	15	CO4

Suggested Readings

1. Thomas H. Coremen, "Introduction to Algorithms", MIT Press.
2. Horowitz & Sahani, "Fundamentals of Algorithms", Galgotia Publications.
3. Aho, Ullman, "Design & Analysis of Computer Algorithms", Pearson.

4. Johnsonbaugh, “Algorithms”, Pearson.
5. Bressard, “Fundamentals of Algorithms”, PHI.

Online Resources

1. https://archive.nptel.ac.in/courses/106/106/106106131/.
2. ttps://onlinecourses.nptel.ac.in/noc19_cs47/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	2	1	3	1		1	2	1	3	3	3
CO2	2	2	2	3	1	3	1		1	2	1	3	3	3
CO3	2	2	2	3	1	3	1		1	2	1	3	3	3
CO4	2	2	2	3	1	3	1		1	2	1	3	3	3

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Simulation and Modelling				
Code	MCAN23204				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre- Requisite		2	0	0	2
Course Objectives	The primary objective of this course is to provide students with a comprehensive understanding of simulation techniques used for modeling complex systems. The course aims to equip students with the knowledge and skills required to analyze real- world systems using discrete-event simulation and system dynamics.				
Course Outcomes:					
CO1	To equip students with the fundamental principles and techniques for developing and implementing simulation models for analyzing the behavior of complex systems.				
CO2	Able to implement the model and from the results check for the correctness of the assumptions.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Foundations of Modelling and Simulation:** **Introduction to Modelling:** The concept of a model, different types of models (deterministic vs. stochastic, static vs. dynamic); Importance of abstraction and idealization; **System Dynamics Modelling (Introduction):** Concepts of feedback loops, rates, and levels, Simple examples of system dynamics models; **Stochastic Processes in Simulation:** Introduction to random processes, Poisson process and its applications in modeling, Markov chains (basic concepts and examples); **Queuing Theory Fundamentals:** Characteristics of queuing systems, Kendall's notation. Basic queuing models (M/M/1). Application of queuing models in computer systems and networks.	15	CO1
2	**Random Number and Random Variate Generation:** Properties of good random numbers, Generation of pseudo-random numbers (Linear Congruential Generators - basic idea), Inverse transform technique for random variate generation; **Discrete-Event Simulation Implementation:** Manual simulation using event scheduling, Introduction to simulation software (a brief overview of features and capabilities of Arena, SimPy).	15	CO2

Suggested Readings:

1. Geoffrey Gordon, “System Simulation”, PHI.
2. Narsingh Deo, “System Simulation with digital computer”, PHI.
3. Averill M. Law and W. David Kelton, “Simulation Modelling and Analysis”, TMH.

Online Resources:

1.https://archive.nptel.ac.in/courses/112/107/112107214

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	1	3	3	3			2	2		1	2	2
CO2	2	3	2	3	3	2			1	2		2	2	2

Program	Master of Computer Applications				
Year	II	**Semester**		III	
Course Name	Generative AI and Prompt Engineering				
Code	MCAN23221				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	The course aims to equip learners with the skills to craft effective prompts for AI models, enhancing their accuracy and usefulness. It also explores the principles and applications of artificial intelligence in real-world problem-solving.				
Course Outcomes					
CO1	Understand the fundamentals of prompt engineering and its role in optimizing AI model outputs.				
CO2	Design and refine effective prompts for various AI applications, including text generation, summarization, and data extraction.				
CO3	Evaluate AI responses for relevance, accuracy, and bias, and apply strategies to improve performance.				
CO4	Apply prompt engineering techniques in real-world AI scenarios such as chatbots, content creation, and automation.				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	**Fundamentals of Generative AI and Large Language Models:** Basics of Artificial Intelligence and Machine Learning; Overview of Deep Learning: Neural networks, Transformers; Introduction to Generative AI: Concepts, evolution, and importance; Types of Generative Models: GANs, VAEs, Diffusion models, Transformers; Role and architecture of Large Language Models (LLMs) such as GPT, BERT, T5.	15	CO1
2	**Principles and Techniques of Prompt Engineering:** Definition and importance of Prompt Engineering; Components of a good prompt; Prompting paradigms: zero-shot, one-shot, and few-shot learning; Strategies for improving prompt quality; Chain-of-Thought prompting and instruction tuning; Limitations and challenges in prompt design.	15	CO2
3	**Applications of Generative AI Across Domains:** Text generation: Summarization, translation, Q&A, content creation; Code generation and documentation, Image generation (e.g., AI art, synthetic media); Generative AI in education, healthcare, entertainment, business, Comparison of major models: GPT, Claude, Gemini, LLaMA, Case studies: Real-world success and failures of Generative AI.	15	CO3
4	**Ethical, Societal, and Future Considerations:** Ethical concerns in Generative AI: Bias, misinformation, manipulation; Issues of copyright, ownership, and content authenticity; AI hallucinations and the problem of truthfulness; Regulatory frameworks and governance in AI; Alignment, safety, and the future of human-AI collaboration; Future trends: Foundation models, open-source LLMs, responsible AI	15	CO4

Suggested Readings

1. James Phoenix, Mike Taylor, “Prompt Engineering for Generative AI: Future-Proof Inputs for Reliable AI Outputs”, O'Reilly Media, 1st Edition.
2. Russel Grant, “Prompt Engineering and ChatGPT: How to Easily 10X Your Productivity, Creativity, and Make More Money Without Working Harder”
3. Melissa Peneycad, “Generative AI Basics & Beyond: Learn Effective Prompt Engineering Quickly & Easily to Harness the Power of Tools Like ChatGPT for Productivity, Career Success, & Creativity—Even If You're a Beginner”

Online Resources:

1. https://youtu.be/UrC6jZJdVXk?list=PL9ooVrP1hQOE5dmqWrYQqQTX-FFyfYdLf.
2. https://youtu.be/MgYXEcI4shI?list=PL9ooVrP1hQOE5dmqWrYQqQTX-FFyfYdLf.

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	1	1	2		1	2	1			2		1	1	1
CO2	1	1	1			2	1			1		1	1	1
CO3		1	1	1	2	2	1					1	1	1
CO4	1	1	1	1	1		1	1		1		1	1	1

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Internet of Things (IoT)				
Code	MCAN23222				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	To study fundamental concepts of IoT, to understand roles of sensors and hardware in IoT, To learn different Wireless Technologies and protocols for IoT, Understand the role of IoT in various domains of Industry.				
Course Outcomes					
CO1	Understand the various concepts, terminologies and architecture of IoT systems.				
CO2	Understand the use of sensors, actuators and IoT supported hardware for design of IoT system.				
CO3	Understand and apply various wireless technology and protocols for design of IoT systems.				
CO4	Understand the various security aspects for IoT system.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Fundamentals of IoT:** Concepts and Definition of IoT, Characteristics, Conceptual Framework, Architectural view, technology behind IoT, M2M Communication; **Design Principles for Connected Devices:** IoT/M2M systems layers and design standardization, Application of IoT, communication technologies, data enrichment and consolidation.	15	CO1
2	**Hardware for IoT:** Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology; **Embedded Platforms for IoT:** Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	15	CO2
3	**Wireless Technologies for IoT:** IEEE 802.15.4, Bluetooth, Wi- Fi, Zigbee, RFID, HART, LoRa, NFCZ-Wave, Z-Wave; **IP Based Protocols for IoT:** IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT, Edge connectivity and protocols, Cloud Computing, Integration of IoT with Cloud Computing.	15	CO3
4	**Overview of IoT Security:** Introduction Securing the Internet of Things, Architecture, Requirements, Security Protocols for IoT Access Networks, Attack, Defense, and Network Robustness of Internet of Things; **Case Studies/Industrial Applications:** Home Automation, Smart Cities, Smart Parking, Air Quality Monitoring, Logistics, Agriculture, Health sector. Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection, Emerging Pillars of IoT.	15	CO4

Suggested Readings

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy "Introduction to IoT" Cambridge University Press.
2. Arsheep Bahga, Vijay Madisetti," Internet of Things - A Hands-On Approach", Orient Blackswan Private Limited.
3. Raj Kamal, "Internet of Things (IoT): Architecture and Design Principles", McGraw Hill.
4. Vibha Soni, "IoT for Beginners: Explore IoT Architecture, Working Principles, IoT Devices, and Various Real IoT Projects", BPB Publication

Online Resources

1. https://archive.nptel.ac.in/courses/106/105/106105166/
2. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	2	1	1	1	-	-	2	1	1	1	1	1
CO2	2	1	3	1	1	2	1	-	1	3	1	2	2	1
CO3	1	3	3	2	3	2	-	-	1	2	1	2	3	1
CO4	3	3	1	1	1	1	1	1	3	1	2	2	1	2

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Big Data & concepts of Hadoop				
Code	MCAN23223				
Course Type	DSE	**L**	**T**	**P**	**Credit**
Pre-Requisite		3	1	0	4
Course Objectives	This course introduces the foundational concepts of big data, focusing on the technologies and methodologies used to process, store, and analyze large volumes of data. Students will learn about distributed computing, Hadoop ecosystem components, NoSQL databases and data visualization techniques. Students will develop practical skills in managing, querying, and analyzing big data, preparing them for roles in data engineering, data science, and analytics.				
Course Outcomes					
CO1	To understand the basic concept of Big Data.				
CO2	To understand the fundamentals of Apache Hadoop.				
CO3	To understand the basics of Apache Hadoop and Map Reduce.				
CO4	To understand the Hadoop eco system frameworks.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	**Introduction to Big Data:** Types of digital data, history of Big Data innovation, introduction to Big Data platform, drivers for Big Data, Big Data architecture and characteristics, 5 Vs of Big Data, Big Data technology components, Big Data importance and applications, Big Data features, security, compliance, auditing and protection, Big Data privacy and ethics, Big Data Analytics, Challenges of conventional systems, intelligent data analysis, nature of data, analytic processes and tools, analysis vs reporting, modern data analytic tools.	15	CO1
2	**Hadoop:** History of Hadoop, Apache Hadoop, the Hadoop Distributed File System, components of Hadoop, data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes; Map Reduce: Map Reduce framework and basics, how Map Reduce works, developing a Map Reduce application.	15	CO2
3	**Hadoop Eco System and YARN:** Hadoop ecosystem components, schedulers, fair and capacity, Hadoop 2.0 New Features, NameNode high availability, HDFS federation; NoSQL Databases: Introduction to MongoDB , data types, creating, updating and deleing documents, querying, introduction to indexing, capped collections	15	CO3
4	**Hadoop Eco System Frameworks:** Applications on Big Data using Hive and HBase; Hive: Apache Hive architecture and installation, Hive shell, Hive services, Hive metastore, comparison with traditional databases, HiveQL, tables, querying data and user defined functions, sorting and aggregating, Map Reduce scripts, joins & subqueries; HBase: Hbase concepts, clients, example, Hbase vs RDBMS, advanced usage, schema design, advance indexing,; Zookeeper: how it helps in monitoring a cluster, how to build applications with Zookeeper.	15	CO4

Suggested Readings

1. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley
2. DT Editorial Services, Big-Data Black Book, Wiley
3. Dirk deRoos, Chris Eaton, George Lapis, Paul Zikopoulos, Tom Deutsch, "Understanding Big Data Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill.
4. Thomas Erl, Wajid Khattak, Paul Buhler, "Big Data Fundamentals: Concepts, Drivers and Techniques", Prentice Hall.
5. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons

Online Resources

1. https://archive.nptel.ac.in/courses/106/108/106108058/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	1	2	2	3	2		1	2	1	2	1	1
CO2	3	3	1	2	3	3	2		1	3	2	2	1	1
CO3	3	3	1	3	3	3	3		2	3	3	3	2	2
CO4	3	3	1	3	3	3	3		2	3	3	3	2	2

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Python Programming Lab				
Code	MCAN23251				
Course Type	DSC-Lab	**L**	**T**	**P**	**Credit**
Pre-Requisite		0	0	4	2
Course Objectives	To Understand the basic and advanced features of core language , using data structures like lists, tuples, sets and dictionaries, using file handling concepts, and developing programs using object oriented concepts like class, objects, method overriding and method overloading..				
Course Outcomes					
CO1	Acquire programming basic concepts in python using functions and strings				
CO2	Understand the data structure and file handling through the python functions and Acquire object-oriented skills using class, objects and polymorphism concepts				

Module	**Course Contents**	**Contact Hrs.**	**Mapped CO**
1	1. Practical Implementation of Variables, keywords, basic operations in python, Taking input, multiple inputs from user in Python, operators implementation 2. Practical implementation of Output using print () function, Python end parameter in print(), if, else, if elif ladder 4. Practical implementation of Special keyword - in and is, for loop, range function, and examples use of enumerate, zip function in loops else with for. 5. Using strings in python, single quoted/double quoted/triple quoted Strings, string functions - split, trim, join, format, replace, count, find, index, just, rjust, ljust, center, upper, lower. 6. Practical implementation of functions , calling function, argument- based functions, different type of style for passing parameter in python 7. Practical Implementation of importing functions from different types of imports in python, , 8. Practical Implementation of importing random and math module OS module for file and folder Operation **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO1

2	1. Practical implementation of list, creation and traversal, List functions: append, insert, extend, remove, pop, clear, sort, count, index, and copy. 2. Practical implementation of Set, creation, and traversal, set functions - add, update, remove, clear, pop, union, intersection, difference, disjoint, subset, superset 3. Practical implementation of tuple,creation, traversal, tuple comprehension, zip, inverse zip 4. Practical implementation of Dict, creation and traversal, Dictionary function - get, update, keys, items, values. 5. Practical implementation of Creating classes, creating objects 6. Implementing function calls, constructor, and self- a parameter keyword 7. Practical implementation of Operator Overloading 8. Practical Implementation of Reference Equality and Object Equality 9. Practical implementation of Special Methods: Arithmetic Operations, comparing types; Equality and Object Equality 10. Practical implementation of , Inbuilt Overloading Method **Note: -** Students will also perform all other exercises provided by course instructor.	15	CO2

Suggested Readings

1. Ashok N. Kamthane & Amit A. Kamthane, "Programming and Problem Solving with Python",
   McGraw Hill Educations
2. Kenneth A. Lambert, "The Fundamentals of Python: First Programs", Cengage Learning
3. Jake VanderPlas "Python Data Science Handbook" O'Reilly Publications
4. David Beazley, "Python Essential Reference (4th Edition) "Addison Wesley.

Online Resources

1. https://python-iitk.vlabs.ac.in/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	2	2	2	1		1	1	1	2	1	2
CO2	2	3	3	3	3	3	2		3	3	3	3	3	3

Program	Master of Computer Applications				
Year	II	**Semester**	III		
Course Name	Mobile Application Development Lab				
Code	MCAN23252				
Course Type	DSC	**L**	**T**	**P**	**Credit**
Pre-Requisite		0	0	4	2
Course Objectives	The capabilities and limitations of mobile platforms that affect application development and deployment. The technology and business trends impacting mobile application development. The characterization and architecture of mobile applications. The techniques for deploying and testing mobile applications, and for enhancing their performance and scalability.				
Course Outcomes					
CO1	To understand the basic concepts of Mobile application development Design and Develop user interfaces for the Android platforms.				
CO2	Able to designing and develop mobile applications using a chosen application development framework.				

Module	Course Contents	Contact Hrs.	Mapped CO
1	1. Demonstrate the installation of Android Studio, including setting up the Android SDK, SDK Manager, and AVD (Android Virtual Device). Provide screenshots of each step. 2. Install additional SDK packages using SDK Manager. Set up and configure a new Android Virtual Device (AVD) with custom specifications. Launch and test it. 3. Create a basic "Hello Android" app using Android Studio. Deploy the app on both an emulator and a USB-connected Android device. 4. Edit the AndroidManifest.xml file to include necessary permissions and activity declarations. Explain how changes in the manifest affect the application. 5. Create an Android app that logs each lifecycle method (e.g., onCreate(), onStart(), onResume(), etc.) using Logcat. 6. Creating an application that displays message based on the screen orientation. **Note:** Students will also perform all other exercises provided by course instructor	20	CO1
2	7. Create an Android app using at least three different layouts: ConstraintLayout, LinearLayout (vertical and horizontal), and RelativeLayout. Show how each layout affects component positioning with screenshots.. 8. Develop a form with multiple fields and buttons using a Vertical ScrollView and place a Horizontal ScrollView inside it. Demonstrate the scrolling behavior and explain its use cases 9. Design a UI that uses the following views: TextView, EditText, Button, CheckBox, RadioButton, ImageView and SeekBar. Capture and display the user input on a button click. 10. Create an app that uses a VideoView to play a video from local storage or a URL and a WebView to load a webpage. 11. Develop an application that makes use of Notification	30	CO2

	Manager. 12. Build an app that stores and retrieves student information (e.g., name, roll number, grade) using SQLite. Implement insert, update, delete, and fetch operations using UI controls. 13. Create a sample application with login module (check user name and password) On successful login change Textview "Login Successful". On login fail alert using Toast "login fail" 14. Create an app to write and read text files using internal and external storage. 15. Develop a Mobile application for simple needs (Mini Project) **Note:** Students will also perform all other exercises provided by course instructor.		

Suggested Readings:

1. Michael Burton, Donn Felker, "Android Application Development for Dummies", Dummies.
2. Pradeep Kothari, " Android Application Development (with Kitkat Support)", Kogent Learning Solutions Inc.
3. W. Frank Ableson, Robi Sen, Et. Al., " Android in Action", Manning.
4. Charlie Collins, Michael Galpin, Et. Al., " Android in Practice", Manning.

Online Resources:

1. https://archive.nptel.ac.in/courses/106/106/106106156/

Course Articulation Matrix														
PO-PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2			2	1	2		1			2	1	1
CO2	2	2			2	2	2		1			2	1	1