

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

<b>Semester</b>	<b>Discipline Specific Core (DSC) (Major)</b>	<b>Discipline Specific Elective (DSE) (Major)</b>	<b>Generic Elective (GE)(Minor)</b>	<b>Co-Curricular (CC)</b>	<b>Vocational Course(VC)</b>	<b>Survey/Seminar/MOOC/Community Outreach (SSMC)</b>	<b>GP</b>	<b>Total Credit</b>
1	6 Subjects 28 Credits (6+6+4+4+4+4 Credits)						1 Credit	29
2	5 Subjects 24 Credits (6+6+4+4+4 Credits)	1 Subject 4 Credits					1 Credit	29
3	3 Subjects 16 Credits (6+6+4 Credits) Dissertation 8 Credits	1 Subject 4 Credits					1 Credit	29
4	1 Subject 4 Credits (Online Mode) Project 24 Credits						1 Credit	29

**Babu Banarasi Das University, Lucknow**  
**School of Computer Applications**  
**Master of Computer Applications**  
**Evaluation Scheme (w. e. f. Academic Session 2023-24)**

**SEMESTER I**

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN11101	Principles of Programming Using Java	3	1	0	40	60	100	4
DSC	MCAN11102	Computer Organization	3	1	0	40	60	100	4
DSC	MCAN11103	Relational Database Management System	3	1	0	40	60	100	4
DSC	MCAN11104	Web Technologies and Application Development	3	1	0	40	60	100	4
DSC	MCAN11105	Discrete Mathematics	3	1	0	40	60	100	4
DSC	MCAN11106	Principles of Management	3	1	0	40	60	100	4
DSC	MCAN11151	Relational Database Management System Lab	0	0	4	40	60	100	2
DSC	MCAN11152	Web Technologies and Application Development Lab	0	0	4	40	60	100	2
	GPN1101	General Proficiency	0	0	0	100	0	100	1
<b>Total</b>			<b>18</b>	<b>6</b>	<b>8</b>	<b>420</b>	<b>480</b>	<b>900</b>	<b>29</b>

**SEMESTER II**

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN12101	Advance Data Mining & Data Warehousing	3	1	0	40	60	100	4
DSC	MCAN12102	Computer Network	3	1	0	40	60	100	4
DSC	MCAN12103	Python Programming Concepts	3	1	0	40	60	100	4
DSC	MCAN12104	Data Structures Using Java	3	1	0	40	60	100	4
DSC	MCAN12105	Software Engineering	3	1	0	40	60	100	4
DSE		Discipline Specific Elective-I	3	1	0	40	60	100	4
DSC	MCAN12151	Python Programming Lab	0	0	4	40	60	100	2
DSC	MCAN12152	Data Structures Using Java Programming Lab	0	0	4	40	60	100	2
	GPN1201	General Proficiency	0	0	0	100	0	100	1
<b>Total</b>			<b>18</b>	<b>6</b>	<b>8</b>	<b>420</b>	<b>480</b>	<b>900</b>	<b>29</b>

**SEMESTER III**

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN13201	.NET Framework Using C#	3	1	0	40	60	100	4
DSC	MCAN13202	Mobile Application Development	3	1	0	40	60	100	4
DSC	MCAN13203	Design & Analysis of Algorithms	3	1	0	40	60	100	4
DSE		Discipline Specific Elective-II	3	1	0	40	60	100	4
DSC	MCAN13251	.NET Framework Using C# Lab	0	0	4	40	60	100	2
DSC	MCAN13252	Mobile Application Development Lab	0	0	4	40	60	100	2
DSC	MCAN13253	Dissertation	0	0	0	80	120	200	8
	GPN1301	General Proficiency	0	0	0	100	0	100	1
<b>Total</b>			<b>12</b>	<b>4</b>	<b>8</b>	<b>420</b>	<b>480</b>	<b>900</b>	<b>29</b>

<b>SEMESTER IV</b>									
Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
DSC	MCAN14201	Pattern Recognition(Online)	4	0	0	40	60	100	4
DSC	MCAN14251	Project	0	0	0	250	450	700	24
	GPN1401	General Proficiency	0	0	0	100	0	100	1
<b>Total</b>			<b>4</b>	<b>0</b>	<b>0</b>	<b>390</b>	<b>510</b>	<b>900</b>	<b>29</b>

<b>Discipline Specific Elective-I</b>		
1	MCAN12121	Artificial Intelligence
2	MCAN12122	Cloud Computing
3	MCAN12123	Theory Of Computation
<b>Discipline Specific Elective-II</b>		
1	MCAN13221	Machine Learning
2	MCAN13222	Internet Of Things(IoT)
3	MCAN13223	Compiler Design

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**

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		I	
<b>Course Name</b>	Principles of Programming Using Java				
<b>Code</b>	MCAN11101				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	The Objective of the course is students will understand basic concepts and structure of programming languages				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the various programming paradigms.				
<b>CO2</b>	Understand the basics of data, data types and statements.				
<b>CO3</b>	Student able to solve problems using functions.				
<b>CO4</b>	Understand object-oriented programming, Functional and Logic Programming Languages.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction: The Role of Programming Languages:</b> Why Study Programming Languages, Towards Higher-Level languages, Programming paradigms; <b>Programming environments Language Description:</b> Syntactic structure; <b>Language Translation Issues:</b> Programming language Syntax, Stages in translation, Formal Translation Models.			15	CO1
2	<b>Data, Data Types, and Basic Statements:</b> Names, Variables, Binding, Type Checking, Scope, Scope Rules, Lifetime and Garbage Collection, Primitive Data Types, Strings, Array types, Associative arrays, Record types, Union types, Pointers and References, Arithmetic expressions, Overloaded operators, Type conversions, Relational and Boolean expressions, Assignment statements, Mixed mode assignments, Control structures, Selection, Iterations, Branching, Guarded statements.			15	CO2
3	<b>Subprograms and Implementations:</b> Subprograms, Design issues, Local referencing, Parameter passing, Overloaded methods, Generic methods, Design issues for functions, Semantics of call and return, Implementing simple subprograms, Stack and Dynamic local variables, Nested subprograms, Dynamic scoping.			15	CO3
4	<b>Object-Orientation, Functional and Logic Programming Languages:</b> Grouping of data and Operations, Constructs for Programming Structures, Abstraction Information Hiding, Program Design with Modules, Defined types, Object Oriented programming concept of Object, Inheritance, Polymorphism, Encapsulation. <b>Functional and Logic Programming Languages:</b> Introduction to Lambda calculus, Fundamentals of functional programming languages, Introduction to LISP Concepts; <b>Introduction to logic and logic programming:</b> Programming with Prolog.			15	CO4

#### Suggested Readings

1. "Programming Languages: Design and Implementations", Terrance W.Pratt, Marvin V. Zelkowitz, T.V. Gopal, Fourth ed., Prentice Hall.
2. "Programming Language Design Concept", David A. Watt, Willey India.
3. "Programming languages: Concepts and Constucts", Ravi Sethi, Second Ed., Pearson.

4. "Types and programming Languages", Benjamin C. Pierce. The MIT Press Cambridge, Massachusetts London, England.

5. Concepts of Programming Languages, Robert W. Sebesta, 10<sup>th</sup> Ed., Pearson.

**Online Resources**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs47/preview](https://onlinecourses.nptel.ac.in/noc22_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		
CO2	2					1	1					2	1	
CO3	2	2				1	1					2	1	2
CO4	2	2	1		2	1	1			3		3	2	2

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		I	
<b>Course Name</b>	Computer Organization				
<b>Code</b>	MCAN11102				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	Enhance understanding of Computer Organization, its design, and implementation, enabling students to articulate design issues in developing processors and components that meet specific requirements.				
<b>Course Outcomes</b>					
<b>CO1</b>	Develop familiarity with Digital Electronics terminology and principles for effective analysis and application of digital circuits and systems.				
<b>CO2</b>	Gain familiarity with Computer Processor terminology and principles to analyze and design efficient and high-performance processor architectures.				
<b>CO3</b>	Understand the principles of communication between I/O devices and Processors, facilitating the design of effective I/O subsystems.				
<b>CO4</b>	Gain an understanding of concepts related to data storage and retrieval from memory systems, enabling the design and optimization of memory hierarchies.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction to Digital Electronics:</b> Number System, Boolean Algebra, Minimization of Boolean Expressions using K-Map; Logic Gates: Implementations of Logic Functions using Gates. <b>Combinational Circuits:</b> Introduction to combinational circuits, Adders & Subtractors; Multiplexer & De-Multiplexer; Decoder. <b>Sequential Circuit:</b> 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	<b>Register Transfer and Micro-operation:</b> 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. <b>Central Processing Unit:</b> Accumulator based organization; General register organization; Stack organization; Addressing Modes; RISC vs. CISC, Hard wired & Micro Programmed control Unit.			15	CO2
3	<b>I/O Organizations:</b> 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	<b>Memory organizations:</b> 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



	<b>Concepts of Parallel Processing:</b> Definition of Parallel Processing, Characteristics of parallelism, Parallelism in Uniprocessor and Multi-Processor System, Introduction to multithreading, Concept of Multiprocessor and Shared memory microprocessor.		
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**Suggested Readings:**

1. M. Morris Mano “Digital Logic and Computer Design”, 2<sup>nd</sup> Edition, PHI.
- 2.P. Raja, “Switching Theory”, Fourth Edition, Umesh Publication.
- 3.M. Morris Mano, “Computer System Architecture”, PHI
- 4.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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>			I
<b>Course Name</b>	Relational Database Management System				
<b>Code</b>	MCAN11103				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	The objective of this course is to introduce the fundamental concepts of DBMS, terminologies of database management system, E-R Modelling, PL/SQL concept, database transactions and concurrency control techniques.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the basic concepts of the database and data models.				
<b>CO2</b>	Understand the fundamentals concepts ER diagrams and map ER diagrams into Relations.				
<b>CO3</b>	Evaluate the alternative database designs to determine which one is better according to selected criteria.				
<b>CO4</b>	Understand the basic concepts/features of database transactions and concurrency control techniques.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<p><b>Introduction:</b> Data and information, Concepts of persistent data, File system , Basic File Operations, File Structure and Organization, Types of File Organization: Sequential file organization, Heap file organization, Hash file organization, B+ file organization, Indexed sequential access method ,Cluster file organization.</p> <p><b>Database Management System:</b> 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 Architecture, 2-Tier Architecture and 3-Tier Architecture. Capabilities of good DBMS, Database Schemas and Instances, Classification of Database Management Systems, Database Languages. <b>Data Models:</b> Introduction of Data Models, Relational Data Model, Entity Relationship Data Model, Object Based Data Model, Semi-Structure Data Model.</p>			15	CO1
2	<p><b>Relational Database Management System &amp; Data Modelling:</b> 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. <b>Relational Algebra:</b> 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</p>			15	CO1 & CO2
3	<p><b>SQL and Database Design Theory:</b> 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,</p>			15	CO3

	Intersection, Minus, View, Cursors Triggers and PL/SQL. <b>Functional Dependencies and Normalization:</b> Informal Design Guidelines for Relation Schemas, Database Anomalies, Functional Dependencies, Armstrong's axioms, Closure of Attribute sets, Normalization, Need of Normalization, Normal Forms, First Normal Form, Second Normal Form, Third Normal Forms and Boyce-Codd Normal Forms, Fourth Normal Form and Fifth Normal Form.		
4	<b>Transaction Processing &amp; Concurrency Control:</b> 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. <b>Concurrency Control:</b> 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](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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>	I		
<b>Course Name</b>	Web Technology & Application Development				
<b>Code</b>	MCAN11104				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the basic concept of HTML and application in web designing.				
<b>CO2</b>	Students develop static and dynamic website using HTML and CSS.				
<b>CO3</b>	Understanding the basic concept of Java Script and its application.				
<b>CO4</b>	Student able to develop personal and professional websites.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>HTML, DHTML:</b> Introduction to HTML5; Introduction to Text Formatting tags; <b>Types of Lists:</b> Ordered, Unordered, Definition lists; <b>Table tags:</b> Methods to Create Tables , Attributes of Table tag, colspan and rowspan; Block level and Inline elements; Classes; Entities; frameset tags and its Attributes; <b>Form tag:</b> Creation of Forms, Textbox, Radio Button, Hidden etc.; Introduction to DHTML; Document Object Model; Style Sheets: Need of CSS; <b>Types of Style Sheet:</b> Inline, Internal and External.			15	CO1
2	<b>JAVA SCRIPT:</b> Introduction to JavaScript: Advantages of JavaScript; Basic Programming Techniques: Data Types and Literal, Creating Variables and JavaScript Array; Operators and Expressions in JavaScript; JavaScript Programming Constructs: Conditional Checking, Loops; Functions in JavaScript: Built in Functions and User Defined Functions; Dialog Boxes; JavaScript Document Object Model (DOM): Object hierarchy in DOM, Event Handling; Form Object: Form Object's Methods and Properties, Text Element, Button Element, etc.; Other Built in Objects in JavaScript: String, Math and Date Object; Writing Client Side Validations HTML Form Elements.			15	CO2
3	<b>Working with XAMPP Web Server:</b> Introduction, Installation, Configuration; <b>Database Handling:</b> Introduction MySQL, Connecting MySQL, Creating and Selecting Database, Creating Table, Inserting, Retrieving, Deleting and Updating Data in Database; <b>Basic of PHP:</b> Introduction to PHP: Features of PHP, Basics of PHP, Data Types, Variables, Constants, Operators, Arrays; Conditional Statements and Iterations;			15	CO3
4	<b>Functions in PHP:</b> User Defined and Built in Functions; Working with String Functions; <b>Working with Forms in PHP:</b> Adding elements to a form, uploading files to the web server using PHP; Debugging and Errors: Types of Errors and Error handling in PHP; Database Connectivity with MySQL.			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 Dhruvi "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. Lynn Beighley & Michael Morrison, "Headfirst PHP & MySQL, First Edition", O'Reilly.

**Online Resources**

1. [https://onlinecourses.swayam2.ac.in/nou20\\_cs05/preview](https://onlinecourses.swayam2.ac.in/nou20_cs05/preview)

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	1	2	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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>	I		
<b>Course Name</b>	Discrete Mathematic				
<b>Code</b>	MCAN11105				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	To Perform operations on discrete structures such as sets, functions, relations, and sequences.				
<b>CO2</b>	To Solve problems of recurrence relations and generating functions.				
<b>CO3</b>	To Verify the correctness of an argument using propositional and predicate logic and truth tables.				
<b>CO4</b>	To understand the concept of graph theory.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Set Theory, Relation &amp; Function: Set Theory:</b> Definition of Sets, Type of Sets, Venn Diagrams, Operation on Sets, Subsets, Power Set, Cartesian Product, Principle of Inclusion and Exclusion, Multisets; <b>Relation:</b> 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; <b>Function:</b> Definition & Type of Functions, One-to-One Function, Onto Function, Inverse Function, Compositions of Functions .			15	CO1
2	<b>Discrete Numeric Function and Recurrence Relation:</b> 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	<b>Fundamentals of Logics:</b> 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	<b>Graph Theory:</b> 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; <b>Tree:</b> 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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		I	
<b>Course Name</b>	Principles of Management				
<b>Code</b>	MCAN11106				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand how managers manage business organizations in the dynamic global environment.				
<b>CO2</b>	Get an understanding of the basic principles of staffing and leadership.				
<b>CO3</b>	Understand contemporary management concepts and skills and put these concepts and skills into practice.				
<b>CO4</b>	Apply conceptual tools and techniques in analyzing, evaluating, and addressing management issues.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> 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, systems and contingency approaches.			15	CO1
2	<b>Planning and Organizing I:</b> Planning: Nature, scope and objectives of planning, Types of plans, Planning process, Business forecasting. MBO: Concept, types, process and techniques of decision-making, Bounded Rationality. <b>Organizing:</b> Concept, nature, process, and significance. Principles of an organization Span of Control, Departmentation, Types of organization. Authority Responsibility, Delegation and Decentralization, Formal and Informal Organization			15	CO2
3	<b>Staffing and Motivation:</b> 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. <b>Leadership:</b> meaning and importance, Traits of a leader, Leadership Styles: Likert's Systems of Management, Tannenbaum, and Schmidt Model and Managerial Grid.			15	CO3
4	<b>Controlling:</b> Nature and Scope of control, Types of Control, Control process, <b>Control techniques:</b> 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](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	

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		I	
<b>Course Name</b>	Relational Database Management System Lab				
<b>Code</b>	MCAN11151				
<b>Course Type</b>	DSC-Lab	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		0	0	4	2
<b>Course Objectives</b>	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				
<b>Course Outcomes</b>					
<b>CO1</b>	Develop database modelling for a problem and normalization.				
<b>CO2</b>	Design a database using PL/SQL.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	1. Creating and Managing Tables <ul style="list-style-type: none"> <li>a. Creating and Managing Tables</li> <li>b. Including Constraints</li> </ul> 2. Manipulating Data <ul style="list-style-type: none"> <li>a. Using INSERT statement.</li> <li>b. Using DELETE statement.</li> <li>c. Using UPDATE statement.</li> </ul> 3. SQL Statements – 1 <ul style="list-style-type: none"> <li>a. Writing Basic SQL SELECT Statements</li> <li>b. Restricting and Sorting Data</li> <li>c. Single-Row Functions</li> </ul> 4. SQL Statements – 2 <ul style="list-style-type: none"> <li>a. Displaying Data from Multiple Tables</li> <li>b. Aggregating Data Using Group Functions</li> <li>c. Subqueries</li> </ul> 5.. Using SET operators, Date/Time Functions, GROUP BY clause <ul style="list-style-type: none"> <li>a. Using SET Operators</li> <li>b. Datetime Functions</li> <li>c. Enhancements to the GROUP BY Clause</li> <li>d. Advanced Subqueries</li> </ul> 6. Creating and Managing other database objects <ul style="list-style-type: none"> <li>a. Creating Views</li> <li>b. Other Database Objects</li> <li>c. Controlling User Access</li> </ul> 7. Using DCL commands <ul style="list-style-type: none"> <li>a. creating users.</li> <li>b. Authenticating users</li> <li>c. c. Roll back command</li> </ul>			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			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

<b>Program</b>	Master of Computer Applications					
<b>Year</b>	I	<b>Semester</b>			I	
<b>Course Name</b>	Web Technology & Application Development Lab					
<b>Code</b>	MCAN11152					
<b>Course Type</b>	DSC-Lab	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>	
<b>Pre-Requisite</b>		0	0	4	2	
<b>Course Objectives</b>	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.					
<b>Course Outcomes</b>						
<b>CO1</b>	Gradually build a static website using HTML, DHTML and CSS. Move this skill upward by creating some degree of user interactivity using JavaScript.					
<b>CO2</b>	Server-side data processing by creating PHP scripts technologies.					
<b>Module</b>	<b>Course Contents</b>				<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<ol style="list-style-type: none"> <li>1. Implementation of List Tags in HTML.</li> <li>2. Implementation of Table Tag in HTML.</li> <li>3. Implementation of Frameset Tag in HTML.</li> <li>4. Implementation of different Form Tags in HTML.</li> <li>5. Implementation of Cascading Style Sheet in Web Pages.</li> <li>6. Implementation of control structure in Java Script.</li> <li>7. Implementation of Looping structure in Java Script</li> <li>8. Implementation of form validate in Java Script.</li> </ol>				15	CO1
2	<ol style="list-style-type: none"> <li>1. Installation, configuration and working with XAMPP Web Server.</li> <li>2. Creating Database, table, and query handling in MySQL.</li> <li>3. Implementation of PHP tags, variables, and conditional construct.</li> <li>4. Implementation of looping structure in PHP</li> <li>5. Implementation of functions in PHP</li> <li>6. Implementation of string functions in PHP</li> <li>7. Implementation of database connectivity using MySQL.</li> <li>8. Writing simple applications with Technologies like HTML, JavaScript, PHP.</li> </ol>				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. Lynn Beighley & Michael Morrison, "Headfirst PHP & MySQL, First Edition", O'Reilly.

#### 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

# **SECOND SEMESTER**

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>	II		
<b>Course Name</b>	Advance Data Mining & Data Warehousing				
<b>Code</b>	MCAN12101				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	To understand the principles of Data warehousing and Data Mining and familiar with the Data warehouse architecture and its Implementation. Students also know the architecture of a Data Mining system, data pre-processing methods and classification of the data for the prediction and analysis.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the concepts and techniques used in Data Warehouse development and deployment.				
<b>CO2</b>	Apply the exploratory analysis for data mining.				
<b>CO3</b>	Apply statistical and pattern analysis techniques.				
<b>CO4</b>	Design and Develop Data Mining Models.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<p><b>Data Warehousing:</b> 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; <b>OLAP:</b> Introduction, Cube, Basic Analytical Operations, System types, Benefits of using OLAP services; <b>ROLAP:</b> Introduction, Architecture, Advantages, Tools; <b>MOLAP:</b> Introduction, Architecture, Advantages, Tools, OLTP vs. OLAP, Benefits of OLTP method.</p> <p><b>Dimensional Model:</b> Dimensional Model in Data Warehouse, Elements, Steps, Rules, and benefits of Dimensional Modeling.</p> <p><b>Schemas:</b> Star and SnowFlake Schema in data warehousing, Multidimensional schemas, Galaxy schema, Star Cluster schema.</p> <p><b>Data Mart:</b> Type of Data Mart, Steps in implementing a Datamart.</p> <p><b>Data Lake:</b> Architecture, concepts, Maturity stages, Difference between Data lakes and Data Warehouse.</p>			15	CO1
2	<p><b>Introduction to Data Mining:</b> Data Mining, Predictive Analysis, Major issues in data mining.</p> <p><b>Data Preprocessing:</b> Data Cleaning, Handling Missing Data, identifying misclassifications, Identifying Outliers, Measure of center and spread, Data transformations, Min-Max Normalization, Z-score Standardization, Decimal scaling, Normality, Transformations to achieve Normality, transforming categorical values to Numerical values, Binning, Reclassifying categorical values.</p> <p><b>Exploratory Data Analysis:</b> Hypothesis Testing Versus Exploratory Data Analysis, Getting to Know the Data Set, Exploring Categorical Variables, Exploring Numeric Variables, Exploring Multivariate Relationships, Selecting Interesting Subsets of the Data for Further Investigation, Using EDA to Uncover Anomalous Fields, Binning Based on Predictive Value,</p>			15	CO2

	<p>Deriving New Variables: Flag Variables, Deriving New Variables: Numerical Variables, Using EDA to Investigate Correlated Predictor Variables.</p> <p><b>Dimension-Reduction Methods:</b> Need for Dimension-Reduction in Data Mining, Principal Components Analysis, Profiling the Principal Components, Communalities, Validation of the Principal Components, Factor Analysis.</p>		
3	<p><b>Univariate Statistical Analysis:</b> Data Mining Tasks in Discovering Knowledge in Data, Statistical Approaches to Estimation and Prediction, Statistical Inference, Confidence Interval Estimation of the Mean, Reducing the Margin of Error, Confidence Interval Estimation of the Proportion, Hypothesis Testing for the Mean, Assessing the Strength of Evidence Against the Null Hypothesis, Using Confidence Intervals to Perform Hypothesis Tests, Hypothesis Testing for The Proportion</p> <p><b>Multivariate Statistics:</b> Two-Sample t-Test for Difference in Means, Two-Sample Z-Test for Difference in Proportions, Test for the Homogeneity of Proportions, Chi-Square Test for Goodness of Fit of Multinomial Data, Analysis of Variance.</p> <p><b>Frequent Pattern Analysis:</b> Frequent Itemset, Frequent Pattern Mining, Apriori, FP growth, Pattern Mining in Multilevel, Multidimensional Space, Constraint based Frequent Pattern Mining, Mining High-Dimensional data, Mining Approximate Pattern, Pattern Application and Exploration</p>	15	CO3
4	<p><b>Preparing to Model the Data:</b> Supervised Versus Unsupervised Methods, Statistical Methodology and Data Mining Methodology, Cross-Validation, Overfitting, Bias-Variance Trade-Off, Balancing the Training Data Set, Establishing Baseline Performance.</p> <p><b>Simple Linear Regression:</b> Simple Linear Regression, Extrapolation, Coefficient of Determination, Standard Error of the Estimate, Correlation Coefficient, Anova Table for Simple Linear Regression, Outliers, High Leverage Points, and Influential Observations, Population Regression Equation, Verifying The Regression Assumptions, Inference in Regression, t-Test for the Relationship Between x and y, Confidence Interval for the Slope of the Regression Line, Confidence Interval for the Correlation Coefficient <math>\rho</math>, Confidence Interval for the Mean Value of Given, Prediction Interval for a Randomly Chosen Value of Given, Transformations to Achieve Linearity, Box-Cox Transformations.</p> <p><b>Classification:</b> k-Nearest Neighbor Algorithm, Classification Task, k-Nearest Neighbor Algorithm, Distance Function, Combination Function, Quantifying Attribute Relevance: Stretching the Axes, Database Considerations, k-Nearest Neighbor Algorithm for Estimation and Prediction. Decision Tree, Classification and Regression Trees, C4.5 Algorithm, Decision Rules.</p> <p><b>Clustering:</b> Hierarchical and k-Means Clustering, The Clustering Task, Hierarchical Clustering Methods, Single-Linkage Clustering, Complete-Linkage Clustering, k-Means</p>	15	CO4





<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Computer Networks				
<b>Code</b>	MCAN12102				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	To study the different aspects of data communication service integrated over the IP networks, focusing on protocol.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand concepts of data communication, signal transmission and different networking elements along with protocols in each layer of references models.				
<b>CO2</b>	Understand the fundamentals of Data Link Layers, Multiple Access Protocols, Wired, and Wireless LAN.				
<b>CO3</b>	Gain basic knowledge of Network layer with routing protocols.				
<b>CO4</b>	Gain basic knowledge of Transport layer and Application Layer with protocols.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<p><b>Data Communications:</b> Definition, Effectiveness (Delivery, Accuracy, Timeliness, Jitter), Components (Message, Sender, Receiver, 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, Message Switching, packet Switching), Modem (ISDN and PSTN); <b>Signals and Transmission Media:</b> Analog and Digital, Transmission Channel, Bandwidth and Throughput; <b>Transmission Modes:</b> Introduction, Modulation (PCM, AM, FM, PM). <b>Introduction to Computer Network:</b> Definition, Application of Network, Network devices (Modem, Repeaters, Hub, Switch, Bridge, Gateway), Network Protocols and Standards, References Models: OSI Model, TCP/IP, Types of Addresses (Unicast, Multicast, Broadcast), Introduction to Physical Layer (Features and Protocols).</p>			15	CO1
2	<p><b>Data Link Layer and Multiple Access:</b> 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); <b>Multiple Access Protocols:</b> ALOHA, CSMA/CD, CSMA/CA, Polling, FDMA, TDMA, CDMA; <b>Wired and Wireless LAN's:</b> IEEE Standards, Standard-Ethernet, Gigabit Ethernet, IEEE 802.11; Frame Relay and ATM.</p>			15	CO2
3	<p><b>Network Layer:</b> Basic Function of Network Layer; Logical Addressing: IPv4, IPv6; Address Mapping: ARP, RARP, DHCP; Routing Protocols: Delivery, Forwarding Techniques, Routing Table, Distance Vector Routing, Link State Routing, Path Vector Routing, Multicast Routing, Flooding; Internetworking: Tunnelling, Fragmentation, OSPF, BGP; Congestion Control Techniques: Open and Closed Congestion with example.</p>			15	CO3
4	<p><b>Transport Layer and User Defined Layer:</b> Basic Function of Transport Layer; Process-to-Process Delivery: TCP, UDP; QoS; Basic Function of Presentation and Session Layer with protocols. <b>Application Layer:</b> Namespace, Domain Namespace,</p>			15	CO4

	Distribution and Resolution of Namespace, DNS, TELNET, E-Mail, SMTP, SNMP, POP, IMAP, FTP, WWW and HTTP.		
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**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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Python Programming Concepts				
<b>Code</b>	MCAN12103				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	To Understand & Appreciate the basic and advanced features of core language built-ins, handle, and control system/OS level features, communicate using sockets, write client and server-side scripts and design and implement basic applications with database connectivity.				
<b>Course Outcomes</b>					
<b>CO1</b>	Acquire programming skills in basic concepts of python.				
<b>CO2</b>	Understand and learn the concepts of the functions and arrays.				
<b>CO3</b>	Understand the data structure and data handling through the python functions.				
<b>CO4</b>	Acquire object-oriented skills and graphical user interface.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<p><b>Introduction to Python:</b> Introduction to python, History of python, installing python, Executing python programs, Comments in python, Internal working of python, Python Implementations, Difference between Python2 and Python3, Indentation Python character set, Tokens, <b>Core Data Types:</b> Integer, Floating Point Number, Complex Number, Boolean Type, String Type; print(), Assigning values to a variable, Multiple Assignments, input(), eval(), Formatting Number &amp; String, Python inbuilt mathematical function, ord and chr Functions;</p> <p><b>Python Operators &amp; Expression:</b> Types of operators; Operator Precedence &amp; Associativity. <b>Decision Statement:</b> if, if-else, nested if, multiway if-elif- else statement, conditional expression. <b>Loop Control Statement:</b> while Loop, for loop, range(), Nested Loops, break, continue, pass.</p>			15	CO1
2	<p><b>Functions:</b> Syntax, use of function, return statement, parameters &amp; 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 &amp; date module.</p> <p><b>String:</b> str class, index [] operator, Traversing: for &amp; 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; <b>Array:</b> Creation, Array (datatype, value), Adding elements, accessing elements, removing elements, Slicing, searching element, Updating Array</p>			15	CO2
3	<p><b>List:</b> Creation, list(), Accessing Elements in List, Negative List Indices , List Slicing[start:end], Built-in list class Methods, List operators, List Comprehension, List &amp; Strings, Passing list to a function and returning from a function, Difference between list &amp; array;</p> <p><b>List/Array Processing:</b> Searching: Linear, Binary; Sorting: Selection, Bubble, Insertion, Merge, Quick. <b>Tuple:</b> Creation, tuple(), Built-in tuple class methods, Indexing &amp; slicing,</p>			15	CO3

	<p>Operations on tuple, Variable length tuple to functions, List &amp; Tuple, Sort, Traverse, zip(), Inverse zip(*);</p> <p><b>Set:</b> Creation, set(), set operator, Built-in set class methods, Set operations: union(), intersection(), difference(), symmetric_difference(); <b>Dictionary:</b> Creation, dict(), Adding values, Replacing values, Retrieving Values, Formatting, Deleting items, Comparing, Built-in dict class methods, Traversing, Nested Dictionary, Traversing Nested Dictionary, polynomial Dictionary. <b>File Handling:</b> Need, Text Files: Open, Read, Write, Append, Close, modes, seek(); Binary Files: Reading, Built-in Functions to to access files and directories;</p>		
4	<p><b>Object Oriented Programming:</b> 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; <code>__init__()</code>(Constructor), <code>__del__()</code>(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 Methods; Inheritance: Introduction, Types of Inheritance, Object Class, Using <code>super()</code>; Method Overriding; Encapsulation; Abstraction; Data hiding.</p> <p><b>GUI Programming:</b> Introduction to graphical user interfaces (GUI); GUI frameworks in Python (e.g., Tkinter); Setting up the development environment for GUI programming, Introduction to Tkinter and its features, Creating and configuring GUI windows and widgets, Layout management (pack, grid, and place) Using various types of widgets (buttons, labels, entry fields, checkbuttons, radio buttons, etc.) Dialog boxes (message boxes, file dialogs, etc.) Customizing widget appearance (colors, fonts, etc.). <b>Database Connectivity:</b> Introduction to database concepts; Connecting Python with databases (e.g., SQLite, MySQL); Executing SQL queries using Python.</p>	15	CO4

#### 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, ISBN: 978-1111822705.
3. Jake VanderPlas "Python Data Science Handbook" O'Reilly Publications.
4. David Beazley, "Python Essential Reference (4th Edition)" Addison Wesley.

#### Online Resources

1. [https://onlinecourses.swayam2.ac.in/cec22\\_cs20/preview](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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>			II
<b>Course Name</b>	Data Structure Using Java				
<b>Code</b>	MCAN12104				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	The course objective is to make the student learn fundamental data structures algorithms and to describe and implement algorithms such as stacks, queues, linked lists, trees, searching techniques, sorting techniques.				
<b>Course Outcomes</b>					
<b>CO1</b>	Students will be able to learn how and why java came about and what makes it so important.				
<b>CO2</b>	Build complex systems from software components.				
<b>CO3</b>	Apply advanced Java programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for problems.				
<b>CO4</b>	Design and implement abstract data types such as linked list, stack, queue, and tree by using Java as the programming language using static or dynamic implementations.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> Introduction to Object Oriented Programming Concept, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism; Introduction of Java: Java History, JDK Directory Structure, Java Features, Structure of Java Program, Compiling and Interpreting Applications; Java Tokens: Java character set, Keywords, Identifiers, Literals; Data types and Variables: Primitive Data types Declarations; Literals: Numeric Literals, Character Literals, String Literals; Non Primitive data types; Operators and Expressions, Implicit Type Conversions, The Cast Operator, Control Flow Statements. Introduction to Object-Oriented Programming, Type Casting, Input and output-Scanner and System class-print(), println(), and printf() methods.			15	CO1
2	<b>Classes &amp; Objects:</b> Creating Classes and objects, Memory allocation for objects, Constructor, Access Modifiers and Access Control, Default, public private protected, Inheritance: Implementation of Inheritance, Simple, Multilevel, and Hierarchical. Polymorphism: Implementation of Polymorphism, Method Overloading, Method Overriding, <b>Thread:</b> Threaded programming. Strings: String, String Methods, String Buffer class. Abstract classes and methods. Package & Interfaces: Interfaces, Packages, Packages Concept, creating user defined packages, Java Built in packages, Java.lang, Java.util. Exception Handling: Exception types, Using try catch and Multiple catch, Nested try, throw, throws and finally, Creating User defined Exceptions.			15	CO1 & CO2
3	<b>Data Structure:</b> Definition & Classification. Array: Single and multidimensional array. Sorting Algorithm: Insertion, Bubble and Selection. Searching Algorithm: Linear & Binary Search.			15	CO2 & CO3

	Stack: Operations on Stack, array representation, Applications of Stack. Queue: Operations on Queue, Circular Queue, Dequeue.		
4	<b>Linked List:</b> Comparison with Array. Single Linked List: Structure & Implementations, Traversing, add new node, delete node. Stack with Single Linked List, Queue as Circular Linked List. Double Linked List. Tree & Binary Tree: Basic Terminology and Properties, Linked representation of Binary Tree. Tree Traversal: in order, pre order and post order.	15	CO3 & CO4

### Suggested Readings

1. E. Balagurusamy, Programming with Java, Tata McGraw Hill.
2. Patrick Naughton and Herbertz Schildt, "Java 2.0: The Complete Reference", TMH, 1999.
3. Deitel & Deitel, "Java How to program", Prentice Hall, 4th Edition, 2000.
4. Gary Cornell and Cay S. Horstmann, "Core Java Vol 1 and Vol 2", TMH.
5. Java 6 Programming black books Kogent solutions published by dreamtech press edition 2007.
6. Steve Holzner, "Java black book", Paraglyph Press; Second Edit ion (July 1, 2002)
7. Duncan A Buell, "Data Structures Using Java", Jones & Bartlett Learning, January 2012
8. Robert Lafore, "Data Structures and Algorithms in Java", Second Edition, SAMS, Second Edition, 2003.
9. Goodrich, "Data Structures & Algorithms in Java", Sixth Edition, (January 2014).

### Online Resources

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs92/preview](https://onlinecourses.nptel.ac.in/noc22_cs92/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	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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Software Engineering				
<b>Code</b>	MCAN12105				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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				
<b>Course Outcomes</b>					
<b>CO1</b>	Develop the understanding of Software Development Life Cycle.				
<b>CO2</b>	Preparation of SRS, High-Level, Low-Level Design and Test Cases.				
<b>CO3</b>	Aware of the various types of software design approaches.				
<b>CO4</b>	Knowledge of software testing and maintenance.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Fundamental Concept of Software Engineering &amp; Models:</b> Introduction to Software Engineering, Software Crisis, Software Problems, Software Engineering Problems, Characteristics of Software, Software Evaluation, Software Applications, SDLC. <b>Software Development Models:</b> Waterfall Model, Prototyping Model, Interactive Enhancement Model, Spiral Model, Iterative Models, Evolutionary Process Models, Role of Management in Software Development and Problem Analysis.			15	CO1
2	<b>Software Requirement Analysis and Project Planning:</b> Requirement Analysis and Requirement Specification Documents, Software Requirement Specification (SRS), Characteristics of SRS, Components of SRS, IEEE Standard of SRS; <b>Project Planning:</b> Project Scheduling Staffing and Personal Planning, <b>Software Cost Estimation:</b> Basic COCOMO Model, Intermediate COCOMO Model, Complete COCOMO Model, Coupling and Cohesion.			15	CO2
3	<b>Software Analysis &amp; Design Approach:</b> Design Concepts, Design Model, Top Down and Bottom-Up Approach, Structure Design Methodology, <b>Functional Oriented Approach:</b> Structured Analysis, Data Flow Diagram, Structured Design, Functional Modelling; <b>Object Oriented Approach:</b> Object Oriented Analysis and Design, Classes and Objects, Relationship among Objects, Inheritance and Polymorphism, Design Concepts, Design Notation and Specification, Design Methodology, Dynamic Modelling.			15	CO3
4	<b>Software Coding, Testing &amp; Maintenance:</b> Introduction to Software Coding: Coding Standards and Guidelines, Code Walkthrough, Code Inspection; <b>Testing:</b> 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. <b>Introduction to Software Maintenance,</b> Need of maintenance, Types of Software Maintenance, Software Quality Assurance (SQA), Software Re-			15	CO4

	Engineering, Reverse Engineering, Software Configuration Management Activities.		
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**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](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



<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Artificial Intelligence				
<b>Code</b>	MCAN12121				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	Ability to identify and formulate appropriate AI methods for solving a problem.				
<b>CO2</b>	Ability to implement AI based Game Playing techniques.				
<b>CO3</b>	Able to Solve Analytical based problems.				
<b>CO4</b>	Students will be able to use the concepts of AI for real world problem solving.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> Definitions, 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.			18	CO1
2	<b>Game Playing:</b> Minimax, Alpha-Beta pruning, Water Jug problem, Chess problem, Tiles problem, Wampus Problem, N-Queen Problem, Travelling Salesman Problem.			10	CO2
3	<b>Knowledge Representation:</b> Introduction, Approaches and Issues in Knowledge Representation, Propositional Logic and Inference, First-Order Logic and Inference, Unification and Resolution, Expert Systems. <b>Reasoning:</b> Introduction, Types of Reasoning, Probabilistic Reasoning, Probabilistic Graphical Models, Certainty factors and Rule Based Systems, Introduction to Fuzzy Reasoning.			17	CO3
4	<b>Planning and Learning:</b> Introduction to 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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Cloud Computing				
<b>Code</b>	MCAN12122				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the Cloud Computing, Reference, and Deployment model basics.				
<b>CO2</b>	To examine existing cloud infrastructures and determine an acceptable architecture that fulfils business goals, you must first understand the evolution, concepts, and benefits of cloud computing.				
<b>CO3</b>	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.				
<b>CO4</b>	Identify cloud computing security and privacy risks and develop appropriate security solutions to secure cloud resources.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<p><b>The Basic Concepts of Cloud Computing:</b> Cloud Computing; Definition, Cloud Computing Vision, Goals and Benefits, Characteristics of Cloud Computing, Risks and Challenges of Cloud Computing, Clustering and Grid Computing.</p> <p><b>Fundamental Concepts and Models:</b> Roles and Boundaries, Cloud Deployment Models; Public, Private, Hybrid and Community Model, Pros and Cons. Cloud Service Models; Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). <b>Fundamental Cloud Security:</b> Basic Concepts; Confidentiality, Integrity, Availability, Introduction Cloud Security Threat, and Mechanism.</p>			15	CO1
2	<p><b>Cloud Computing Architecture and Virtualization:</b> The Cloud Reference Model; Introduction, Workload Distribution, Resource Pooling, Dynamic Scalability, Elastic Resource Capacity, Service Load Balancing, Cloud Bursting, <b>Virtualization:</b> Definition, Benefits, Drawback and. Characteristics of Virtualized Environments, Virtualization vs. Cloud Computing, Types of Virtualizations; Application, Network, Storage, Server, Data. <b>Taxonomy of Virtualization Techniques:</b> Introduction, Hypervisor, Type-1, Type-2, Pros and Cons, Full and Para Virtualization.</p>			15	CO1 & CO2
3	<p><b>Cloud Computing Economics and Data in the Cloud:</b> Cloud Computing Economics: Cloud Infrastructure; Economics of Private Clouds, Software Productivity in the Cloud, Economies of Scale: Public vs. Private Clouds; Multi-software: Multi-tenancy Support, Multi-schema Approach, Multi-tenancy using Cloud Data Stores, Data Access Control for Enterprise Applications; <b>Data in the Cloud:</b> Relational Databases, Cloud File Systems: Introduction to Google File System and Hadoop Distributed File System, BigTable, HBase, Cloud Data Stores: Datastore and SimpleDB.</p>			15	CO2 & CO3

4	<b>Cloud Platforms in Industry and Cloud Applications:</b> Amazon Web Services; Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine; Architecture and Core Concepts, Application Lifecycle, Cost Model, Observations. Microsoft Azure; Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. <b>Cloud Applications:</b> Healthcare; ECG Analysis in the Cloud, Biology: Protein Structure Prediction, Gene Expression Data Analysis for Cancer Diagnosis. Geoscience; Satellite Image Processing.	15	CO3 & CO4
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#### Suggested Readings

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology & Architecture", 1st edition, Pearson, 2019.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013. Cloud Security & Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD,O'REILLY).
3. Gautam Shroff, "Enterprise Cloud Computing: Technology, Architecture, Applications", Cambridge University Press, 2010.
4. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 1st Edition, O'Reilly Media, 2009.
5. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter "Cloud Computing, A Practical Approach", Tata McGraw Hill Education Publication (TMH Publication), 2009.
6. Kailash Jayaswal, Jagannath Kallakurchi, Donald J. Houde, Dr. Deven Shah, "Cloud Computing", Black Book, Dreamtech, 2015.

#### Online Resources

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs14/preview](https://onlinecourses.nptel.ac.in/noc21_cs14/preview)

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		1	1	2	1
CO2	1	2	1		2	2	1	1	2		1	1	2	2
CO3	2	2	2	2	2	2	2	1	2	2	2	3	2	3
CO4	1	2	2	2	2	2	2	1	2	2	1	3	2	3

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Theory of Computation				
<b>Code</b>	MCAN12123				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	Objective of a Theory of Computation (TOC) is to introduce the fundamental mathematical and computational principles that are the foundation of computer science.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand basic properties of deterministic and nondeterministic finite automata.				
<b>CO2</b>	Understand basic properties of formal languages and formal grammar.				
<b>CO3</b>	Understand the relation between types of languages and types of finite automata.				
<b>CO4</b>	Understand basic properties of Turing machines and computing with Turing machines.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Finite Automata (FA):</b> Introduction to Alphabets; Strings and Language, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), Language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of NFA, Language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.			15	CO1
2	<b>Regular Expressions (RE):</b> Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions-Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. <b>Regular Grammars:</b> Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, Closure properties of regular languages.			15	CO2
3	<b>Context Free Grammar (CFG):</b> Introduction to Context free language, Chomsky normal forms, Greibach normal forms, Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings, Ambiguity in CFGs, Ambiguous and unambiguous CFG, Minimization of CFG's, Pumping Lemma for CFL's, Algebraic expression, Closure properties of Context Free Language.			15	CO3
4	<b>Push Down Automata (PDA) &amp; Turing Machines:</b> Push Down Automata (PDA): Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG. <b>Turing Machines:</b> Introduction, Basic Features of Turing Machine, Languages of Turing Machine, Turing Machine as Acceptor, Computing Devices, Universal Turing Machine, Undecidable problems about Turing Machines; Rice's Theorem.			15	CO4

### Suggested Readings

1. John E. Hopcroft & Jeffery D. Ullman, "Introduction to Automata Theory, Languages & Computation", Pearson.
2. K L P Mishra & N. Chandra Shekhran, "Theory of Computer Science", PHI 2010.
3. Kamala Krithivasan Rama R., "Introduction to Formal Languages, Automata theory & Computation", Pearson 2010.
4. E.V. Krishnamurthi, "Introductory Theory of Computer Science", East West Press.
5. ZVI Kohavi, "Switching & Finite Automata Theory", TMH.

### Online Resources

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs83/preview](https://onlinecourses.nptel.ac.in/noc21_cs83/preview)

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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Python Programming Lab				
<b>Code</b>	MCAN12151				
<b>Course Type</b>	DSC-Lab	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		0	0	4	2
<b>Course Objectives</b>	To Understand & Appreciate the basic and advanced features of core language built-ins, handle, and control system/OS level features, communicate using sockets, write client and server-side scripts and design and implement basic applications with database connectivity.				
<b>Course Outcomes</b>					
<b>CO1</b>	Acquire programming basic concept implementation in python.				
<b>CO2</b>	Develop the skill of Object-Oriented and designing Graphical user Interfaces and ability to write database applications in Python.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<ol style="list-style-type: none"> <li>1. Installing and configuring Anaconda on windows, Linux, or mac.</li> <li>2. Introduction to Jupyter lab, Variables, keywords, basics operation in python, Taking input in jupyter , console Taking multiple inputs from user in Python operators implementation</li> <li>3. Python Input Methods for Competitive Programming, Python Output using print () function Python end parameter in print(), if, else, if elif ladder implementation</li> <li>4. Special keyword - in and is, for loop, range function, and examples use of enumerate, zip function in loops else with for.</li> <li>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.</li> <li>6. Practical implementation of Array, creation, and traversal, adding, removing, accessing, updating elements</li> <li>7. Practical implementation of list, creation and traversal, listfunctions: append, insert, extend, remove, pop, clear, sort, count, index, and copy.</li> </ol>			15	CO1
2	<ol style="list-style-type: none"> <li>1. Practical implementation of tuples, creation and traversal, Practicalimplementation of Set, creation, and traversal, set functions - add, update, remove, clear, pop, union, intersection, difference, disjoint, subset, superset.</li> <li>2. Practical implementation of Dict, creation and traversal, dictionaryfunction - get, update, keys, items, values.</li> <li>3. creating functions in jupyter calling function, argument-based functions, different type of style for passing parameter in python</li> <li>4. Making module for functions, and importing them different types of imports in python, random and math module OS module for file and folder operation, file handing in python</li> <li>5. Creating classes, creating objects, implementing</li> </ol>			15	CO2

	function calls, constructor, and self-keyword implementation, super method 6. Practical implementation on Inbuilt overloading Methods. 7. Practical implementation of inheritance and Method Overriding 8. Practical Implementation of GUI framework and connect it to the database (SQLite, MYSQL).		
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### 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, ISBN: 978-1111822705.
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



<b>Program</b>	Master of Computer Applications				
<b>Year</b>	I	<b>Semester</b>		II	
<b>Course Name</b>	Data Structure Using 'Java' Lab				
<b>Code</b>	MCAN12152				
<b>Course Type</b>	DSC-Lab	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		0	0	4	2
<b>Course Objectives</b>	To understand Java Programming language and various concepts of Data Structures, their usage and implement them using 'Java' programming language.				
<b>Course Outcomes</b>					
<b>CO1</b>	Students will be able to learn how and why Java came about and what makes it so important. They will be able to Build complex system from software components and apply advance Java programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for problem.				
<b>CO2</b>	Design and implement abstract data types such as linked list, stack, queue, and tree by using Java as the programming language using static or dynamic implementations.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	1. Implementation of Fundamental Data Types & Testing and Debugging of Programs 2. Implementation of Basic Control Constructs such as loops etc. 3. Implementation of classes & objects 4. Implementation of Methods in Java. 5. Implementation of constructors. 6. Implementation of Inheritance 7. Implementation of Polymorphism. 8. Implementation of String Handling. 9. Implementation of Abstract Class, Interfaces & Packages. 10. Implementation of String Handling. 11. Implementation of Input Output Streams. 12. Implementation of Exception Handling. 13. Implementation of Event Handling			15	CO1
2	1. Implementation of Arrays (Single & Double Dimension). 2. Implementation of Searching techniques: Linear Search, Binary Search. 3. Array implementation of Stack, Queue, Circular Queue, Linked List. 4. Implementation of Stack, Queue, Circular Queue, Linked List using dynamic memory allocation. 5. Implementation of Binary tree. 6. Implementation of Tree Traversals (preorder, inorder, postorder). 7. Implementation of B-Tree. 8. Implementation of sorting techniques: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort			15	CO2

#### Suggested Readings

1. E. Balagurusamy, Programming with Java, Tata McGraw Hill.
2. Patrick Naughton and Herbertz Schildt, "Java 2.0: The Complete Reference", TMH, 1999.
3. Deitel & Deitel, "Java How to program", Prentice Hall, 4th Edition, 2000.
4. Gary Cornell and Cay S. Horstmann, "Core Java Vol 1 and Vol 2", TMH.
5. Java 6 Programming black books Kogent solutions published by Dreamtech press edition 2007.
6. Steve Holzner, "Java black book", Paraglyph Press; Second Edit ion (July 1, 2002)

7. Duncan A Buell, "Data Structures Using Java", Jones & Bartlett Learning, January 2012
8. Robert Lafore, "Data Structures and Algorithms in Java", Second Edition, SAMS, Second Edition, 2003.
9. Goodrich, "Data Structures & Algorithms in Java", Sixth Edition, (January 2014).

**Online Resources**

1. <https://archive.nptel.ac.in/courses/106/105/106105225/>
2. <http://cse01-iiith.vlabs.ac.in/>

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

# **THIRD SEMESTER**

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>	III		
<b>Course Name</b>	.Net Framework using C#				
<b>Code</b>	MCAN13201				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	The Subject provides the Fundamental Concepts of the Windows Desktop Application and Website Development with machine learning and data science through .Net framework and C#.				
<b>Course Outcomes</b>					
<b>CO1</b>	To develop an understanding of .Net technology using C# and Asp.net.				
<b>CO2</b>	To understand the Database Connectivity.				
<b>CO3</b>	To develop an understanding of Static and Dynamic web pages.				
<b>CO4</b>	To understand API, REST, SOAP and AJAX				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>.Net Framework:</b> Introduction and Origin of .Net technology; Framework Components, Common Language Runtime (CLR) and FCL; Managed and Unmanaged Code; Common Type System (CTS) & Common Language Specification (CLS); Microsoft Intermediate Language (MSIL) and Metadata; Just- In-Time Compilation (JIT); Garbage Collection; Base Classes and Ms.Net Namespaces; <b>Object and Classes:</b> Properties (Read, Write), Indexers, Inheritance (Multilevel and Hierarchical), Constructor Polymorphism (Runtime, Compile Time), Operator Overloading, Interfaces, Delegates and Events, Boxing and Un-boxing.			15	CO1
2	<b>C# Libraries and Assemblies:</b> Input-output (Streams Classes); Multithreading; Networking and Sockets; Managing Console I/O Operations; <b>.NET Assemblies:</b> Type of Assemblies, GAC (Global Assembly Cache), Concept of Strong Names, Global ASAX Files; <b>Caching Concepts:</b> Page Output Caching, Page Fragment Caching; <b>State management:</b> Session Object, Hidden Fields, View State, Cookies, Cross page posting; Introduction to Generics; Web Configuration and Machine Configuration Files.			15	CO2
3	<b>Windows and Website Development:</b> Windows Forms (A Skeletal Form Based Windows Program, Remoting: Server Activated Object, Client Activated Object; <b>Marshalling:</b> Marshal by value, Marshal by reference; Debugging, Exceptions and Error Handling; <b>ASP.NET Web Form Controls:</b> User controls and Server Controls; <b>Web Services:</b> UDDI, DISCO, WSDL; ADO.NET: Architecture, Difference between Dataset and Data Reader, Connection and Command Object; Distributed applications; Reflection; Globalization and Localization; Authentication and Authorizations; XML in .NET.			15	CO3
4	<b>.Advanced Concepts:</b> REST AND SOAP: Rest, Restful, Soap, WCF, WPF, Implementation of Rest and Soap, Restful Vs Soap. <b>Web server:</b> web server, types, web server used in .net; <b>Ajax Controls:</b> AJAX and need for AJAX, Implement with JavaScript, ASP.NET AJAX – Update Panel, Update Progress etc., ASP.NET Ajax Control toolkit, Client-side Template Rendering – Data View control.			15	CO4

### Suggested Readings

1. E. Balagurusamy, "Programming. with C#", Tata McGraw Hill Publication.
2. Mark J Price, "C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals", Packt Publishing.
3. Herbert Schildt, "C# 4.0: THE COMPLETE REFERENCE", Tata McGraw-Hill Education.
4. Joseph Albahari, Ben Albahari, "C# 5.0 in a Nutshell: The Definitive Reference", O'Reilly Media

### Online Resources

1. <https://nptel.ac.in/courses/106105151>
2. <https://nptel.ac.in/courses/106104128>

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	2	1					2	1	1
CO2	2	2	2	2	2	2	1		2	2		2	2	2
CO3	2	2	1	2	3	2	2		2	2	2	2	2	2
CO4	2	2	1	2	3	2			2	2	2	3	3	3

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>		III	
<b>Course Name</b>	Mobile Application Development				
<b>Code</b>	MCAN13202				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	To understand the basic concepts of Mobile application development				
<b>CO2</b>	Able to design and develop user interfaces for the Android platforms.				
<b>CO3</b>	Able to design and develop mobile applications using a chosen application development framework.				
<b>CO4</b>	Able to develop enterprise-level mobile solutions.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> 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.			15	CO1
2	<b>Development Environment:</b> 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, Installing and Running Android - Hello App, Activity Life Cycle and its methods, Logcat, Components of an Android App: Activity, Service, Broadcast Receiver, Content Provider.			15	CO2
3	<b>Layout:</b> 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. 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.			15	CO3
4	<b>Introducing SQLite,</b> In and Out of SQLite, Hello Database, Data Binding, using content provider, implementing content provider. Reading/writing local data, Accessing the InternalFile system, Accessing the SD card. Preparing app for publishing, Deploying APK files, uploading in Market, Consuming Web Services			15	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., Black Book, DreamTech Press.
3. W. Frank Ableson, Robi Sen, Et. Al., " Android in Action", Manning.
4. Charlie Collins, Michael Galpin, Et. Al., " Android in Practice", Manning.
5. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile App, Learn | Explore | Apply using Android", Wiley.

**Online Resources**

1. <https://archive.nptel.ac.in/courses/106/106/106106156/>
2. [https://onlinecourses.nptel.ac.in/noc20\\_cs52/preview](https://onlinecourses.nptel.ac.in/noc20_cs52/preview)

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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>		III	
<b>Course Name</b>	Design & Analysis of Algorithms				
<b>Code</b>	MCAN13203				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	Able to Argue the correctness of algorithms using inductive proofs and analyze worst-case running times of algorithms using asymptotic analysis.				
<b>CO2</b>	Able to explain advanced data structures used in problem solving.				
<b>CO3</b>	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.				
<b>CO4</b>	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.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Basic Concepts of Algorithms:</b> 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	<b>Analysis of Data Structures:</b> 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	<b>Advanced Design &amp; Analysis Techniques: Dynamic Programming:</b> Assembly Line Scheduling, Matrix Chain Multiplications, Longest Common Subsequence; <b>Greedy Algorithms:</b> Optimal Binary Search Tree, Activity Selection Problem, Knapsack Problem, Huffman Codes, An Activity Selection Problem, Task Scheduling Problem, Traveling salesman problem; <b>Back Tracking:</b> Hamiltonian Circuit Problem, Subset Sum Problem, N-Queens Problem; <b>Branch &amp; Bound:</b> FIFO Branch-and-Bound Algorithm, Knapsack Problem, Assignment Problem, Traveling Salesman Problem.			15	CO3
4	<b>Analysis of Graph Algorithms:</b> 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. Cormen, "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. [https://onlinecourses.nptel.ac.in/noc19\\_cs47/preview](https://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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>		III	
<b>Course Name</b>	Machine Learning				
<b>Code</b>	MCAN13221				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	Understanding foundational concepts and principles of machine learning.				
<b>Course Outcomes</b>					
<b>CO1</b>	To understand the basics of machine learning concepts.				
<b>CO2</b>	To learn various algorithms of machine learning				
<b>CO3</b>	To learn and apply extended concepts of machine learning				
<b>CO4</b>	To learn and solve the Neural Network concepts and problems				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> Definition of Machine Learning, Key elements of machine Learning, The origins of Machine Learning, Machine learning in practice, Design of a Learning System, Types of Machine Learning: Supervised Learning, Semi-Supervised Learning, Unsupervised Learning, Reinforcement Learning and Artificial Neural Network, Applications of Machine Learning; <b>Data Pre-Processing:</b> Overview and Need of Data Preprocessing, Data Quality, Factors Affecting Data Quality; <b>Major Task in Data Pre-processing:</b> Cleaning, Integration, Reduction, Transformation, and discretization; <b>Scaling:</b> Types of Scaling, Normalization and Standardization.			15	CO1
2	<b>Supervised Learning:</b> Classification and Regression, Generalization, Overfitting, and Underfitting, Supervised Machine Learning Algorithms, K-Nearest Neighbors(KNN); <b>Support Vector Machine(SVM):</b> Working of SVM, Implementation; <b>Decision Tree:</b> Working and Implementation; <b>Naïve Bayes Classifier:</b> Introduction to Naïve Bayes Algorithm, building a model Using Naïve Bayes.			15	CO2 & CO3
3	<b>Unsupervised Learning:</b> Types of Unsupervised Learning, Introduction to Clustering, K-means Clustering Algorithm, Working and Implementation of K-means Clustering, Introduction to Hierarchical Clustering, Agglomerative Hierarchical Clustering, Density-Based Method; <b>Reinforcement Learning:</b> Overview of Reinforcement Learning, The Learning Task, Markov Decision process, Q-learning, The Q function, Algorithm for Learning Q.			15	CO2 & CO3
4	<b>Artificial Neural Network:</b> Motivation, Neural Network Representation, Perceptron, Training Rule, Activation Functions and Types of Activation Functions, Introduction to Gradient Descent and Delta Rule. Feed Forward Neural Network, Back Propagation Network: Overview, Back Propagation Algorithm.			15	CO3 & CO4

### Suggested Readings

1. Tom M. Mitchell, " Machine Learning", Tata McGraw Hill Education.
2. Jiawei Han, Micheline Kamber, JianPie, "Data Mining Concept and Techniques", Morgan Kaufmann.
3. Fengxiang He and Dacheng Tao, "Machine Learning Foundation, Methodologies and Application", Springer.

4. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and Tensor Flow”, O'Reilly.

#### Online Resources

1. [https://onlinecourses.nptel.ac.in/noc23\\_cs18/previewhttps://bloomberg.github.io/foml/#home](https://onlinecourses.nptel.ac.in/noc23_cs18/previewhttps://bloomberg.github.io/foml/#home)
2. <https://archive.nptel.ac.in/courses/106/106/106106139/>

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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>		III	
<b>Course Name</b>	Internet of Things (IoT)				
<b>Code</b>	MCAN13222				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	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 therole of IoT in various domains of Industry.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the various concepts, terminologies and architecture of IoT systems.				
<b>CO2</b>	Understand the use of sensors, actuators and IoT supported hardware for design of IoT system.				
<b>CO3</b>	Understand and apply various wireless technology and protocols for design of IoT systems.				
<b>CO4</b>	Understand the various security aspects for IoT system.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Fundamentals of IoT:</b> Concepts and Definition of IoT, Characteristics, Conceptual Framework, Architectural view, technology behind IoT, M2M Communication; <b>Design Principles for Connected Devices:</b> IoT/M2M systems layers and design standardization, Application of IoT, communication technologies, data enrichment and consolidation.			15	CO1
2	<b>Hardware for IoT:</b> Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology; <b>Embedded Platforms for IoT:</b> 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	<b>Wireless Technologies for IoT:</b> IEEE 802.15.4, Bluetooth, Wi- Fi, Zigbee, RFID, HART, LoRa, NFCZ-Wave, Z-Wave; <b>IP Based Protocols for IoT:</b> IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT, Edge connectivity and protocols, Cloud Computing, Integration of IoT with Cloud Computing.			15	CO3
4	<b>Overview of IoT Security:</b> Introduction Securing the Internet of Things, Architecture, Requirements, Security Protocols for IoT Access Networks, Attack, Defense, and Network Robustness of Internet of Things; <b>Case Studies/Industrial Applications:</b> 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 Madiseti," 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 Publications.

**Online Resources**

1. <https://archive.nptel.ac.in/courses/106/105/106105166/>
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>	III		
<b>Course Name</b>	Compiler Design				
<b>Code</b>	MCAN13223				
<b>Course Type</b>	DSE	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		3	1	0	4
<b>Course Objectives</b>	Teach concepts of language translation and phases of compiler design, describe the common forms of parsers, demonstrate intermediate code using technique of syntax directed translation, Illustrate the various optimization techniques for designing various optimizing compilers.				
<b>Course Outcomes</b>					
<b>CO1</b>	Use compiler construction tools and describes the Functionality of each stage of compilation process.				
<b>CO2</b>	Construct Grammars for Natural Languages and find the Syntactical Errors/Semantic errors during the compilations using parsing techniques.				
<b>CO3</b>	Analyze different representations of intermediate code.				
<b>CO4</b>	Construct new compiler for new languages.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> Compilers & Translators; <b>Computational Model:</b> Analysis & Synthesis; Phases of Compiler & Analysis of Source Code; Pass Structure of Compiler; Bootstrapping of Compiler; Finite state machines and regular expressions and their applications to lexical analysis; lexical-analyzer generator; LEX-compiler; BNF notation; Ambiguity; YACC.			15	CO1
2	<b>The Syntactic Specification of Programming Languages &amp; Parsing Techniques:</b> Context free grammars; Derivation and parse trees; Capabilities of CFG; <b>Parsing Techniques:</b> Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR).			15	CO2
3	<b>Syntax-directed Translation:</b> Intermediate code; Postfix notation; Parse trees & syntax trees; <b>Three address code:</b> Quadruple, Triples; Translation of assignment statements; Boolean expressions; Statements that alter the flow of control; Postfix translation; Translation with a top-down parser; Array references in arithmetic expressions; Procedures call; Declarations and case statements.			15	CO3
4	<b>Code Optimization and Code Generation, Symbol Table, Error Detection &amp; Recovery: Sources of optimization:</b> Local optimization, Loop optimization, Peephole optimization; Basic blocks and flow graphs; DAG; Data flow analyzer; Machine Model; Order of evaluation; Register allocation and code selection; <b>Symbol Table:</b> Symbol Table Implementation, Data Structure for Symbol Table, Symbol Table Handler; Implementation of simple stack allocation scheme; Storage allocation in block structured language; <b>Error Detection &amp; Recovery:</b> Error Representation, Sources of Errors, Lexical Phase Errors, Syntax Error Detection & Recovery, Semantic Errors.			15	CO4

### Suggested Readings

1. Alfred V. Aho, Jeffrey D. Ullman, "Principles of compiler design", Pearson Education.
2. Kenneth C. Loudon, "Compiler Construction– Principles and Practice", PWS Publishing.
3. K. L. P Mishra, N. Chandra Shekaran, "Theory of computer science- Automata Languages and computation", Prentice Hall of India.
4. Andrew W. Appel, "Modern Compiler Implementation C", Cambridge University Press.

### Online Resources

1. <http://www.nptelvideos.com/lecture.php?id=5506>
2. <http://www.nptelvideos.com/lecture.php?id=5232>

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

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>	III		
<b>Course Name</b>	.NET FRAMEWORK & C# LAB				
<b>Code</b>	MCAN13251				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		0	0	4	2
<b>Course Objectives</b>	To Provide the Fundamental Concepts of Windows Desktop Application and Website Development with machine learning and data science through .Net framework and C#.				
<b>Course Outcomes</b>					
<b>CO1</b>	To develop an understanding of .Net technology using C# and Asp.net and the Database Connectivity.				
<b>CO2</b>	To develop an understanding of Static and Dynamic web pages.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<ol style="list-style-type: none"> <li>1. Implementation of Decision Making and Branching Statements.</li> <li>2. Implementation of Iterative Statements on Console Applications.</li> <li>3. Implementation of Enum and Structures on Console Applications.</li> <li>4. Implementation of Arrays and ArrayList on Console Applications.</li> <li>5. Implementation of Boxing and UnBoxing on Console Applications.</li> <li>6. Implementation of Strings on Console Applications.</li> <li>7. Implementation of Inheritance and Polymorphism</li> <li>8. Implement concepts of Inheritance, visual inheritance and Interface.</li> <li>9. Construct the C# application to implement the Operator Overloading.</li> <li>10. Implementation of Delegates on Console Applications.</li> <li>11. Implementation of Multithreading in C#</li> <li>12. Implementation of Interfaces on Console Applications.</li> </ol> <p>Note: Students will also perform all other exercises provided by course instructor.</p>			30	CO1
2	<ol style="list-style-type: none"> <li>1. Implementation of Events on Console Applications.</li> <li>2. Implementation of Properties and Indexers on Console Applications.</li> <li>3. Implement Master Form with Windows application.</li> <li>4. Implementation of Networking and Socket Programming in asp.net.</li> <li>5. Implementation of Database Connectivity in asp.Net</li> <li>6. Implementation of various Data Rendering Controls in asp.Net.</li> <li>7. Implementation of Web Services in ASP.Net Applications.</li> <li>8. Implement web application using ASP.NET with web controls.</li> <li>9. Use Dataset, Data Reader, XML Reader &amp; Data Sources (SQL, Object &amp; XML) with Any Windows or Web Application.</li> <li>10. Write a code for web application to provide input validations using Input Valuator.</li> <li>11. Create a Web application that illustrates the use of themes and master pages with Site-Map.</li> <li>12. Create a Web Application in ASP.NET using various CSS</li> </ol> <p>Note: Students will also perform all other exercises provided by course instructor.</p>			30	CO2



### Suggested Readings

1. E. Balagurusamy, "Programming. with C#", Tata McGraw Hill Publication.
2. Mark J Price, "C# 12 and .NET 8 - Modern Cross-Platform Development Fundamentals", Packt Publishing.
3. Herbert Schildt, "C# 4.0: The Complete Reference", Tata McGraw-Hill Education.
4. Joseph Albahari, Ben Albahari, "C# 5.0 in a Nutshell: The Definitive Reference", O'Reilly Media

### Online Resources

1. <https://nptel.ac.in/courses/106105151>
2. <https://nptel.ac.in/courses/106104128>

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	2	2
CO2	2	2	1		2					1		1	2	2

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>	III		
<b>Course Name</b>	Mobile Application Development Lab				
<b>Code</b>	MCAN13252				
<b>CourseType</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		0	0	4	2
<b>Course Objectives</b>	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.				
<b>Course Outcomes</b>					
<b>CO1</b>	Understand the basic concepts of Mobile application development Designing and develop mobile applications using a chosen application development framework.				
<b>CO2</b>	Develop enterprise-level mobile solutions.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<ol style="list-style-type: none"> <li>1. Creating "Hello world" Application.</li> <li>2. Creating an application that displays message based on the screen orientation.</li> <li>3. Create an application to develop Login window using UI controls.</li> <li>4. Create an application to implement new activity using explicit intent, implicit intent and content provider.</li> <li>5. Create an application that displays custom designed Opening Screen.</li> <li>6. Create an UI with all views.</li> <li>7. Create Calculator in Application</li> <li>8. Read/ write the Local data.</li> <li>9. Create an UI with all Layouts.</li> <li>10. Create a sample application with login module (check user name and password) On successful login change Text view "Login Successful". On login fail alert using Toast "login fail"</li> </ol> <p>Note: Students will also perform all other exercises provided by course instructor</p>			30	CO1
2	<ol style="list-style-type: none"> <li>1. Develop a native application that uses GPS location information.</li> <li>2. Develop an application that makes use of Notification Manager</li> <li>3. Implement an application that writes data to the SD card.</li> <li>4. Learn to deploy Android applications.</li> <li>5. Create menu in Application</li> <li>6. Create / Read / Write data with database (SQLite).</li> <li>7. To develop a Simple Android Application that makes use of Database.</li> <li>8. Create an application to send SMS and receive SMS</li> <li>9. Create an application to send an e-mail.</li> <li>10. Develop a Mobile application for simple needs (Mini Project)</li> </ol> <p>Note: Students will also perform all other exercises provided by course instructor</p>			30	CO2

**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.
5. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile App, Learn | Explore | Apply using Android", Wiley.

**Online Resources**

3. <https://archive.nptel.ac.in/courses/106/106/106106156/>
4. [https://onlinecourses.nptel.ac.in/noc20\\_cs52/preview](https://onlinecourses.nptel.ac.in/noc20_cs52/preview)

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

# **FOURTH SEMESTER**

<b>Program</b>	Master of Computer Applications				
<b>Year</b>	II	<b>Semester</b>	III		
<b>Course Name</b>	Pattern Recognition (Online)				
<b>Code</b>	MCAN14201				
<b>Course Type</b>	DSC	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Pre-Requisite</b>		4	0	0	4
<b>Course Objectives</b>	To understand basic, as well as advanced techniques of pattern classification. Statistical, nonparametric and neural network techniques for pattern recognition have been discussed. Finding and understanding patterns is crucial to mathematical thinking and problem solving.				
<b>Course Outcomes</b>					
<b>CO1</b>	To understand the meaning of intelligence and study various intelligent agents.				
<b>CO2</b>	To understand, analyze and apply AI searching algorithms in different problem domains.				
<b>CO3</b>	To study and analyze various models for knowledge representation.				
<b>CO4</b>	To understand the basic concepts of machine learning to analyze and implement neural network concepts.				
<b>Module</b>	<b>Course Contents</b>			<b>Contact Hrs.</b>	<b>Mapped CO</b>
1	<b>Introduction:</b> Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches; <b>Statistical Pattern Recognition:</b> Bayesian Decision Theory, Classifiers, Normal density and discriminates functions.			15	CO1
2	<b>Nonparametric Techniques:</b> Density Estimation, Parzen Windows, K- Nearest Neighbor Estimation, Nearest Neighbor Rule, Fuzzy classification; <b>Parameter estimation methods:</b> Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods; Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.			15	CO1
3	<b>Linear Discriminant Functions:</b> Gradient descent procedures, Perceptron, Support vector machines a brief introduction; <b>Dimensionality reduction:</b> Principal component analysis, Fisher discriminant analysis, Eigen vectors/Singular vectors as dictionaries, Factor Analysis, Dictionary learning method, Total variability space and non-negative matrix factorization;			15	CO1
4	<b>Artificial neural networks:</b> Multilayer Perceptron, Feed Forward neural network, A brief introduction to deep neural networks, Convolution neural networks, recurrent neural networks, <b>Non-metric methods for pattern classification:</b> Non numeric data or nominal data, <b>Decision trees:</b> Classification and Regression Trees (CART).			15	CO1

### Suggested Readings

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", John Wiley.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer.
3. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", Academic Press.
4. Earl Gose, Richard Johnsonbaugh, Steve, "Pattern Recognition and Image Analysis", Pearson.

**Online Resources**

1. <https://nptel.ac.in/courses/117105101>
2. <https://archive.nptel.ac.in/courses/117/105/117105101/>

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