

**Dharmsinh Desai University**

**Department of MCA**

**Syllabus**

**Dharmsinh Desai University**  
**Department of MCA**  
**Teaching Scheme : w.e.f. 2020-21 batch**

<b>Semester I</b>										
<b>Subject Code</b>	<b>Subject</b>	<b>Teaching Scheme</b>			<b>Exam Scheme</b>					<b>Credit</b>
		<b>T</b>	<b>L</b>	<b>Tut</b>	<b>S</b>	<b>T</b>	<b>P</b>	<b>TW</b>	<b>Total</b>	
MCA-101	Algorithm Development & Programming Fundamentals	4	2	0	36	60	25	25	150	5
MCA-102	DataBase Management System	4	2	0	36	60	25	25	150	5
MCA-103	Web Designing	4	2	0	36	60	25	25	150	5
MCA-104	Computer Organization and Architecture	4	0	0	36	60	0	25	125	4
MCA-105	Communication Skills	0	2	0	0	0	25	0	25	1
	<b>Elective - I</b>	4	0	0	36	60	0	0	100	4
MCA-111	Financial Management & ERP									
MCA-112	Discrete Mathematics									
MCA-113	Management Information Systems									
MCA-114	Computer Oriented Numerical & Statistical Methods									
	<b>Total</b>								<b>700</b>	<b>24</b>

<b>Semester II</b>										
<b>Subject Code</b>	<b>Subject</b>	<b>Teaching Scheme</b>			<b>Exam Scheme</b>					<b>Credit</b>
		<b>T</b>	<b>L</b>	<b>Tut</b>	<b>S</b>	<b>T</b>	<b>P</b>	<b>TW</b>	<b>Total</b>	
MCA-201	Operating system & Linux Programming	4	2	0	36	60	25	25	150	5
MCA-202	Object Oriented Programming with Java	4	2	0	36	60	25	25	150	5
MCA-203	Data Structures	4	2	0	36	60	25	25	150	5
MCA-204	Software Engineering	4	2	0	36	60	25	25	150	5
MCA-205	Seminar Presentation	0	2	0	0	0	25	0	25	1
	<b>Elective – II</b>	4	0	0	36	60	0	25	125	4
MCA-222	System Analysis Design & Management									
MCA-223	Analysis and Design of Algorithms									
MCA-224	Cyber Security and Digital Forensic									
	<b>Total</b>								<b>750</b>	<b>25</b>

Exam scheme indicates marks.

Teaching scheme indicates number of hours.

Semester III										
Subject Code	Subject	Teaching Scheme			Exam Scheme					Credit
		T	L	Tut	S	T	P	TW	Total	
MCA-301	Software Design and Testing	4	0	0	36	60	0	25	125	4
MCA-302	Web Development with PHP	4	2	0	36	60	25	25	150	5
MCA-303	Mobile Application Development	4	2	0	36	60	25	25	150	5
MCA-304	Computer Networks and Security	4	0	0	36	60	0	25	125	4
	<b>Elective – III</b>	4	2	0	36	60	25	25	150	5
MCA-331	Python Programming									
MCA-332	Advanced Web Development									
MCA-333	Cloud Computing									
MCA-334	Artificial Intelligence									
	<b>Elective – IV</b>	4	2	0	36	60	25	25	150	5
MCA-341	Applied Machine Learning									
MCA-342	ASP .Net Programming with C#									
MCA-343	Big Data Analytics									
MCA-344	Advanced Java Programming									
	<b>Total</b>								<b>850</b>	<b>28</b>

Semester IV										
Subject Code	Subject	Teaching Scheme			Exam Scheme					Credit
		T	L	Tut	S	T	P	TW	Total	
MCA-401	Project	0	40	0	0	0	400	300	700	20
	<b>Total</b>								<b>700</b>	<b>20</b>
	<b>TOTAL</b>								<b>3000</b>	<b>97</b>

Exam scheme indicates marks.

Teaching scheme indicates number of hours.

**MCA SEMESTER – I**  
**SUBJECT : ALGORITHM DEVELOPMENT AND PROGRAMMING FUNDAMENTALS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

The course is designed to provide knowledge of programming fundamentals and fundamental constructs of the C programming language. Students will be able to develop logic for creating basic C programs.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Program Development Life Cycle, Introduction to Flowchart, Symbols Used in Flowchart, Preparation of Flowchart, Advantages and Limitations of Flowchart, Development of Program Flowchart, Introduction to Pseudo Code. Introduction to Algorithm, Structured Programming Concepts.	9	CO1 CO3
[2]	Introduction, Standardizations of C Language, Structure of a Simple C Program, Concept of a Variable in C, Data Types in C, Program Statement, Declarations in C, Memory Storage of Data in Computer, C Tokens, Operators and Expressions in C, Type Conversion in C, Working with Complex Numbers, Basic Screen and Keyboard I/O in C, Non-Formatted Input and Output, Formatted Input and Output Functions. Introduction to Compiler – Linker – Preprocessor in C.	10	CO2 CO5
[3]	Specifying Test Condition for Selection and Iteration, Writing Test Expression, Conditional Execution and Selection, Iteration and Repetitive Execution, Which Loop Should be Used?, Goto Statement, Special Control Statements, Nested Loops.	10	CO2 CO3 CO5
[4]	Introduction to Array, One-Dimensional Array, Declaration of a One-dimensional Array, Initializing Arrays, Accessing Array Elements, Allowed Operations on Arrays, Internal Representation of Arrays in C, Variable Length Arrays, Working with One-dimensional Array, Strings: One-dimensional Character Arrays, Declaration of a String, String Initialization, Printing Strings, String Input, Character Manipulation in the String, String Manipulation, Introduction to Multidimensional Arrays, Declaration of a Two-dimensional Array, Declaration of a Three Dimensional Array, Initialization of a Multidimensional Array, Unsized Array Initializations, Accessing Multidimensional Arrays, Working with Two-dimensional Arrays, Understanding Array of Strings its Initialization and Manipulating.	12	CO2 CO3 CO5
[5]	Introduction to Functions, Concept of Function, Need of Functions in a Program, Function Prototype Declaration, Function Definition, Function Calling, Call by Value Mechanism, Working with Functions, Passing Arrays to Functions, Concept of Global and Local Variables, Scope Rules, Storage Classes in C, Storage Class Specifiers for Variables, Storage Class Specifiers for Functions, Linkage, Inline Function, Constant	12	CO2 CO3 CO4 CO5

	Parameters in Functions. Introduction to Recursion, Basic Needs for Implementing Recursion, Implementing Recursion, Comparing Recursion and Iteration.		
[6]	Introduction to Structures, Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Copying and Comparing Structures, typedef and its Use in Structure Declarations, Arrays of Structures and its Initialization, Structures and Functions, Union, Declaring a Union and its Members, Accessing and Initializing the Members of a Union, Structure Versus Union, Introduction to enum Datatype.	7	CO2 CO3 CO4 CO5

### C. TEXT BOOKS

1. Pradip Dey and Manas Gosh, *Programming in C*; 2nd ed.; Oxford Publication.

### D. REFERENCE BOOKS

1. V. K. Kapoor, *Introduction to Computer Data Processing and System Analysis*; Sultan Chand and Sons Publication.
2. Brian W. Kernighan and Dennis Ritchie, *C Programming Language*; 2<sup>nd</sup> ed.; Prentice Hall Publication
3. K. R. Venugopal, *Mastering C*; Tata McGraw Hill Publications.

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Develop algorithms and flowcharts for a given problem.
CO2	Apply	Demonstrate programming fundamentals.
CO3	Apply	Interpret algorithms and Pseudocode to generate computer programs in C language.
CO4	Apply	Develop modular programs for given basic problems.
CO5	Evaluate	Debug basic computer programs written in C language.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	3	3	3	3	-	2	-	2	-	3	-	2
CO2	3	2	2	1	2	-	2	-	2	-	2	-	2
CO3	1	2	2	2	1	-	2	-	2	-	2	-	2
CO4	2	2	3	2	3	-	2	-	2	-	3	-	2
CO5	2	1	2	2	2	-	2	-	2	-	1	-	2
Avg	2	2	2.4	2	2.2	-	2	-	2	-	2.2	-	2

**MCA SEMESTER – I**  
**SUBJECT : DATABASE MANAGEMENT SYSTEM**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

The purpose of this course is to provide fundamentals of database management system focusing on how to create, organize and maintain structured information in database. The course covers in-depth knowledge of Entity-Relational model, Normalization, Relational model, Relational algebra as well as essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also outlines handling of semi-structured data using NOSQL.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Database System Applications, Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, Transaction Management, Database System Structure, Application Architectures, History of Database Systems.	5	CO1
[2]	Basic Concepts, Constraints, Keys, Design Issues, Entity Relationship Diagram, Weak Entity Sets, Extended ER Features, Design of an ER Database Schema, Reduction of an ER Schema to Tables.	6	CO2
[3]	Structure of SQL Structure of Relational Databases, The Relational Algebra, Extended Relational Algebra Operations, Modification of the Database, Views, Basic Structure of Structured Query Language, the select clause, the where clause, the from clause.	8	CO2
[4]	Pitfalls in Relational Database Design, Functional Dependencies, Normalization.	6	CO2
[5]	Overview of Physical Storage Media, RAID, Storage Access, File Organization, Organization of Records in Files, Data Dictionary Storage.	4	CO1
[6]	Basic Concepts, Ordered Indices, B+ Tree Index Files, B-Tree Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Multiple Key Access.	9	CO1
[7]	Transaction Concept, Transaction State, Need for Concurrent Executions, Serializability concept, Recoverability Lock Based Protocol and Time Stamp Based Protocol, Deadlock Handling, Insert and Delete Operations Failure Classification, Storage Structure, Recovery and Atomicity, Log Based Recovery, Shadow Paging.	10	CO6
[8]	Centralized and Client Server Architectures, Parallel Systems, Distributed Systems, Network Types	2	CO1
[9]	Introduction to Procedure, Function and Trigger	5	CO3
[10]	Overview of NoSQL: Defining NoSQL, Need of NoSQL, List of NoSQL Databases Characteristics of NoSQL: Application, RDBMS approach, Challenges, NoSQL Approach, NoSQL Storage Types: Comparing the Models, Advantages and Drawbacks, Case Study using MongoDB	5	CO4

### C. TEXT BOOKS

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, *Database System Concepts* ; 4<sup>th</sup> ed ; McGraw Hill Publication
2. Joel Murach, Mike Murach & Associates , *Murach's MySQL* 3<sup>rd</sup> ed;
3. Gaurav Vaish, *Getting Started with NoSQL* ; Packt Publishing

### D. REFERENCE BOOKS

1. Carlos Coronel, Steven Morris, Peter Rob, *Database Systems : Design, Implementation and Management*; Cengage Learning
2. Ramez Elmsari, Shamkant B Navathe, *Fundamentals of Database Systems*; 7<sup>th</sup> ed ;Pearson Education
3. S K Singh, *Database Systems : Concepts, Design and Applications* ; Pearson Education
4. [www.mysqltutorial.org](http://www.mysqltutorial.org)

### E. COURSE OUTCOMES

CO Number	Skill	Statement
<b>CO1</b>	Understand	Describe building blocks and importance of database management system
<b>CO2</b>	Analyse, Evaluate	Design robust relational database for a given problem
<b>CO3</b>	Apply	Construct relational database for a given problem
<b>CO4</b>	Apply	Demonstrate usage of procedural language in relational database environment.
<b>CO5</b>	Apply	Demonstrate basic operations in NoSQL environment.
<b>CO6</b>	Analyse, Apply	Implement transaction management and concurrency control.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
<b>CO1</b>	3	-	-	-	-	-	2	-	-	-	-	-	3
<b>CO2</b>	2	3	3	3	3	-	3	-	-	-	3	-	1
<b>CO3</b>	2	3	3	3	3	-	3	-	-	-	3	-	1
<b>CO4</b>	2	3	3	2	3	-	2	-	-	-	3	-	1
<b>CO5</b>	2	2	2	2	3	-	2	-	-	-	3	-	3
<b>CO6</b>	2	2	1	2	-	-	2	-	-	-	-	-	3
<b>Avg</b>	2.1	2.1	2	2	2	-	2.3	-	-	-	2	-	2

**MCA SEMESTER – I**  
**SUBJECT : WEB DESIGNING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

The course helps in creating effective web pages, including in-depth consideration of information architecture using HTML5, CSS and Javascript. Use various CSS layouts and models for responsive web design. Develop basic programming skills using Javascript for writing dynamic pages.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Internet - WWW, Understanding the URLs, Introduction to HTML, History of HTML, Understanding Basic Structure of HTML Document, Basic Structure Elements of HTML Document, Introduction to Web Technologies.	4	CO1 CO2
[2]	Working with <Head> Section and its Elements – Title, Meta, Link, Base, Style, Script, Isindex. Working with <Body> Section and its Elements – Block-Level Elements, Basic Text-Level Elements, Font-Style Elements, Phrase Elements, Marking Elements, Linking Element [<a/>], Image Element [<img>], Basic Table Element.	8	CO1 CO2 CO3 CO5
[3]	Introduction to HTML5, Understanding Basic Structure of HTML5 Document, Strict and Loose Type HTML5 Document, Validating HTML Document, Understanding DOCTYPE Element, Root Elements, Metadata Elements, Section Elements, Heading Elements, Introduction to Flow Elements, Introduction to Phrasing Elements, Introduction to Embedded Elements, Introduction to Interactive Elements.	10	CO1 CO2 CO5
[4]	Text Formatting with Physical Style Elements, Text Formatting with Logical Style Elements, Character Entities in HTML5, PRE Element, DIV Element, SPAN Element, Tables Element, Lists, Hyperlinks.	8	CO1 CO2 CO5
[5]	Inserting Image in a Web Page, Image Map, Introduction to Canvas, Exploring FORM Element, Observing Various INPUT Elements, Button Element, Progress Element, Meter Element, Output Element, Datalist Element, Textarea Element, Label Element, Select Element, Option Element, Optgroup Element, Submitting a Form, Details and Summary Element, Menu Element, Command Element, Time Element, KBD Element, Video Element, Audio Element, Embed Element, Object Element, Figure and Figcaption Element.	10	CO1 CO2 CO3 CO4 CO5
[6]	Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Exploring Background of Webpage using CSS, Exploring Font Properties in CSS, Controlling the Display of an Element using CSS, Positioning of Element using CSS, Floating and Element using CSS Exploring Different Model in CSS – Box Model, Line Box Model, Template Layout Model, Multi- Column Model.	10	CO1 CO3 CO5



[7]	Introduction to Java Scripting and <script>, Client-Side JavaScript, Advantages of JavaScript, Limitations of JavaScript, Placement of Script, JavaScript Datatypes, JavaScript Variables, JavaScript Variable Scope, JavaScript Variable Names, JavaScript Reserved Words, Operators in JS, Control Statements in JAVASCRIPT, Introduction to Java Script Functions, Introduction to Java Script Events, Introduction to Java Script Built-in Objects, Localization in HTML Document via JS and CSS.	10	CO1 CO2 CO3 CO4 CO5
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### C. TEXT BOOKS

1. DT Editorial Service, *HTML 5 Black Book*; 2nd ed.; Dreamtech Press Publication

### D. REFERENCE BOOKS

1. Will Train, *HTML 4.0*; BPB Publication.
2. Rob Crowther, Joe Lennon, Ash Blue and Greg Wanish, *HTML5 in Action*; Manning Publication
3. Mark Pilgrim, *HTML5 Up and Running - Dive into the Future of Web Development*; 5<sup>th</sup> ed.; O'Reilly Media Publication

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Express importance of consistent and robust web design.
CO2	Apply	Design and develop web pages using HTML5 and JavaScript.
CO3	Apply	Develop consistent, attractive and animated web pages using CSS.
CO4	Apply	Validate user input in web pages using HTML5 and Javascript.
CO5	Apply	Create interactive web sites individually and in teams.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	1	2	2	1	-	1	-	1	-	1	-	2
CO2	3	2	3	2	3	-	3	-	3	3	2	-	2
CO3	1	2	3	2	3	-	3	-	2	3	2	-	2
CO4	2	2	1	2	2	-	2	-	2	2	2	-	2
CO5	3	3	3	2	3	-	1	-	2	2	3	-	2
Avg	2.4	2	2.4	2	2.4	-	2	-	2	2	2	-	2

**MCA SEMESTER – I**  
**SUBJECT : COMPUTER ORGANIZATION AND ARCHITECTURE**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	0	4	4	60	40	25	0	125

### A. COURSE OVERVIEW

This course is intended to teach the basics involved in data representation and digital logic circuits used in the computer system. It covers the general concepts of digital logic design, including logic elements, and their use in combinational and sequential logic circuit design. Provide insights in basic architecture of processing, memory and i/o organization in a computer system.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Generation of Computers, Analog and Digital Computer, Block Diagram of Computer, Positive and Negative Numbers, Integers and Reals, Number Systems: Binary, Octal, Decimal and Hexadecimal, Binary Addition, Subtraction, Multiplication and Division, r's and (r-1)'s Complement, Conversion from One System to Another, Characters and Codes ASCII, EBCDIC, UNICODE, Redundant Coding for Error Detection and Correction (Parity and Hamming Code)	9	CO1 CO2
[2]	Basic Gates & its Truth Tables, Boolean Algebra: Fundamental Concepts, Basic Theorem and Properties, Boolean Functions Canonical and Standard Forms, Sum of Product, Product of Sum, K-map Method, Don't Care Condition, Combination Circuit Design with Gates, Universal Gates Functionality.	11	CO1 CO3 CO4
[3]	Block Diagram of ALU, Binary Half and Full Adder, Decimal Adder, Binary Parallel Adder, BCD Adder, Half and Full Subtractor.	6	CO1 CO3 CO4
[4]	Encoder, Decoder, Multiplexer, Demultiplexer.	5	CO3 CO4
[5]	Flip Flops: RS, D, T, JK, Asynchronous, Synchronous and Master Slave, Shift Registers, Bidirectional Shift Register with Parallel Load Counters: Synchronous and Ripple Counter, Simple Arithmetic and logic Circuits.	10	CO3 CO4
[6]	Memory Hierarchy, Random Access Memory, Read Only Memory, Serial Access Memory, Direct Access Memory, Cache Memory and Overview of Virtual Memory and Auxiliary Memory.	6	CO5
[7]	Introduction to 8085 Microprocessor, 8085 Hardware Model, Programmable Registers, Instruction Format, Addressing Modes-Direct, Indirect, Immediate, Relative, Indexed, Addressing Formats: Zero, Single, Double, Register etc., Instruction Set, Instruction Execution, Fetch and Execution Cycles, Micro-Programming Concept.	7	CO1 CO5
[8]	Peripheral Devices, Properties of Simple I/O Devices and Their Controllers, Asynchronous Data Transfer, Handshaking, Data Transfer Modes, Programmed I/O, Interrupted I/O, DMA, Transfer of Information between I/O Devices, CPU and Memory.	6	CO5

### C. TEXT BOOKS

1. M. Morris Mano, *Digital Logic and Computer Design*; 2nd ed.; PHI
2. Ramesh S. Gaonkar, *Microprocessor Architecture, Programming and Applications with 8085*; 4th Ed.; Penram International Publishing PVT. LTD.

### D. REFERENCE BOOKS

1. M Morris Mano, *Computer System Architecture*; 3rd ed.; PHI
2. William Stallings, *Computer Organization and Architecture*; 6th ed.; PHI
3. Andrew S Tanenbaum, *Structure Computer Organization* ; 4th ed.; Pearson Education

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe role of various elements of computer organization and architecture.
CO2	Apply	Use various number systems for representation of data.
CO3	Apply	Derive boolean expression and digital circuit from a given logic design problem.
CO4	Understand	Interpret combinational and sequential logic circuit design.
CO5	Understand	Explain microprocessor architecture, I/O architecture and memory hierarchy.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	-	-	1	1	-	2	-	1	-	-	-	3
CO2	2	3	-	2	3	-	2	-	3	-	-	-	2
CO3	2	3	-	3	3	-	2	-	3	-	-	-	2
CO4	2	2	-	3	3	-	2	-	2	-	-	-	2
CO5	2	2	-	1	-	-	2	-	1	-	-	-	1
Avg	2	2	-	2	2	-	2	-	2	-	-	-	2

**MCA SEMESTER – I**  
**SUBJECT : Communication Skills**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme			
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac
-	-	2	2	1	-	-	-	25

### A. COURSE OVERVIEW

The course is intended to familiarize students with the basics of English language and help them to learn to identify language structures for correct English usage. To enable the students to adopt strategies for effective reading and writing skills. It helps students to carry out day to day communication at the work place by adequate understanding of various types of communication to facilitate efficient interpersonal communication.

### B. COURSE CONTENT

NO	TOPIC	Practical	COs
[1]	Concord, Tenses, Impersonal Passive Voice, Conditional Sentences, Conjunctions and Prepositions, Idioms.	4	CO1
[2]	Nature and Scope, Communication Networks, Supervisor and Employee Communication, Organizational Structure, Lack of Trust, Un-ethical Communication. Non-verbal Communication: Significance and Forms, Elements of Non-verbal Communication. Cross-cultural Communication: Concept, Different Communication Styles and Strategies. Technology-enabled Business Communication: Tools, Impact, Effectiveness. Case Study.	6	CO2 CO3
[3]	Business Messages: Importance, Types, Approaches, Stages. Business Letter Writing: Principles and Components, Kinds of Business Letters Instructions: Written Instructions, Format, Audience Analysis, Characteristics Business Reports: Kinds, Characteristics, Parts, Elements, Steps Proposals: Types, Components, Format, Proposal Layout and Design Resume: Format, Types, Video Resumes, Send Resumes, Online Recruitment: Process and Techniques.	8	CO3 CO5
[4]	Interviews: Principles, General Preparations, Follow up, Questions Group Discussion: Planning and Preparation, Steps.	6	CO4 CO5

### C. TEXT BOOKS

1. Meenakshi Raman and Prakash Singh, *Business Communication*; Oxford University Press
2. Meenakshi Raman and Sangeeta Sharma, *Technical Communication*; Oxford University Press

#### D. REFERENCE BOOKS

1. Sangeeta Sharma & Vinod Mishra , *Communication Skills for Engineers and Scientists*; PHI
2. William Sanborn Pfeiffer and T. V. S. Padmaja, *Technical Communication*; Pearson

#### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Effective use of tenses and Conditional Sentences for academic writing
CO2	Analyze	Identify Various Means of Professional Communication
CO3	Apply	Practice Effective Business Writing and Correspondence
CO4	Apply	Exercise Interviews and Group Discussion Practices
CO5	Apply	Understanding Professional Environment and Being Competent

#### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	2	2	2	3	2	-	-	1	3	-	-	2
CO2	2	2	2	2	3	2	-	-	3	3	2	-	2
CO3	2	2	2	3	2	2	-	-	2	3	2	-	2
CO4	2	2	2	2	2	2	-	-	3	3	2	-	2
CO5	2	2	2	1	1	2	-	-	3	3	2	-	2
Avg	2	2	2	2	2.2	2	-	-	2.4	3	2	-	2

**MCA SEMESTER – I**  
**SUBJECT: FINANCIAL MANAGEMENT & ERP**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	-	-	100

**A. COURSE OVERVIEW**

The course helps learners to understand accounting principles, recording, classifying, summarizing transactions, preparing financial statements such as Trial balance, Balance Sheet, Income statements and Cash flow statements. It provides overview of ERP - Automated approach for Financial Planning and Management.

**B. COURSE CONTENT**

NO	TOPIC	L+T (hrs)	COs
[1]	Definition, Objective & Scope, Concepts, Principals and Convictions in Accountancy, Advantages, Disadvantages, Meaning of an Account, Classification of an Accounts, Rules of Debit and Credit.	13	CO1
[2]	Passing of Entries in Books of Accounts – Trial Balance –Final Accounts – Current Assets – Current Liabilities – Other liabilities – Owner Equities – Trading Account – Record and Systems – Control Accounts and Subsidiary Ledgers –Limitations of Profit & Loss Account & Balance Sheet.	18	CO1 CO2
[3]	Use of Ratios in Interpreting Financial Statements – Limitations – Other Methods of Evaluation	9	CO2
[4]	Evolution of ERP, What is ERP?, Reason for the Growth of the ERP Market, Advantages of ERP, Why do many ERP Implementations Fail?, Why are ERP Packages being used now? Finance Sales and Distribution, Manufacturing Human Resources, Plant Maintenance, Quality Management, Purchasing, Marketing, Production Planning, Materials Management. Benefits of ERP: Reduction of Lead Time, On Time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Utilization, Improved Supplier Performance.	12	CO3 CO4
[5]	Pre Evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering Configuration, Implementation Team Training, Testing, Going Live, End-User Training, Post Implementation.	8	CO5

**C. TEXT BOOKS**

1. Rana T. J., *Financial Accounting & Management*; B.S. Shah Pub.
2. P. C. Tulsyn, *Financial Accounting*
3. Shukla M.C. & Grawal T.S., *Advanced Accounts*; Chand Pub.
4. R. L. Gupta, *Advanced Accounts*; Sultan Chand Publication
5. Alexis Leon, *Enterprise Resource Planning*; Tata McGraw Hill

#### D. REFERENCE BOOKS

1. Luvai F. Motiwalla, Jeff Thompson, *Enterprise Systems for Management* ; PHI
2. Alexis Leon, *ERP Demystified*; 2nd ed.; McGraw-Hill Education (India) Ltd., 2007

#### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Express elements of accounting and various business transactions.
CO2	Apply, Analyse	Prepare various accounting statements.
CO3	Understand	Describe steps and activities in the ERP life cycle.
CO4	Understand	Classify various functionalities of ERP system.

#### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	3	-	-	-	2	2	2	-	-	-	-	2
CO2	3	3	-	-	-	2	2	2	-	-	-	-	3
CO3	2	-	-	-	-	2	2	2	-	-	-	-	2
CO4	1	2	-	-	-	2	2	2	-	-	-	-	2
Avg	2	2	-	-	-	2	2	2	-	-	-	-	2.2

**MCA SEMESTER – I**  
**SUBJECT: DISCRETE MATHEMATICS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	-	-	100

### A. COURSE OVERVIEW

This course focuses on fundamental concepts of discrete mathematics and its applications in computer science. Topics include logic, sets theory, probability, relation & functions, graph theory and group theory. It will help the learners to think logically for solving mathematical problem.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Definition of Sets, Venn Diagrams, Types of set, Finite, Infinite, Power, Countable and Uncountable Sets, Operations on Sets, Mathematical Induction, Principles of Inclusion and Exclusion, Propositions, Tautology and Contradiction	10	CO1 CO2
[2]	Rules of Sums and Products, Permutations, Permutation with Repetition of Objects, Restricted Permutation, Circular Permutation, Combinations, Restricted Combinations, Combinations with Repetition, Difference between Permutation and Combination. Probability: Important Definition, Theorems, Conditional Probability.	10	CO4
[3]	Relation: Definition, Domain and Range of Relation, Kinds of Relation, Types of Relation, Composition of Relations, Partial Ordering and Equivalent Relation Functions: Definition and Types of Functions, Composition of functions, Inverse of a Function and Pigeon-hole Principle.	12	CO3
[4]	Basic Terminology, Multi- and Weighted Graphs, Paths, Circuits, Eulerian Path, Traveling Salesman Problem, Isomorphic Graphs, Factors of a Graph, Planar Graphs, Operations on a Graph Trees, Rooted Trees, Path Length, Prefix Codes: Generation , Application, Spanning Trees, Transport Networks Using Ford-Fulkerson	14	CO5
[5]	Groups and Sub-Groups, Evaluation of Powers, Cosets, Lagrange's Theorem, Permutation Group and Burnside's Theorem, Group, Codes, Isomorphism, Automorphism, Homomorphism, Normal Subgroups, Rings, Integral Domains and Fields, Rings.	14	CO1

### C. TEXT BOOKS

1. S. K. Chakraborty and B. K. Sarkar, *Discrete Mathematics*; Oxford University Press
2. Rosen K. H., *Discrete Mathematics and its Applications*; 7th ed.; Tata McGraw-Hill Pub. Co. Ltd.

### D. REFERENCE BOOKS

1. Birkoff and Bartee, *Modern Applied Algebra*; McGraw-Hill, CBS



2. Stephen A. Wiitala., *Discrete Mathematics A Unified Approach*; Computer Science Series, McGraw-Hill

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand fundamentals of set theory and group theory.
CO2	Apply	Interpret propositions for given truth value.
CO3	Understand	Compare usage of relations and functions.
CO4	Apply	Solve relevant given problems using counting techniques.
CO5	Apply	Use graph theory for solving relevant mathematical problems.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	-	2	-	-	-	3	-	-	-	-	-	2
CO2	2	-	2	-	-	-	-	-	-	-	-	-	3
CO3	3	-	2	-	-	-	1	-	-	-	-	-	2
CO4	-	-	2	-	-	-	3	-	-	-	-	-	3
CO5	2	-	2	-	-	-	3	-	-	-	-	-	1
Avg	2	-	2	-	-	-	2	-	-	-	-	-	2.2

**MCA SEMESTER – I**  
**SUBJECT: MANAGEMENT INFORMATION SYSTEMS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	-	-	100

### A. COURSE OVERVIEW

The course is intended to describe the role of information systems in business management. It covers the fundamentals of decision support systems and Enterprise Systems including E-commerce for business and explain the ethical and societal issues related to information systems.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Organizations and Information Systems, Impact of Information Systems on Organizations and Business Firms, Using Information Systems to Achieve Competitive Advantage Management Information System in a Digital Firm: Concept, Definition, Role of MIS, Impact of MIS, MIS and User, MIS as a Control System, MIS A Support to the Management, Management Effectiveness and MIS, Organization as System.	10	CO1
[2]	Introduction, Infrastructure Components, Contemporary Hardware Platform Trends, Management Issues, Dealing with Platform and Infrastructure Change, Management and Governance, Making Wise Infrastructure Investments Development of Long Range Plans of the MIS, Ascertaining the Class of Information, Determining the Information Requirement, Development and Implementation of MIS, Management of the Information Quality in the MIS, Organisation for Development of MIS, MIS: Development Process Model	9	CO1 CO2
[3]	Applications in Manufacturing Sector: Personnel Management, Financial Management, Production Management, Raw Materials Management, Marketing Management, Corporate Overview Applications in Service Sector: Introduction, Creating a Distinctive Service, Service Concept, Service Process Cycle and Analysis, Customer Service Design, Service Management System, MIS Applications in Service Industry.	10	CO1 CO3
[4]	Concept of Decision Support Systems (DSS), DSS Models, Group Decision Support Systems, AI System, Knowledge based Expert System, DSS Application in E-enterprise, MIS and the Benefits of DSS.	10	CO1
[5]	Enterprise Systems, Enterprise Software and Business Value, Supply Chain Management Systems and its Applications, Global Supply Chains and Internet, Business Value of Supply Chain Management Systems E-Commerce: E-Commerce and the Internet, E-Commerce: Business and Technology, The Mobile Digital Platform and Mobile E-Commerce, Building an E-Commerce Web Site.	10	CO1 CO5
[6]	Understanding Ethical and Social Issues Related to Systems, Ethics in an Information Society, The Moral Dimensions Of Information Systems.	5	CO4
[7]	Case Studies Relevant to the Topics.	6	CO1 CO2

			CO3 CO4 CO5
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### C. TEXT BOOKS

1. Waman S. Jawadekar, *Management Information Systems Texts and Cases*; 5th ed.; Tata McGrawHill Education Pvt. Ltd.
2. Kenneth C Laudon and Jane P Laudon, *Management Information System*; 12th ed.; PHI, New Delhi.

### D. REFERENCE BOOKS

1. S. Sadagopan, *Management Information Systems* ; PHI, New Delhi
2. Sanjay Mahapatra, *Cases in Management Information Systems*; PHI, New Delhi
3. Uma G. Gupta, *Management Information Systems*; Galgotia Publications

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Interpret the Role and Applications of Information Systems in Business Management.
CO2	Understand	Express Relationships Between Information Systems, Organization, Management and Strategy.
CO3	Understand	Explain the importance of information quality and the development process of MIS.
CO4	Understand	Summarize ethical aspects of the information system in professional practices and social issues.
CO5	Evaluate	Evaluate the applicability of relevant IT infrastructure in management of various business processes.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	3	2	-	-	2	2	2	-	2	-	-	2
CO2	2	2	2	-	-	2	2	1	-	2	-	-	2
CO3	2	1	2	-	-	2	2	3	-	2	-	-	2
CO4	1	2	2	-	-	3	2	1	-	2	-	-	2
CO5	3	2	2	-	-	1	2	3	-	2	-	-	2
Avg	2	2	2	-	-	2	2	2	-	2	-	-	2

**MCA SEMESTER – I**  
**SUBJECT: COMPUTER ORIENTED NUMERICAL & STATISTICAL METHODS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	-	-	100

### A. COURSE OVERVIEW

The course is intended to make the learner understand and use various concepts of numerical and statistical methods for solving relevant real life problems. It enables the learner to gain fundamentals of probability distributions, testing of hypotheses. It makes the learner solve numerical integration, algebraic/transcendental, ordinary differential equations and interpolation function.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction & Scope of Statistics, Scales of Measurements, Collection of data, Functions and Limitations of Statistics, Frequency Distribution (F.D.), Graphical Presentation of F.D. Arithmetic Mean, Properties of Arithmetic Mean, Weighted A.M, Geometric Mean, Harmonic Mean, Relation between A.M, G.M, H.M., Median, Quartiles, Deciles, Percentiles, and Mode.	9	CO1 CO2
[2]	Range (IQR, Q.D, Coefficient of Q.D), Mean Deviation, Standard Deviation, Coefficient of Variation, Combined mean and Standard Deviation, Coefficient of Skewness : Karlpearson's & Bowley's.	7	CO1
[3]	Introduction Probability, Addition Theorem – Examples, Multiplication Theorem – Examples, Conditional Probability Examples, Bayes theorem Examples, Mathematical Expectation Example, Probability Distribution Function. Discrete Probability Distribution, Bernoulli/Binomial Distribution and Fitting of Binomial Distribution, Poisson Distribution & Fitting of Poisson Distribution, Continuous Probability Distribution, Normal Distribution & Fitting of Normal Distribution, Multinomial Distribution.	11	CO3
[4]	Random Sampling, Test of Hypothesis (except Testing the Significance of an Observed Correlation Coefficient). Test of Significance of Attributes, Test of Significance of Variables for Large Samples and Small Samples. t-Test, Chi-Square Test, F (Variance Ratio) Test, ANOVA Technique.	13	CO4
[5]	Solution of Algebraic and Transcendental Equations: Bisection, False-Position, Newton-Raphson Methods Numerical Solution of Ordinary Differential Equations: Euler's Methods and Runge-Kutta (2nd and 4th) Methods.	9	CO5
[6]	Polynomial interpolation, difference tables, Newton forward and backward Interpolation formula, Extrapolation, Divided Differences, Lagranges formula, Newton's Divided Difference Formula, Inverse Interpolation. Trapezoidal rule, Simpson's 1/3 and 3/8 Rules.	11	CO5

### C. TEXT BOOKS

1. S S Sastry, *Introductory Methods of Numerical Analysis*; 4<sup>th</sup> ed.; PHI Learning Pvt. Ltd.
2. S. P. Gupta, *Statistical Methods*; Sultan Chand & Sons

### D. REFERENCE BOOKS

1. Bobby Srinivasan & C.L. Sandblom , *Quantitative Analysis for Business Decisions* ; 1<sup>st</sup> ed.; McGraw Hill.
2. Manish Goyal, *Computer Based Numerical and Statistical Methods*; Laxmi Publications (P) Ltd.
3. V. Rajaraman, *Computer Oriented Numerical Methods*; 3rd ed.; PHI Publication

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Calculate various measures of central tendency.
CO2	Apply	Sketch suitable curve fitting for given data.
CO3	Apply	Interpret various probability distributions.
CO4	Analyse	Identify suitable Test for a given hypothesis.
CO5	Understand	Describe the role of interpolation and integration.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	3	-	3	-	1	-	-	-	-	-	2
CO2	2	2	1	-	3	-	1	-	-	-	-	-	2
CO3	3	2	2	-	2	-	3	-	-	-	-	-	2
CO4	-	2	3	-	1	-	3	-	-	-	-	-	2
CO5	2	2	1	-	1	-	2	-	-	-	-	-	2
Avg	2	2	2	-	2	-	2	-	-	-	-	-	2

**MCA SEMESTER – II**  
**SUBJECT : OPERATING SYSTEM AND LINUX PROGRAMMING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course explains building blocks of operating system such as process management, memory management, deadlock management and disk scheduling. The course covers usage of system calls for process, file and memory management. It illustrates basics of file handling commands and shell scripts.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Basic Elements, Processor Registers, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory Operating System: Introduction, Objectives, Functions, Evolution, Major Achievements, Characteristics of Modern Operating System.	8	CO1
[2]	Process Concept, Process States, Process Control, System Calls for Process Management (fork, wait), Process Scheduling: Types and Algorithms, Introduction to Threads Principles of Concurrency, Semaphores, Monitors, Reader/Writer Problem Deadlock: Introduction, Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection.	18	CO2 CO3 CO4
[3]	Memory Management Requirements, Memory Partitioning, Paging, Segmentation, System Calls for Memory Management(shmget, shmat, shmdt, shmctl), Hardware and Control Structures, Virtual Memory, Operating System Software.	15	CO2 CO4
[4]	Overview, Disk Scheduling, Redundant Array of Independent Disks File Management Overview, File Organization and Access, System Calls for File Management (open, close, read, write, lseek).	10	CO2 CO4
[5]	Basic commands: who, whoami, man, ps, pwd, echo Directory Handling Command: cd, mkdir, rmdir File Handling Command: cat, cp, mv, rm, wc Shell Script: read Command, Command Line Arguments, if, case, expr (arithmetic operation), while Loop, for Loop.	9	CO5

### C. TEXT BOOKS

1. William Stalling, *Operating Systems: Internals and Design Principles*; 6th ed.; Prentice Hall India
2. Sumitabha Das, *UNIX- Concepts and applications*; 4th ed.; TMH Publication

## D. REFERENCE BOOKS

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, *Operating System Principles*; 9<sup>th</sup> ed.; Wiley-Indian
2. A. S. Tanenbaum, *Modern Operating Systems*; 4th ed.; PHI
3. Yashvant P. Kanetkar , *Unix Shell Programming*; BPB publication

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Express significance of the operating system and its various building blocks.
CO2	Analyze	Contrast various algorithms for process scheduling, memory management and disk scheduling.
CO3	Apply	Justify the importance of concurrency control and deadlock management.
CO4	Apply	Experiment basic management of processes, files and memory using Linux system calls.
CO5	Apply	Implement various shell scripts for file management, user management and privilege management.

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	-	-	-	-	-	2	-	-	-	1	-	2
CO2	2	3	3	2	-	-	3	-	-	-	2	-	2
CO3	3	3	1	2	-	-	2	-	-	-	1	-	2
CO4	2	3	3	3	-	-	2	-	-	-	3	-	2
CO5	1	2	3	3	-	-	1	-	-	-	3	-	2
Avg	2.2	2.2	2	2	-	-	2	-	-	-	2	-	2

**MCA SEMESTER – II**  
**SUBJECT : OBJECT ORIENTED PROGRAMMING WITH JAVA**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course provides the basic concepts and fundamentals of platform independent object oriented programming language. Provides hands-on experience in writing, compiling, and executing Java programs. Enables to build cross platform robust applications.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Object Oriented Paradigm, Concepts of Object Oriented Programming (OOP): Object and Class, Encapsulation, Data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Message Communication, Benefits of OOP, Applications of OOP .	5	CO1 CO2
[2]	History of Java, Salient features of Java, How Java Differs from C, Java and Internet, Java and World Wide Web, Java Development Kit, Using JDK's Command-line tools, Application Programming Interface. A Simple Java Program, Identifying a Class, Using predefined classes, Defining your own Class, Object Construction, Access Specifiers, Data types, Variables and Constants, Operators, Strings & String Buffer, Input & Output, Control Flow, Arrays, Conversions, Static Fields & Methods, Constructors, Packages, Documentation Comments.	9	CO1 CO2
[3]	Classes, Super Classes & Subclasses, Object – The Universal Superclass, Wrapper Classes, Reflection, Enumeration Classes, Inner Classes, the Interface Concept, Properties of Interfaces, Interfaces and Abstract Classes, Static and Private Methods, Default Methods, Interfaces and Callbacks, Object Cloning, The Comparator Interface.	10	CO1 CO2
[4]	Java Collection Framework: Separating Collection Interfaces and Implementation, Collection Interface, Iterators, Generic Utility Methods, Interfaces in the Collections Framework Concrete Collections: ArrayList, Linkedlist, Hashset, Tree Sets, Queues Lambda Expression: Why Lambdas?, Syntax Of Lambda Expression, Functional Interfaces, Method References, Constructor References, Variable Scope, Processing Lambda Expressions.	10	CO2 CO3 CO4
[5]	Classification of Exceptions, Exception Handling Techniques, User Define Exception, The Finally Clause, Thread Basics, Thread States, Thread Properties, Implementation of Thread Class and Runnable Interface, Thread Synchronization.	8	CO2 CO4
[6]	Applets Basics, Building and Running Applets, Working with Graphics Class, Inter-Applet Communication, Creating Frame, Frame Properties, The Delegation Event Model, Basics of Event Handling, Specifying Listeners Concisely, The AWT Event Hierarchy, Implementation of Click Event.	5	CO2 CO4 CO6
[7]	Streams, Text Input and Output, Reading Writing Binary Data, Object	8	CO4



	Streams and Serialization, Zip Archives, String Tokenizer, Working With Files, JDBC Architecture, Basic JDBC Programming Concepts (Making Connection, Creating Statement and Executing Query), Classes of Java.sql.		CO5 CO6
[8]	Introduction to Networking, Introduction to Client/Server Programming, Introduction to Socket Programming.	5	CO4 CO6

### C. TEXT BOOKS

1. Cays Horstmann, Gary Cornell, *Core Java volume I & II*; 11th ed.; Pearson Education
2. Herbert Schildt, *The Complete Reference JAVA 2*; 11th ed.; Tata McGraw Hill
3. E Balagurusamy, *Programming with Java*; Tata McGraw Hill

### D. REFERENCE BOOKS

1. Y. Danial Liang, *Introduction to Java Programming*; Pearson
2. Rajkumar Buyya, *Object Oriented Programming with Java*; Tata McGraw Hill

### E. COURSE OUTCOMES

(Minimum 5 Cos are required)

CO Number	Skill	Statement
CO1	Apply	Demonstrate object-oriented principles using Java Programming language.
CO2	Understand	Explain the importance of multithreading for performance centric object oriented application development in Java.
CO3	Analyse	Determine suitable data structures from Collection Framework for solving given problems.
CO4	Apply	Develop robust and database centric applications using Java.
CO5	Apply	Implement file handling and file management in Java.
CO6	Apply	Illustrate basic Interactive application development using Java.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	1	1	1	3	-	3	2	-	2	2	-	2
CO2	2	2	1	2	2	-	3	1	-	2	1	-	2
CO3	2	3	3	2	3	-	2	1	-	-	3	-	2
CO4	3	3	3	3	2	-	3	3	-	3	3	-	2
CO5	2	3	2	3	3	-	2	3	-	2	3	-	2
CO6	2	2	2	2	2	-	1	2	-	3	3	-	2
Avg	2.3	2.3	2	2.16	2.5	-	2.3	2	-	2	2.5	0	2

**MCA SEMESTER – II**  
**SUBJECT : DATA STRUCTURES**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course provides basic concepts, importance and applications of various data structures such as array, stack, queue, linked list, tree, and graph. Enables to implement various data structures efficiently. The subject enables examine working of various sorting and searching techniques. Provides awareness in algorithm analysis and dynamic memory management.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Pointers, Understanding Memory Addresses, Address Operator (&), Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Void Pointer, Null Pointer, Use of Pointers, One-dimensional Arrays and Pointers, Passing an Array to a Function, Differences Between Array Name and Pointer, Pointers and Strings, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointers To an Array, Two-dimensional Arrays and Pointers, Passing Two dimensional Array to a Function. Introduction to Dynamic Memory Allocation, Dynamic Allocation of Arrays, Freeing Memory, Reallocating Memory Blocks, Memory Leak and Memory Corruption, Pointer to Constant, Constant Pointers.	11	CO1 CO2
[2]	Data Structures, Classification of Data Structures, Operations of Data Structures, Define Abstract Data Types. Introduction to Algorithms, Approaches of Designing an Algorithm, Control Structures used in Algorithms, Understanding Basics of Time Complexity, Introduction to Asymptotic Notation, Rate of Growth in Algorithm, Basics of Storage Management.	4	CO1 CO3
[3]	Introduction to Stack, Applications of Stack, Representation of Stack using Array, Implementation of Operations on Stack Using Array, Implementation of Applications of Stack. Introduction to Queue, Applications of Queue, Representation of Queue using Array, Implementation of Queue Operations, Understanding Circular Queue. Introduction to Priority Queue and its Operations, Introduction to Dqueue and its Operation.	12	CO1 CO2 CO5
[4]	Introduction to Singly Linked List, Representation of Singly Linked List using Array and Pointer, Implementing Operations on Singly Linked List – Insertion as a First Node, Head Node, Insertion as a Last Node, Insertion of a Node at Specific Location, Deletion of First Node, Deletion of Last Node, Deletion of a Desired Node, Searching for the Particular Element in List, Sorting the Linked List, Reversing the Linked List, Traversing a Linked List. Introduction to Doubly Linked List, Representation of Doubly Linked List, Implementing Operations of Doubly Linked List – Insertion as a	14	CO1 CO2 CO5

	First Node, Insertion as a Last Node, Insertion of a Node at Specific Location, Deletion of First Node, Deletion of Last Node, Deletion of a Desired Node, Searching for the Particular Element in Doubly Linked List, Sorting the Doubly Linked List, Traversing a Linked List. Introduction to Circular Linked List, Representation of Circular Linked List, Implementing Operation of Circular Linked List – Inserting and Deleting a Node in Circular Linked List, Traversing a Circular Linked List Implementing Stack and Queue Operations using Singly Linked List.		
[5]	Definition of Tree, Representation of Tree, Basic Terminology of Tree, Types of Tree. Binary Tree, Types of Binary Tree, Conversion of General Tree to a Binary Tree, Understanding and Implementing Binary Tree Traversal, Constructing a Binary Tree from Traversal Results, Storage Representation and Manipulation of Binary Tree, Applications of Tree. Binary Search Trees, Operations on Binary Search Trees – Searching for a Node in a Binary Search Tree, Inserting a New Node in a Binary Search Tree, Deleting a Node from a Binary Search Tree, Determining the Height of a Binary Search Tree, Determining the Number of Nodes, Finding the Smallest Node in a Binary Search Tree, Finding the Largest Node in a Binary Search Tree, Traversal and Search in Binary Search Tree, Implementation of Basic Operation in Binary Search Tree, Representation of AVL Tree, Understanding Insertion and Deletion in AVL Tree, Determining Height in an AVL Tree. Definition of Graph, Representation of Graphs, Types of Graph, Graph Traversal, Graph Traversal and Spanning Forest, Minimum Spanning Tree, Finding the Shortest Path.	14	CO1 CO2 CO5
[6]	Linear Search, Binary Search Sorting Methods, Internal and External Sorting, Bubble Sort, Quick Sort, Merge Sort, Insertion Sort.	5	CO1 CO4 CO5

### C. TEXT BOOKS

1. Reema Thereja, *Data Structures Using C*; 2nd ed.; Oxford University Press.
2. R. B. Patel, *Expert Data Structures with C*

### D. REFERENCE BOOKS

1. Sanjay Pahuja, *A Practical Approach to Data Structures and Algorithms*; New Age International Publishers
2. Y. Langsam, M. J. Augenstein, A. M. Tenenbaum, *Data structures using C and C++*
3. Yashvant Kanetkar, *Pointers in C*; BPB Publications.
4. Yashvant Kanetkar, *Data Structures Through C*; BPB Publications.
5. Jean-Paul Trembley and Paul G. Sorenson, *An Introduction to Data Structures with Applications*; 2nd ed.; Tata McGraw Hill Publications.

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Analyse	Determine suitable data structure to solve given societal problems
CO2	Apply	Exercise dynamic memory management using C language.
CO3	Analyse	Analyse efficiency of given algorithms on present and futuristic applications.
CO4	Analyse	Compare various searching and sorting algorithms.
CO5	Evaluate	Develop computing solutions for given problems using suitable linear and non linear data structures.

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	3	2	2	1	-	3	-	2	-	2	-	2
CO2	3	2	2	2	3	-	3	-	2	-	2	-	2
CO3	1	1	1	1	1	-	1	-	2	-	1	-	1
CO4	2	3	2	2	2	-	2	-	2	-	2	-	2
CO5	3	2	3	3	3	-	3	-	2	-	3	-	3
Avg	2.2	2.2	2	2	2	-	2.4	-	2	-	2	-	2

**MCA SEMESTER – II**  
**SUBJECT : SOFTWARE ENGINEERING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

## A. COURSE OVERVIEW

This course describes software engineering approaches and principles. It imparts the knowledge of various software process models as well as phases of software development. The course includes agile development and testing approach used for software development. It gives understanding of various quality measures of software and development process .

## B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Software and Role of Software, Types (nature) of Software, Software Engineering-A Layered Technology, Software Process, Software Myths, Software Engineering Practices.	3	CO1
[2]	Process Models – A Generic Process Model, Process Assessment and Improvement, Overview of Prescriptive Process Models: Waterfall, Incremental, Evolutionary, Concurrent, Overview of Specialized Process Models: Component-Based, Formal Methods, Aspect-Oriented Software Development, Unified Process, Personal and Team Process Models.	8	CO1 CO2
[3]	Requirements Engineering, Establishing the Ground Work, Eliciting Requirements, Developing Use Cases, Building the Requirement Model, Negotiating Requirements, Validating Requirements.	5	CO1 CO3
[4]	Requirements Analysis: Domain Analysis, Analysis Rules of Thumb, Requirements Modelling Approaches: Scenario Based, Information Based, Flow Oriented Strategies.	5	CO1 CO3
[5]	Abstraction, Architecture, Aspects, Cohesion, Coupling, Data Design, Design Process, Functional Independence, Good Design, Information Hiding.	5	CO1 CO4
[6]	Software Architecture, Importance of Architecture, Architectural Descriptions and Decisions, Architectural Mapping Using Data Flow.	4	CO4
[7]	User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Web App Interface Design.	4	CO4
[8]	Agility and Cost of Change, Agile Process, Extreme Programming, Introduction to Agile Process Models: Adaptive Software Development, Dynamic Systems Development Method, Scrum, Crystal, Feature Driven Development, Lean Software Development, Agile Modeling, Agile Unified Process, Advantages and Disadvantages of Agile.	8	CO5
[9]	Agile Requirements Abstraction Model, Requirements Management in Agile Environment, Agile Requirements Prioritization, Agile Requirements Modeling and Generation, Collaborative User Story Creation.	7	CO5
[10]	Agile Testing – Principles, Methods & Advantages, Agile Testing Quadrants: the Purpose of Testing, Technology- Facing Tests that Supports the Team, Overview of Agile Testing Methods: Test Driven, Ac-	8	CO5

	ceptance Test Driven, and Behaviour Driven Development.		
[11]	Verification and Validation, Software Quality Assurance, Software Quality, Capability Maturity Model (SEI-CMM), International Standard Organization (ISO), Comparison of ISO-9000 Certification, SEI-CMM, Reliability Issues, Reliability Metrics.	3	CO6

### C. TEXT BOOKS

1. Robert C. Martin, *Agile Software Development, Principles, Patterns and Practices* ; Prentice Hall
2. Lisa and Janet, *Agile Testing – A Practical Guide For Testers And Agile Teams*
3. Roger Pressman, *Software Engineering A practitioner's Approach*; 6th ed.; Mcgraw-Hill International Edition

### D. REFERENCE BOOKS

1. Jim Highsmith, *Agile Software Development Ecosystems*; Addison Wesley
2. Rajib Mall, *Fundamentals of Software Engineering*; 3rd ed.; PHI
3. Ian Sommerville, *Software Engineering*; 5th ed.; Addison Wesley

### E. COURSE OUTCOMES

CO1	Understand	Describe the importance of software engineering approaches, principles, models and processes.
CO2	Analyse	Identify an appropriate process model for effective planning for the given system.
CO3	Analyse	Perform requirements engineering for the given system.
CO4	Apply	Prepare robust software design for given system requirements individually and in team.
CO5	Apply	Demonstrate Agile software development and testing.
CO6	Understand	Understand significance of software reliability and quality measures for lifelong software practices

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	1	-	-	-	-	3	1	-	-	-	-	-
CO2	2	2	3	3	-	-	3	3	3	-	3	-	-
CO3	3	3	3	3	-	-	3	3	3	-	3	-	-
CO4	2	3	3	3	-	-	-	2	3	-	3	-	-
CO5	3	2	2	2	-	-	2	2	3	-	3	-	-
CO6	-	1	1	1	-	-	2	1	-	-	-	-	-
Avg	2	2	2	2	-	-	2.1	2	2	-	2	-	-

**MCA SEMESTER – II**  
**SUBJECT : SEMINAR PRESENTATION**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
-	-	2	2	1	-	-	-	25	25

**A. COURSE OVERVIEW**

The course aims to develop learners' communication, presentation and report writing skills lifelong. It enables the learner strengthen and practice discussion abilities, develop Internet research skills, increase vocabulary, improve reading and listening comprehension & build confidence for oral communicative purposes.

**E. COURSE OUTCOMES**

CO Number	Skill	Statement
CO1	Understand	Independently explore and identify a suitable technological topic.
CO2	Understand	Find relevant literature for a given technological topic individually and in a team.
CO3	Analyse	Perform detailed literature review on the identified topic to pursue lifelong learning.
CO4	Evaluate	Summarise reviewed literature.
CO5	Create	Prepare a detailed informative report individually and in a team based on the reviewed literature.
CO6	Create	Prepare an effective presentation.
CO7	Apply	Deliver presentations to individuals and groups to practice lifelong in a professional environment.

**F. COURSE MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	-	-	2	2	3	-	1	2	2	-	2
CO2	3	2	-	-	2	2	3	-	2	2	2	-	2
CO3	2	3	-	-	2	2	2	-	2	2	2	-	2
CO4	1	2	-	-	2	2	2	-	2	2	2	-	2
CO5	2	2	-	-	2	2	2	-	2	2	2	-	2
CO6	2	2	-	-	2	2	3	-	2	2	2	-	2
CO7	1	1	-	-	2	2	3	-	3	2	2	-	2
Avg	2	2	-	-	2	2	2.57	-	2	2	2	-	2

**MCA SEMESTER – II**  
**SUBJECT : SYSTEM ANALYSIS DESIGN AND MANAGEMENT**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25	-	125

### A. COURSE OVERVIEW

The course covers various stages of information system development life cycle. It also emphasizes on analytical techniques to develop analysis and design solutions for business problems and user requirements. It enables the learners to understand essential concepts of Project Management and cost estimation.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Overview of Information System, Information Technology, Information System Components, Business Process Modeling – Business Information System, Characteristics of Information System, Types of Business Information System -Organizational Structure, Systems Development Techniques and Tools, Role of System Analyst.	5	CO1
[2]	Technical, Operational and Financial Feasibility, Request Approval, Project Selection Requirement and Methods, Steering Committee, Information System Group, Scope, Boundary and Objective of the Project Undertaken.	7	CO2
[3]	Structured English, Decision Tables, Methods of Performing Cost Benefit Analysis, System Logical and Physical Design, Selection of Hardware and Software, Criteria to Evaluate Hardware and Software.	5	CO5
[4]	Data Flow Analysis, Developing Logical Model Of the System Using Data Flow Diagram, Data Dictionary, HIPO Chart, Visual Table of Content, System Flow Chart, Data Structure Diagram.	8	CO5
[5]	System, Design, Operational, User, Time Chart, Budget Chart.	3	CO5
[6]	Planning, Equipment Installation, Program Developments, Design and Documentation of Software, Program and System Testing, Errors, File Conversions, User Training, Performance Evaluation of the System, Quality Assurance, Post-Implementation Review.	6	CO6
[7]	Project, Project Management, Relationships among Portfolio, Program, Project and Organizational Management, Relationship Between Project, Operations and Organizational Strategy, Business Value, Role and Responsibilities Of Project Manager.	8	CO4 CO7
[8]	Organizational Influences on Project Management, Project Stakeholders and Governance, Project Team, Project Life Cycle.	4	CO4 CO7
[9]	Common Project Management Process Interactions, Project Management Process Groups, Initiating, Planning, Executing, Monitoring and Controlling, Closing Process Group, Project Information, Role of the Knowledge Areas.	7	CO7
[10]	Process Metrics, Project metrics, Halstead's Software Science, Function Point(FP), Cyclomatic Complexity Measures; Software Project Estimation Models- Empirical, Putnam, COCOMO Estimating Size with Story	7	CO3



	Points, Velocity, Estimating Time: Ideal Days for Estimated Size, Techniques for Estimation: Estimates Shared, Estimation Scale, Derive Estimation, Planning Poker.		
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### C. TEXT BOOKS

1. Henry Lucas, *Analysis, Design and Implementation of an Information System*; McGraw Hill
2. James Senn, *Analysis and Design of an Information System* ; McGraw Hill
3. Uma Gupta, *Management Information Systems, A Managerial Perspective* ; Galgotia Publications Pvt Ltd
4. *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*; 5th ed.

### D. REFERENCE BOOKS

1. H. Lucas, *Information System Concept for Management*; McGraw Hill
2. Cleland and King, *System Analysis and Project Management*; McGraw Hill

### E. COURSE OUTCOMES

CO Number	Skill	Statement
<b>CO1</b>	Understand	Explain the importance of structured approach of system analysis and design in software development.
<b>CO2</b>	Apply	Perform feasibility study for evaluating the scope of the given system.
<b>CO3</b>	Evaluate	Practice software estimation for software project planning.
<b>CO4</b>	Understand	Understand the significance and practice to comply with ethics in system development.
<b>CO5</b>	Understand	Explain the structured approach of analysis and development.
<b>CO6</b>	Analyse	Prepare software analysis and design deliverables for specified requirements individually and in team.
<b>CO7</b>	Understand	Associate Project management principles and processes for lifelong software development practice.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
<b>CO1</b>	2	2	-	-	-	-	2	1	1	-	-	-	-
<b>CO2</b>	2	2	2	-	-	2	2	3	3	-	3	-	-
<b>CO3</b>	2	2	3	-	-	3	2	3	3	-	3	-	-
<b>CO4</b>	1	2	2	-	-	3	2	1	1	-	2	-	-
<b>CO5</b>	3	3	2	-	-	2	2	1	2	-	3	-	-
<b>CO6</b>	3	2	3	-	-	2	2	3	3	-	3	-	-
<b>CO7</b>	2	1	2	-	-	2	2	2	1	-	-	-	-
<b>Avg</b>	2.1	2	2	-	-	2	2	2	2	-	2	-	-

**MCA SEMESTER – II**  
**SUBJECT : ANALYSIS AND DESIGN OF ALGORITHMS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25	-	125

### A. COURSE OVERVIEW

The course provides important algorithmic design paradigms and methods of analysis. It will enable learners carry out analysis of various algorithms for mainly time and space complexity. It will make learners familiarize with specific algorithms for a number of important computational problems like sorting, searching, graphs etc. and introduce the concept of NP-complete problems.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Fundamentals of Mathematics: Role of Algorithms in Computing, Mathematics for Algorithmic Sets, Data Structures: Array, Stack and Queue, Pointers, Linked List, Graph, Tree, Associative Table	5	CO2
[2]	The Efficient Algorithm, Average, Best and Worst Case Analysis, Elementary Operation, Asymptotic Notations, A Notation for “The Order Of”, Analysing Control Structures: Loop Statements, Recursive Calls, Correctness of Algorithms, Sorting Algorithms and Analysis: Bubble Sort, Selection Sort, Amortized Analysis.	10	CO1 CO2
[3]	Introduction, Recurrence and Different Methods to Solve Recurrence, Multiplying Large Integers Problem, Problem Solving using Divide and Conquer Algorithm - Binary Search, Max- Min Problem, Matrix Multiplication.	9	CO3
[4]	Types of Graphs: Undirected, Unidirectional, Bidirectional Graphs, Traversing Graphs, Graph Search: Depth First Search and Breadth First Search.	5	CO3 CO4
[5]	Greedy Algorithm: Introduction and Characteristics, Spanning Tree, Minimum Spanning Tree: Kruskal’s Algorithm, Prim’s Algorithm, Shortest Path Algorithm.	9	CO3 CO4
[6]	Introduction, The Optimality Principle, Problem Solving using Dynamic Programming: All Points Shortest Path, Matrix Chain Multiplication, Longest Common Subsequence, Knapsack Problem.	10	CO4
[7]	Back Tracking: General Strategy, N-Queen’s Problem, Traveling Salesman Problem.	6	CO4
[8]	Basic Concepts: Non-Deterministic Algorithms, The Classes NP Hard and NP complete.	6	CO4 CO5

### C. TEXT BOOKS

1. Thomas Cormen, Charles Leiserson, Ronald Rivest, Clifford Stein, *Introduction to Algorithms* ; 3rd ed.; PHI
2. Gilles Brassard, Paul Bratley, *Fundamentals of Algorithmics*; PHI
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, *Computer Algorithms*; Computer Science Press

## D. REFERENCE BOOKS

1. Prabhakar Gupta, Vineet Agarwal, Manish Varshney, *Design and Analysis of Algorithms*; PHI
2. Parag Dave, Himanshu Dave, *Design and Analysis of Algorithms*; 2nd ed.; Pearson Education

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe importance of efficient algorithm design, algorithm complexity and asymptotic notations
CO2	Analyse	Estimate complexity of given algorithm.
CO3	Analyse	Identify an appropriate algorithmic approach for solving a given problem.
CO4	Understand	Demonstrate various graph based searching and traversal techniques.
CO5	Understand	Understand basic concepts of P, NP and NP-complete problems.

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	2	2	3	-	-	2	-	-	-	2	-	2
CO2	1	2	3	2	-	-	2	-	-	-	2	-	2
CO3	2	2	3	3	-	-	2	-	-	-	2	-	2
CO4	2	2	2	2	-	-	2	-	-	-	2	-	2
CO5	1	2	-	-	-	-	2	-	-	-	2	-	2
Avg	2	2	2	2	-	-	2	-	-	-	2	-	2

**MCA SEMESTER – II**  
**SUBJECT : CYBER SECURITY AND DIGITAL FORENSICS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25		125

### A. COURSE OVERVIEW

This course aims to provide a foundational platform for Cyber Security aspirants by providing Cyber Security awareness. It enables the learners to gain relevant knowledge in the field of Cyber Security, Cyber Crime and Computer forensics. It covers various crime prevention techniques, safety measures as well as forensic investigation approaches and tools.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Data Communications, Networks, Internet, Protocols and, Standards, Layered Tasks, The Internet Model, The OSI Model, Addressing, Over-view of UDP and TCP, DNS.	8	CO1
[2]	Introduction to Cybercrime: Definition and Origins of the Word, Cyber-crime and Information Security, Cybercriminals, Classifications of Cybercrimes Introduction to Cyber Offences, Phases of cybercrime used by Criminals, Social Engineering, Cyberstalking, Cybercafe and Cybercrimes, Botnets, Attack Vector, Cybercrime and Cloud Computing.	9	CO2
[3]	Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile Devices-Related Security Issues.	10	CO2-CO3
[4]	Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks.	10	CO4
[5]	Phishing: Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing, Scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures, Identity Theft (ID Theft): Personally Identifiable Information (PII), Types of Identity Theft, Techniques of ID Theft, Identity, Theft-Countermeasures, Protecting one's Online Identity.	8	CO4
[6]	Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Tools and equipment requirements for forensics, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites, Challenges in Computer Forensics, Special Tools and	10	CO1

	Techniques, Forensics Auditing, Antiforensics.		
[7]	Introduction to Cell-Phone Working Characteristics, Hand-Held Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics.	5	CO5

### C. TEXT BOOKS

1. Nina Godbole, SunitBelapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*; Wiley

### D. REFERENCE BOOKS

1. Cory Altheide, Harlan Carvey, *Digital Forensics With Open Source Tools*; Elsevier Syngress
2. andréÅrnes, *Digital Forensics*; Jonn Wiley and Sons

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Explain significance of cyber forensics and computer forensics in Information Security.
CO2	Understand	Discuss various offences in cyber world and its modus operandi.
CO3	Understand	Describe crimes and preventive measures associated with mobile and wireless devices.
CO4	Apply	Demonstrate the use of tools and methods used for cybercrime.
CO5	Understand	Understand computer forensics principles and demonstrate the use of forensic of handheld devices.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	1	-	-	-	1	2	-	-	2	1	-	2
CO2	3	2	-	-	-	3	2	-	-	2	2	-	2
CO3	2	3	-	-	-	3	2	-	-	2	2	-	2
CO4	1	2	-	-	-	1	1	-	-	2	3	-	2
CO5	2	2	-	-	-	3	3	-	-	2	2	-	2
Avg	2	2	-	-	-	2.2	2	-	-	2	2	-	2

**MCA SEMESTER – II**  
**SUBJECT : RESEARCH METHODOLOGY**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25	-	125

**A. COURSE OVERVIEW**

The purpose of this course is to let the learners understand methodology, processes and criteria for good research. The course covers various aspects of defining research problem and its design. Various methods about designing samples and data collection also are covered. The course also includes statistical data analysis techniques and aspects of writing basic research report.

**B. COURSE CONTENT**

NO	TOPIC	L+T (hrs)	COs
[1]	Meaning of Research, Objective, Motivation, Types, Approaches, Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.	10	CO1
[2]	Introduction to Research Problem, Selecting the Problem, Necessity of Defining the Problem, Meaning of Research Design, Need for Research Design, Future of a Good Design, Important Concepts Relating to Research Design, Different Research Design, Basic Principals of Experimental Designs.	12	CO1
[3]	Census and sample survey, Implications of a Sample Design, Steps in sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of sample Designs, How to Select a Random Sample. Collection of Primary Data, Observation Method, Interview Method, Collection of Data through Questionnaires, Collection of Data through Schedules, Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.	12	CO1 CO2 CO3
[4]	Processing Operation, Types of Analysis, Statistics in Research, Measure of Central Tendency, Measure of Dispersion, Measure of Asymmetry, Measure of Relationship, Basic Regression Analysis, Multiple Correlation and Regression, Partial Correlation, Association of Attributes, Other Measures.	14	CO4
[5]	Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Significance of Report Writing, Deferent Steps in Writing Report. Layout of the Research Report, Types of Report, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing a Research Report.	12	CO5

### C. TEXT BOOKS

1. C. R. Kothari, *Research Methodology Methods and Techniques; 2nd ed.; New Age International Publishers*

### D. REFERENCE BOOKS

1. Ranjit Kumar, *Research Methodology a step-by-step guide for beginners; 3rd ed.; Sage Publications*
2. D. K. Bhattacharyya, *Research Methodology; Excel Books Publication.*
3. B.L. Garg, Renu Kavdia, Sulochana Agrawal and U.K. Agrawal, *An Introduction to Research Methodology; RBSA PUBLISHERS.*

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand significance and general characteristics of research design
CO2	Apply	Contrast sampling design techniques
CO3	Understand	Differentiate data collection methods
CO4	Apply	Apply relevant basic statistical methods required for a given research design
CO5	Apply	Express data interpretation techniques and report writing

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	-	2	-	-	2	2	-	2	-	2	3	-
CO2	2	-	3	-	-	2	2	-	2	-	2	2	-
CO3	2	-	2	-	-	2	2	-	2	-	2	-	-
CO4	2	-	3	-	-	2	2	-	2	-	2	2	-
CO5	2	-	-	-	-	2	2	-	2	-	2	3	-
Avg	2.2	-	2	-	-	2	2.2	-	2	-	2	2	-

**MCA SEMESTER – III**  
**SUBJECT : SOFTWARE DESIGN AND TESTING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25	-	125

### A. COURSE OVERVIEW

This course provides a way of thinking about real world information system design problems and their solutions using various UML models. It covers various phases of software testing life cycle. The course will enable the learners to use various testing techniques and automated testing tools. It also introduces testing of web-based and object-oriented systems.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	The Importance of Modeling. Object-Oriented Modeling and Principles, An Overview and Conceptual Model of UML	6	CO1
[2]	Classes, Relationships and Other Common Mechanisms, Types of Diagrams, Class Diagrams, Interfaces: Types and Roles, Object Diagrams	9	CO1 CO2
[3]	Interactions, Use-cases, Use-Case Diagrams, Interaction Diagrams, Activity Diagrams, State-chart Diagrams.	9	CO2
[4]	Patterns and Frameworks, Component Diagrams, Deployment Diagrams, A Detailed Case Study on System Analysis and Design using Unified Approach.	6	CO2
[5]	Introduction and Evolution of s/w Testing, Definition and Goals of Testing, Effective and Exhaustive Testing, Software Testing Life Cycle (STLC), Testing Terminology and Methodology.	3	CO3
[6]	Verification, Verification of Requirements, High-level and Low-Level Design, How to Verify Code? Validation, Validation Activities: Unit Testing, Integration Testing, Function Testing, System Testing, Acceptance Testing, Overview of Regression Testing	6	CO3
[7]	Static Testing: Inspection, Structured Walkthroughs, Technical Reviews Dynamic Testing Black-Box Testing: Boundary Value Analysis, Equivalence-Class Testing, White-box Testing: Need of White-box Testing, Basis Path Testing, Graph and Loop Testing, Data Flow Testing.	8	CO3
[8]	Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design and Test	3	CO4
[9]	Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Cost Incurred in Testing Tools, Guidelines for Automated Testing, Overview of some Commercial Testing Tools.	4	CO3
[10]	Object-Oriented Testing (OOT) Basics, Comparison: Conventional testing and OOT, Issues in OOT, Issues in testing Inheritance, Various OO Testing Techniques.	3	CO5
[11]	Overview of Web-Based Systems, Web Technology Evolution And Comparison with Traditional Software, Challenges in Testing Web-Based Systems, Web Engineering, Testing Web-Based Systems.	3	CO5



### C. TEXT BOOKS

1. Grady Booch, James Rumbaugh, and Ivar Jacobson. *The Unified Modeling Language User Guide*; Low Price Edition, Pearson Education
2. Naresh Chauhan. *Software Testing Principles and Practices*; Oxford Publication

### D. REFERENCE BOOKS

1. Joseph Schumuller. *Teach yourself UML in 24 Hours; 3rd ed.*; Sams Publication.
2. Rax Black, Eric Van Veenendaal and Dorothy Greham. *Foundations of Software Testing ISTQB Certification*; Cengage Learning.

### E. COURSE OUTCOMES

CO Number	Skill	Statement
C01	Understand	Describe Object Oriented Methodology and Unified Modeling Language for software design and development
C02	Apply	Prepare overall design using various UML models and diagrams.
C03	Apply	Understand software testing life cycle and efficiently use modern testing techniques and tools to test software.
C04	Evaluate	Write and execute test plan, test case and test specification
C05	Understand	Discuss object-oriented and web-based testing techniques.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
C01	2	-	1	1	-	1	1	2	1	-	-	-	-
C02	3	3	3	3	-	3	3	2	3	-	-	-	-
C03	2	3	3	2	-	3	2	2	2	-	-	-	-
C04	3	3	3	3	-	3	3	2	3	-	-	-	-
C05	1	1	-	1	-	1	1	2	1	-	-	-	-
Avg	2.2	2	2	2	-	2	2	2	2	-	-	-	-

**MCA SEMESTER – III**  
**SUBJECT : WEB DEVELOPMENT WITH PHP**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

## A. COURSE OVERVIEW

This course provides the knowledge necessary to design and develop dynamic, object oriented, database-driven and MVC based web applications using PHP. It will enable learners to work with the server environment and database interaction using MySQL. The course also makes learners familiar with popular PHP development frameworks.

## B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	A Brief Introduction to Apache, Mysql, PHP and Open Source, Configuring Apache, Mysql and PHP, PHP Structure and Syntax, Creating PHP Program, PHP Using HTML	9	CO1
[2]	PHP Files, Variables, Data Types, Strings, Arrays, Operators PHP in Web Applications: Getting Information from the User, Working with HTML Forms, Persisting Data with Cookies, Conditionals, Switch... Case, Loops, Function Declaration, Function Arguments, Return Statement, Type Hinting and Return Types, Reading and Writing Files, File System Functions.	14	CO1 CO2
[3]	Classes and Objects, Properties, Methods, Constructors, Magic Methods, Properties and Methods Visibility, Encapsulation, Namespaces, Autoloading Classes, Inheritance, Overriding Methods, Abstract Classes, Interfaces, Polymorphism, Traits, Handling Exceptions, Anonymous Functions.	10	CO3
[4]	Connecting to the Database using PHP Data Objects, Performing Queries, Prepared Statements MVC: The MVC Pattern, using Composer, Managing Dependencies, Autoloader with PSR-4, Adding Metadata, Working with Requests, The Request Object, Filtering Parameters from Requests, Mapping Routes to Controllers, The Router, Model, View, Controller, Implementation of MVC Application, Dependency Injection.	14	CO4
[5]	The Purpose of Frameworks, The Main Parts of a Framework, Other Features of Frameworks, Authentication and Roles, ORM, Complete and Robust Frameworks, Lightweight and Flexible Frameworks Popular Frameworks: Symfony 2, Zend Framework 2 Laravel Framework: Composer, Laravel Homestead, Virtual Box, and Vagrant, File Structure, Routing, A Static Method, Controller Class, View and Blade, Environment, Database Migration, Eloquent Model Class, Model, View, Controller Workflow, HTML Form Builder, A CRUD Application, Conditional Rules, Custom Validation, Form Validation.	13	CO5

### C. TEXT BOOKS

1. Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz and Michael K. Glass. *Beginning PHP6, Apache, and MySQL Web Development*; Wrox,
2. Antonio Lopez. *Learning PHP 7*; 2016 Packt Publishing
3. Sanjib Sinha. *Beginning Laravel*; Apress

### D. REFERENCE BOOKS

1. Atkinson Leon. Suraski Zeev. *Core PHP Programming*; Pearson Publication
2. Robin Nixon. *Learning PHP, MySQL & JavaScript; 4<sup>th</sup> ed.*; O'Reilly Publication.

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Explain the basics of open-source software and the building blocks of PHP
CO2	Apply	Experiment handling of HTML forms, files and cookies in PHP
CO3	Apply	Demonstrate robust object-oriented programs with PHP
CO4	Create	Develop MVC based and database centric web applications using PHP and MySQL
CO5	Apply	Summarize different PHP frameworks and develop basic CRUD applications using Laravel framework

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	1	1	1	-	-	1	-	1	-	-	-	2
CO2	2	3	2	3	2	-	2	-	2	-	2	-	2
CO3	2	1	3	2	2	-	2	-	2	-	2	-	2
CO4	3	3	3	3	3	-	3	-	3	-	3	-	2
CO5	2	2	2	1	3	-	2	-	2	-	3	-	2
Avg	2.2	2	2.2	2	2	-	2	-	2	-	2	-	2

**MCA SEMESTER – III**  
**SUBJECT: Mobile Application Development**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course is intended to make learners capable of developing applications for mobile devices. It will enable learners to develop data centric applications on android platform. The course also covers hybrid mobile application development.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	The Evolution of Mobile Application Development, Different Ecosystems: Apple, Google, Microsoft, Problems with Ecosystem-Based Applications, Web Sites and Web Views for Mobile Devices, Adding Javascript, Hybrid Mobile Applications, Front-End and Back-End Development, Introduction to Testing Mobile Applications, Native Vs. Hybrid Mobile Applications.	4	CO1
[2]	An Android Platform, Android SDK Features, Which Devices Android Runs on, Why Android For Mobile Development, Comparison of Android with other Platform, Android Development Framework, Understanding Android Software Stack, Android Application Architecture Installing and Updating Android SDK, Android Development Tools: AVD Manager, Android SDK Manager, Emulator, Dalvik Debug Monitor Service, Debug Bridge, Hierarchy View and Lint Tool, Monkey and Monkey Runner.	3	CO1
[3]	Building Blocks of Android Application, The Application Manifest File, Manifest Editor, Creating Resources, Using Resources, Android Application Lifecycle, Application's Priority and Its Process States, Extending and Using Android Application Class, Overriding the Application Lifecycle Events Android Activities: Creating Activities, Activity Lifecycle, Activity Stacks, Activity States, Monitoring State Changes, Understanding Activity Lifetimes, Android Activity Classes Introduction to an Intent, Starting Activities, Sub Activities and Services using Implicit and Explicit Intents.	4	CO1 CO2
[4]	Fundamental Android UI Design, Assigning UI To Activities, Layout Classes, Defining Layouts, Linear Layout, Relative Layout, Grid Layout, Optimizing Layouts Fragments, Creating New Fragment, Fragment LifeCycle, Fragment Manager, Fragment Specific LifeCycle Events, Fragment States, Adding Fragments to Activities, Using Fragment Transaction, Interfacing Between Fragments and Activities, Fragment Without User Interfaces, Android Fragment Classes.	7	CO2
[5]	Toolbox Controls, Creating and Modifying Views, Creating Compound Controls, Custom Views, Handling User Interaction Events, Custom Controls, Customizing Array Adapter and Simple Cursor Adapter.	10	CO2
[6]	Introduction to Sqlite Database, Content Values and Cursors, Working with Sqlite Databases: Opening and Creating Database without	8	CO4

	Sqlite Open Helper, Querying Database, Extracting Values from a Cursor, Adding, Updating and Removing Rows, Content Provider's URI Address, Content Provider Transaction, Adding, Deleting and Updating Content, Storing and Accessing Files from a Content Provider, Introduction to Native Android Content Providers.		
[7]	Broadcasting Events with Intents, Introduction to Intent Filters and Broadcast Receiver Saving Simple Application Data: Shared Preferences, Saved Application UI State, Files Creating, Saving and Retrieving Shared Preferences, Persisting the Application Instance State, Working with the File System	4	CO2
[8]	Introduction to Location Based Services, Emulator with Location Based Services, selecting a Location Provider, Finding your Current Location Hardware Support Phone States, Monitoring Changes in Phone State using the Phone Listener, Using Intent Receiver to Monitor Incoming Calls SMS and MMS, Sending SMS at for Telephony, Initiating Phone Calls, Replacing Native Dialer, Accessing Telephony Properties and MMS Using Intents, Sending SMS Using SMS Manager, Listening For Incoming SMS.	5	CO2
[9]	iOS Layer, Windows Phone Layer, Browser-Based Applications and Browser Runtime, How Hybrid Application Works Basics of HTML 5 and Useful APIS : Integrated and Associated APIS Data Formats: Using XML, JSON, JQuery Basics, JQuery Selectors, Server-Side Support SOA Architecture: Web Services, WCF Services, Rest Based Services, CSS, Bootstrap, Skeleton HMAD Development and Packaging Frameworks, Testing Mobile Applications.	5	CO3
[10]	HTML with JQuery, Event Handling in JQuery, Live Event Binding in JQuery Using On function, JQuery Plug-in-based Approach to Generating a UI, Miscellaneous Libraries and Plugins, Responsive UI, Frequently Used Style Classes.	4	CO3
[11]	Saving A File to Device Storage, Opening a Local File from Device Storage, Displaying the Contents of a Directory, Creating a Local Sqlite Database, Uploading a File to a Remote Server Via a Post Request, Caching Content using the Web Storage Local Storage API	6	CO4

### C. TEXT BOOKS

1. Reto Meier. *Professional Android 4 Application Development*; Wrox (Willey) Publication
2. Mahesh Panhale. *Beginning Hybrid Mobile Application Development*; Apress
3. Matt Gifford. *PhoneGap Mobile Application Development Cookbook*; PACKT.

### D. REFERENCE BOOKS

1. Lauren Dercey & Shane Conder. *Android Wireless Application Development Vol-I Android Essential; 3rd ed.*; Pearson
2. W.Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz. *Android in action; 3rd ed.*; Dreamtech Press.

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe mobile application environment, android development framework and android application structure.
CO2	Apply	Develop native mobile applications using android
CO3	Apply	Develop hybrid mobile applications using opensource platform
CO4	Apply	Design and develop dynamic mobile applications with sqlite database

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	1	-	-	-	-	2	-	1	-	-	-	-
CO2	3	3	3	3	3	-	2	-	2	-	3	-	-
CO3	2	2	2	2	3	-	2	-	2	-	2	-	-
CO4	3	3	3	3	3	-	2	-	3	-	3	-	-
Avg	2.75	2.2	2	2	2.25	-	2	-	2	-	2	-	-

**MCA SEMESTER – III**  
**SUBJECT : COMPUTER NETWORKS AND SECURITY**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	-	4	4	60	40	25	-	125

### A. COURSE OVERVIEW

The course aims to provide understanding of computer networks and data communication. It covers various networking devices, layered task and Open Systems Interconnection (OSI) model. The course introduces the learners to computer network security, information security and various cryptographic techniques.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Data Communications, Networks and Types of Networks, Protocols and Standards, Layered Tasks, The OSI Model, TCP/IP Protocol Suit	6	CO1
[2]	Analog and Digital Data, Analog and Digital Signals, Periodic and Non-periodic Signals , Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Bit Rate, Bit Length , Digital Signal as a Composite Analog Signal, Attenuation, Distortion, Noise Guided Media: Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Unguided Media: Radio Waves, Microwaves, Infrared.	6	CO3
[3]	Error Detection and Correction: Types of Errors, Redundancy, Detection Versus Correction, Forward Error Correction Versus Retransmission, Coding Block Coding: Error Detection, Error Correction, Hamming Distance, Minimum Hamming Distance Cyclic Codes: Cyclic Redundancy Check, Checksum: One's Complement, Internet Checksum Framing: Fixed-Size Framing, Variable-Size Framing, Connecting Devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Two-Layer Switches, Routers, Three-Layer Switches, Gateway.	6	CO2
[4]	IPv4 Addresses: Address Space, Notations, Classful Addressing, Classless Addressing, Network, Address Translation (NAT) Need for Network Layer, Internet as a Datagram Network, Internet as a Connectionless Network IPv4: Segment Header Format, Datagram, Fragmentation, Checksum, Options IPv6: Advantages, Packet Format, Extension Headers Forwarding Techniques, Forwarding Process, Routing Table.	8	CO2
[5]	Process-To-Process Delivery: Client/Server Paradigm, Multiplexing and Demultiplexing, Connectionless Versus Connection-Oriented Service, Reliable Versus Unreliable User Datagram Protocol (UDP): Well-Known Ports for UDP, User Datagram Checksum, UDP Operation, Use of UDP	6	CO3

	TCP Services, TCP Features, Segment, Segment Header Format, A TCP Connection, Flow Control, Error Control, Congestion Control		
[6]	Name Space: Flat Name Space, Hierarchical Name Space Domain Name Space, Distribution of Name Space: Hierarchy of Name Servers, Zone, Root Server, Primary and Secondary Servers, DNS in the Internet: Generic Domains, Country Domains, Inverse Domain, Resolution: Resolver, Mapping Names to Addresses, Mapping Address to Names, Recursive Resolution, Iterative Resolution, Caching, DNS Messages and Types of Records Introduction to Telnet, SMTP, FTP, WWW	6	CO3
[7]	Computer Security Concepts, Security Attacks, Security Services, Security Mechanisms, Techniques, Model for Network Security	4	CO1
[8]	Symmetric Encryption: Principles, Symmetric Block Encryption Algorithms (Data Encryption Standard, Triple DES, Advanced Encryption Standard), Random and Pseudorandom Numbers, Stream Ciphers and RC4, Cipher Block Modes of Operation Public Key Cryptography: Approaches to Message Authentication, Secure Hash Functions, Message Authentication Codes, Public-Key Cryptography Principles, Public-Key Cryptography Algorithms (RSA and Diffie-Hellman Exchange), Digital Signatures.	14	CO4
[9]	The Need For Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Firewall Location and Configurations	4	CO1

### C. TEXT BOOKS

1. Behrouz Fourozan. *Data Communication and Networkin; 4th ed.*; Tata McGraw-Hill Publications
2. William Stallings. *Network Security Essentials By Applications and Standards; 4th ed.*; Pearson

### D. REFERENCE BOOKS

1. Andrew S. Tanenbaum. *Computer Networks*; Prentice Hall Publications
2. William Stallings. *Cryptography and Network Security- Principles and Practice; 7<sup>th</sup> ed.*; Pearson
3. Behrouz A. Fourouzan. *Cryptography & Network Security; Special Indian Edition*; Tata McGraw-Hill
4. Atul Kahate. *Cryptography and Network Security*; Tata McGraw-Hill



## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand Networking fundamentals and importance of Computer and Network security Practice Signals, error detection, correction and IP addressing
CO2	Apply	Practice Signals, error detection, correction and IP addressing
CO3	Understand	Interpret functionalities of OSI layers
CO4	Apply	Demonstrate the use of various Cryptographic techniques for secure communication over the networks.

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	-	1	-	-	-	3	-	2	-	1	-	2
CO2	3	3	3	-	-	-	2	-	2	-	3	-	2
CO3	3	2	1	-	-	-	3	-	2	-	1	-	2
CO4	2	3	3	-	-	-	2	-	2	-	3	-	2
Avg	2.75	2	2	-	-	-	2.5	-	2	-	2	-	2

**MCA SEMESTER – III**  
**SUBJECT : PYTHON PROGRAMMING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course helps the learners build foundation in programming using Python. The course covers various Python standard libraries and object-oriented features. The course also covers working with Python modules, sequences, exception handling and interfacing databases.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	Cos
[1]	Introduction to Python Programming Environment, Writing and Executing Basic Python Program. Data types: Built-in Types, str, bytes, Literals, type() function. Operators: Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity. Input & Output statements, Command line arguments. Control Statements: if, else, elif, while, for, break, continue, pass, assert, return.	6	CO1 CO2
[2]	List: create, update, delete elements, list methods, indexing and slicing. Tuple: create, basic operations, functions to process tuple. Dictionary: create, update, delete elements, dictionary methods.	8	CO1
[3]	Difference between Function and Method, Create and Use Function, Return Multiple Results from Function, Pass by ObjectReference. Arguments: Positional, Keyword, Default, Variable length. Local and Global Variables, Global Keyword, Passing group of Elements to Function. Anonymous Functions: Using Lambdas with: filter(), map() and reduce()	10	CO1 CO2
[4]	Create Class and its Objects, Self variable, Constructor, Instance methods, Class methods, Static methods. Inheritance: Constructors in Inheritance, Overriding Super Class Constructors and Methods, super(), Method Overloading and Overriding. Abstract class, Interface.	8	CO1
[5]	Types of Errors, Exceptions, Handling Exceptions, Types of Exceptions, Assert and Except Statements.	4	CO1
[6]	Introduction, Working with MySQLdb module, Establish connection, Create database and table, CRUD operations, Invoke stored procedure.	6	CO1 CO3
[7]	Introduction: single and multi tasking, Difference between Process and Thread. Create Thread: Without Using a Class, Using a Thread Class. Thread Class Methods, Single Tasking Using a Thread, Multitasking Using Multiple Threads. Thread Synchronization, Communication between Threads.	6	CO1
[8]	numpy arrays: zeros(), ones(), reshape(), hstack(), vstack(), arange(), linspace(), logspace(), asarray(), dot(), matmul(), indexing and slicing.	6	CO1 CO2

	pandas: Work with Series and Dataframe: create, delete rows and columns, index and select data, handle missing data, iterate over rows and columns matplotlib: Plotting- bar graph, histogram, pie chart, line graph.		CO3
[9]	Django Introduction, Setup environment, Create project, Life Cycle, Admin Interface, Create Views, Models, Page Redirection, Process Form.	6	CO4

### C. TEXT BOOKS

1. R Nageswara Rao. *Core Python Programming; 2nd Edition*; Dreamtech press

### D. REFERENCE BOOKS

1. <https://www.djangoproject.com>
2. John V Guttag. *Introduction to Computation and Programming Using Python; 6th edition*; Prentice Hall of India
3. Sanjeev Jaiswal and Ratan Kumar. *Learning Django Web Development*; PACKT

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Create	Create Basic Desktop Applications using Python Programming Language
CO2	Create	Develop Scientific Programs using numpy and pandas
CO3	Apply	Plot Diversified Charts
CO4	Create	Create Basic Web Applications using Django Framework

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	3	2	2	-	2	-	2	1	2	1	2
CO2	3	3	2	2	3	-	2	-	2	3	2	3	2
CO3	2	1	1	2	3	-	2	-	2	1	2	2	2
CO4	2	2	2	2	2	-	2	-	2	3	2	2	2
Avg	2.5	2	2	2	2.5	-	2	-	2	2	2	2	2

**MCA SEMESTER – III**  
**SUBJECT : Advanced Web Development**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course covers concepts to build responsive web design using Bootstrap. Also aspects related to dynamic web development using AJAX, jQuery and AngularJS it focuses on. It covers basic aspects on developing server side programs using Node.JS.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	What Is JQuery and How It Works, Adding JQuery Code to HTML Page, JavaScript Vs JQuery, The Document Object Model, \$() Function, CSS Selectors, Custom Selectors, DOM Traversal, Accessing DOM Elements, Page Load Events, Simple Events, Compound Events, Event Object, Remove Event Handler, Simulating User Interaction.	10	CO1 CO2 CO3
[2]	Inline CSS Modification, Basic Hide & Show, Effects & Speed, Custom Animations, Simultaneous Versus Queued Effects, Attribute Manipulation, DOM Tree Manipulation, Copying Elements, Content Getter & Setters. Loading Data on Demand using AJAX, Data Formats, Passing Data to Server, Deliver Content based on Ajax Requests, Introduction to Error Handling and Events in AJAX.	8	CO1 CO2 CO3
[3]	Introduction to Bootstrap 4, Installing and Setup, Structure of the CSS Files, Structure of Web Page, Typography Elements .	8	CO1 CO2
[4]	Structure of A Form, Input Elements, Buttons, Dropdown Menus, Toolbars, Menu Buttons, Navigation, Page Headers, Progress Bar, Media, Lists, Cards, Modal Dialogs, Tabs, Tooltips, Popover, Alerts, Carousel.	10	CO1 CO2 CO3
[5]	Introduction, Key Concept of Angular JS: Angular JS Modules, Data Binding, Dependency Injection, Directives, Installation, Structuring and Bootstrapping Angular JS Application, MVC Entities, Routing, Services, Simple Authentication Management	12	CO1 CO2 CO3 CO4
[6]	Introduction to NPM – Node Package Manager, Node JS and Modules, Connect Module, Introduction to Express, Express Setup, Request and Response Objects, MVC Pattern, Express Application Configuration, Rendering Views, Configuring Sessions, Making a Simple Web Application with Express.	12	CO1 CO2 CO3 CO5

### C. TEXT BOOKS

- Jonathan Chaffer, Karl Swedberg. *Learning JQuery; 3rd Edition*; Packt Publishing.
- Jorg Krause. *Introducing Bootstrap 4*; Apress Publications.
- Amos Q. Haviv. *MEAN Web Development*;, Packt Publishing

### D. REFERENCE BOOKS

1. Simon Holmes Clive Harber. *Getting MEAN – with Mongo, Angular, Express and Node*; Manning Publication.
2. Ken Williamson. *Learning Angular JS*; Oreilly Publishing.
3. Pedro Teixeira. *Professional Node.js: Building Javascript Based Scalable Software*; Willey Publication.
4. <https://angular.io/tutorial/>

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand Fundamental Concepts & Components of Internet & Web Development
CO2	Apply	Develop Interactive Websites Using Latest Frontend and Backend Development Tools and Technology
CO3	Create	Design & Create Webpages with Standard User Interface Using Various Client Side Scripting Libraries
CO4	Apply	Develop responsive web design using AngularJS
CO5	Apply	Develop server side web application using Node.JS

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	1	-	1	-	1	-	1	-	-	-	1	-	3
CO2	3	2	2	3	3	-	2	-	3	-	3	-	2
CO3	2	2	3	3	3	-	3	-	3	-	3	-	2
CO4	2	3	2	2	3	-	2	-	2	-	2	-	1
CO5	2	3	2	2	3	-	2	-	2	-	2	-	2
Avg	2	2	2	2	2.6	-	2	-	2	-	2.2	-	2

**MCA SEMESTER – III**  
**SUBJECT: Cloud Computing**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course makes learners understand virtualization concepts and ecosystem of cloud computing. The course covers key services of public cloud for deploying applications on the cloud platform. It includes containerization and DevOps concepts. Enables Learners set up applications in container as well as DevOps environment. The course contains fundamentals of openstack platform.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Defining Cloud Computing, Cloud Types, Characteristics of Cloud Computing, The Role of Open Standards, Benefits of Cloud Computing, Cloud Architecture, Cloud Computing Service Models (IaaS, SaaS, PaaS, IDaaS, CaaS).	9	CO1
[2]	Introduction to Virtualization Technologies, Advanced Load Balancing on Google Cloud, Understanding Hypervisors, Virtual Machine Types, Oracle VirtualBox, KVM.	5	CO3
[3]	Using Amazon Web Services, Understanding Amazon Web Services (AWS), AWS Components and Services, Working with Elastic Compute Cloud (EC2), Working with Amazon Storage Systems: Amazon Simple Storage Systems (S3), Amazon Elastic Block Storage (EBS), Understanding Amazon Database Services: Different Database Services of AWS, Amazon Relational Database Service (RDS), Steps for Creating RDS and Connect with EC2 Application Using Microsoft Cloud Services: Microsoft Cloud Services, Windows Azure Platform, Azure Service, Azure Content Delivery Network, Azure Virtual Machine, SQL Azure, Windows Live Services.	16	CO2
[4]	Introduction to Docker Container, Advantage of Container over Virtual Machine, Work with Docker Image and Container, Work with Data Docker, Publish Docker Image on Public Repository, Container Orchestration Docker Swarm: Docker Swarm Architecture, Steps for Creating Docker Swarm Kubernetes: Introduction to Kubernetes, Kubernetes Architecture Docker and DevOps: Continuous Integration, Continuous Delivery, Need for CI/CD, Running Jenkins Master within Docker Container, Setup Build Job, Test Job with Jenkins Master.	16	CO3
[5]	Introduction to OpenStack and its Components, Keystone - OpenStack Identity Service, Nova- OpenStack Compute, Swift- OpenStack Object Storage.	8	CO4
[6]	Security in Cloud: Securing the cloud, Securing Data, Establishing identity and Presence, Docker and Security.	6	CO5

### C. TEXT BOOKS

1. Barrie Sosinsky, *Cloud Computing Bible*; Wiley Publishing Inc.
2. Kevin Jackson, Cody Bunch, Egle Sigler, *OpenStack Cloud Computing Cookbook*; 3rd ed.; Packt Publishing
3. Ian Miell, Aidan Hobson Sayers, *Docker in Practice*; 2nd ed.; Manning

### D. REFERENCE BOOKS

1. <https://docs.aws.amazon.com>
2. <https://docs.microsoft.com/en-us/azure/>
3. <https://docs.openstack.org>
4. <https://help.ubuntu.com/community/KVM>
5. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, *Cloud Computing Concepts Technology and Architecture*; Prentice Hall
6. Anthony Velte, Tony Velte, Robert Elsenpeter, *Cloud Computing A Practical Approach*; McGrawHill
7. Nigel Poulton, *Docker Deep Dives*; 4th ed.;

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe cloud computing ecosystem
CO2	Apply	Develop and deploy cloud based applications on public clouds
CO3	Apply	Work with virtualization and containerization
CO4	Understand	Describe openstack fundamentals
CO5	Understand	Understand importance of security measures on cloud environment

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	2	1	1	-	1	2	-	2	-	-	-	-
CO2	3	3	3	3	3	3	3	-	3	-	-	-	-
CO3	3	3	3	3	3	3	3	-	3	-	-	-	-
CO4	3	-	1	2	2	1	2	-	1	-	-	-	-
CO5	3	2	2	1	2	2	2	-	1	-	-	-	-
Avg	3	2	2	2	2	2	2.4	-	2	-	-	-	-

**MCA SEMESTER – III**  
**SUBJECT : ARTIFICIAL INTELLIGENCE**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course exposes learners to the theory and practical methods associated with the field of artificial intelligence. It covers knowledge representation, logic & searching techniques for problem solving.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to Artificial Intelligence (AI), History of AI, What is Intelligence?, Significance of AI, Applications of AI.	5	CO1
[2]	Generate and Test, Depth First Search, Breadth First Search, Comparison of BFS and DFS, Depth Bounded DFS, Depth First Iterative Deepening (DFID).	9	CO1 CO2
[3]	Heuristic Functions, Best First Search, Hill Climbing, Local Maxima, Solution Space Search, Variable Neighbourhood Descent, Beam Search, Tabu Search.	8	CO1 CO2
[4]	Iterated Hill Climbing, Simulated Annealing, Genetic Algorithms, The Travelling Salesman problem, Emergent Systems, Ant Colony Optimization.	9	CO1 CO2
[5]	Brute Force, Branch and Bound, Dijkstra's Algorithm, A* Algorithm, Admissibility of A*, Iterative Deepening A*(IDA*), Recursive Best First Search (RBFS), Pruning the CLOSED List, Pruning the OPEN List.	8	CO4
[6]	Goal Trees, AO* Algorithm, Rule Based Systems, Rete Algorithm.	4	CO3
[7]	MINIMAX Algorithm, Alpha-Beta Pruning, SSS*.	4	CO3
[8]	The STRIPS Domains, Forward and Backward State Space Planning, Goal Stack Planning, Plan Space Planning, Means Ends Analysis, Graph Plan, Constraint Satisfaction Problems, N-Queens Problem.	6	CO5
[9]	Propositional Logic, Resolution Method in Propositional Logic, First Order Logic, Soundness and Completeness, Forward and Backward Chaining.	7	CO4

### C. TEXT BOOKS

1. Deepak Khemani, *A First Course in Artificial Intelligence*; McGraw Hill
2. Elaine Rich and Kevin Knight, *Artificial Intelligence*; 3rd ed.; McGraw Hill

### D. REFERENCE BOOKS

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*; 3rd ed.; Prentice Hall
2. Prateek Joshi, *Artificial Intelligence with Python*; Packt Publishing



## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Apply	Analyze and apply various search techniques
CO2	Understand	Understand various knowledge representation methods
CO3	Apply	Solve AI problems through programming with Python.
CO4	Understand	Explain logic inference and finding optimal path.
CO5	Understand	Discuss planning and constraint satisfaction

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	3	2	3	-	3	-	3	-	3	-	-
CO2	2	2	2	2	1	-	2	-	2	-	2	-	-
CO3	3	3	3	3	3	-	3	-	3	-	3	-	-
CO4	1	1	1	2	1	-	1	-	1	-	1	-	-
CO5	1	1	1	1	2	-	1	-	1	-	1	-	-
Avg	2	2	2	2	2	-	2	-	2	-	2	-	-

**MCA SEMESTER – III**  
**SUBJECT : APPLIED MACHINE LEARNING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course will introduce the field of Machine Learning, in particular focusing on the core concepts of supervised and unsupervised learning. It familiarizes the learners with the techniques on learning by a model, its evaluation and implementation of basic algorithms to construct a learning model using Python libraries. The course covers fundamentals of neural networks and regression.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	Cos
[1]	Python: Introduction to Python, Basic Loop Structure of Python, Use of Pandas, NumPy, Sklearn, Matplotlib, Scipy, Scikit-learn library Data Preprocessing: Introduction to Outlier, Missing Data, Types of Data, NULL Values, Handle Categorical Data, Display Data Graphically.	9	CO1 CO6
[2]	Introduction to machine learning, Key Terminology, Types of Machine Learning, Key Tasks, Right Algorithm, Steps for Developing a Machine Learning Application, Python for Machine Learning.	5	CO1
[3]	Classification Naïve Bayes Method: Introduction to Bayesian Decision Theory, Naive Bayes Classification, Estimating Accuracy Decision Tree: Introduction, Building and Splitting Decision Tree, Decision Forest Introduction Logistic Regression: Logistic Regression Introduction, Sigmoid Function, Classification with Logistic Regression, Find Best Regression Coefficient K-Nearest Neighbor: Introduction, Distance Measurement, Classification with K-Nearest-Neighbor, Case Study.	14	CO2
[4]	Linear Regression: Introduction, Finding Best Fitting Line using Least - Square Method, Solving Regression with Gradient Decent Decision Tree Regression: Building tree with continuous and Discrete Features, Using CART for Regression Case Study.	7	CO3
[5]	Clustering Introduction to Cluster Analysis, K-Mean Clustering: Steps for K-Mean Clustering, Generates Clusters, Hierarchical Clustering: Introduction, Distance Measurement between Clusters, Agglomerative Method for Creating Clusters, Locating Regions of High Density using DBSCAN Association Rule Mining: Introduction, Terminology, Working of Apriori Algorithm, Working of Eclat Algorithm Case Study.	12	CO4
[6]	Introduction to Perceptron, Single-layer Neural Network, Introduction to Multilayer Neural Network Architecture, Activating Neural Network using Forward Propagation, Introduction to Back Propagation, Train Neural Network via Back Propagation.	8	CO5

[7]	Introduction to Principal Component Analysis, steps for PCA Algorithm, Features Transformation, PCA using Python.	5	CO5
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### C. TEXT BOOKS

1. Sebastian Raschka, *Python Machine Learning* ; Packt Publication
2. GK Gupta, *Introduction to Data Mining with Case Study*
3. Peter Harrington, *Machine Learning in Action*; Dreamtech Press

### D. REFERENCE BOOKS

1. Stephen Marsland, *Machine Learning Algorithmic Perspective*
2. Shai Shalev-Sharwts, Shai Ben-David, *Understanding Machine Learning from Theory to Algorithm* ; Cambridge University Press
3. Tom M Mitchell, *Machine Learning*; McGraw Hill
4. I H Witten, Eibe Frank, Mark A Hall, *Data Mining: A Practical Machine Learning Tools and techniques*; 3rd ed.; Elsevier

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Describe the basic machine learning concept and perform data preprocessing operations
CO2	Understand	Distinguish between Supervised and Unsupervised learning techniques
CO3	Apply	Apply classification and regression techniques
CO4	Apply	Apply clustering and association rules techniques
CO5	Understand	Understand dimensionality reduction using principal component analysis and Neural Network fundamentals.
CO6	Evaluate	Demonstrate Python libraries for machine learning and implement basic machine learning algorithms using Python.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	1	-	-	2	-	2	-	2	3	2	-	2
CO2	2	2	3	3	-	-	2	-	2	3	2	-	2
CO3	2	3	3	3	3	-	3	-	3	2	3	-	2
CO4	3	3	3	3	3	-	3	-	2	2	2	-	2
CO5	2	2	1	-	1	-	-	-	-	1	-	-	2
CO6	3	1	3	3	3	-	2	-	3	1	3	-	2
Avg	2.33	2	2.16	2	2	-	2	-	2	2	2	-	2

**MCA SEMESTER – III**  
**SUBJECT : ASP.NET PROGRAMMING WITH C#**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course introduces console applications, windows form applications and web applications using C# programming language. Learners will be able to develop data centric web applications using ASP.NET technology on Visual Studio IDE.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	Cos
[1]	The Evolution of Web Development: Active Server Page (ASP).NET, Server-Side and Client Side Programming, The .NET Framework: CLR, The .NET Class Library, Features of Visual Studio .NET.	5	CO1 CO3
[2]	Variables, Data Types, Flow Control, Enumeration, Arrays, Namespaces, Main() Method, Compiling C# File, Console I/O, Comments, Rules for Identifiers, Class Members, Inheritance: Types, Implementation, Abstract Class, Sealed Class, Modifiers, Interfaces Operators, Type Safety, Comparing Objects for Equality, User-Define Casts Advanced C#: Memory Management, Feeing Unmanaged Resources, Unsafe Code, String Class, Error and Exception Handling, Delegates and Events.	7	CO2 CO3
[3]	Creating Windows Form Applications, Control Class, Size and Location, Appearance, User Interaction, Windows Functionality, Class Hierarchy Standard Controls and Components: Button, Checkbox, Combobox, Listbox, Datetimepicker, Error Provider, Help Provider, Image List, Label, Listview, Panel, PictureBox, Progressbar, Radio Button, Taxtbox, Richtxtbox, Splitter, Statusbar, Tabcontrol, Tabpages, Menu, Toolbar, Form Class.	10	CO3
[4]	Creating Website Using Visual Studio, Designing A Web Page, Anatomy of Webform, Writing Code, Debugging, Anatomy of ASP.NET Application, Introduction of Server Controls, Page Class, Configuring ASP.NET Application, Basic Web Control Classes, Web Control Tags, Webcontrol Base Class, The Default Button, List Controls, Web Control Events, Autopostback, Page Life Cycle, Validation Controls, Calendar and Adrotator Control State Management: View State, Transferring Information between Pages, Cookies, Session State, Configure Session, Application State, Comparison of State Management Options.	10	CO2 CO5
[5]	Configure Database, Basic SQL in Visual Studio, Data Provider Model, Direct Data Access, Disconnected Data Access Data Binding: Single Value Databind, Repeated Value Data Bind, Working with Data Source Controls, Gridview, Details View, Form View.	8	CO2 CO5
[6]	XML Basics, Attributes, Comments, XML Display and Transform XML Web Controls, Introduction to AJAX, Script Manager, Update	4	CO2 CO4

	Panel, Progressbar, Timer.		CO5
[7]	History of MVC, Principles, MVC Pattern Flow, Advantages of MVC, Webforms and MVC in ASP.NET, Programming Model, Main Elements, Relation between ASP.NET, ASP.Net Webforms and ASP.NET MVC, Implementation of MVC in ASP.NET, ASP.NET MVC Project, Examining the Solution Structure, Test Projects, Demonstration of MVC in ASP.NET.	8	CO2 CO5
[8]	Introduction, WCF vs. ASP.NET Web API, Scenarios, Security, RESTful Service, Identification of Resources, Manipulation of Resources, Self-Descriptive Messages, Hypermedia, Implementing and Consuming an ASP.NET Web API.	8	CO5

### C. TEXT BOOKS

1. Robinson, Nagel, Watson, Glynn, Skinner, Evjen, *Professional C#*; 3rd ed.; Wrox –Wiley Publication
2. Matthew Macdonald, *Beginning ASP.NET 4.5 In C#*; APRESS
3. Chiaretta & Nayyeri, *Beginning ASP.NET MVC 1.0*; Wrox –Wiley Publication
4. Badrinarayanan Lakshmiraghavan, *Pro ASP.NET Web API Security Securing ASP.NET Web API*; Apress

### D. REFERENCE BOOKS

1. Evjen, *Professional ASP.NET 4 In C# And VB*; Wrox –Wiley Publication
2. Matthew Macdonald, *Professional ASP.NET 3.5 In C# 2008*; APRESS

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand .NET Framework Architecture and Features
CO2	Apply	Develop Database Driven MultiTier ASP.Net Web Applications
CO3	Create	Develop Windows Applications using C# Language and .NET Framework Controls
CO4	Apply	Demonstrate use of Ajax Controls, Xml And Xml Schema Definition in .NET Applications
CO5	Create	Develop MVC based application and implement Web API

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	-	1	1	-	-	1	-	-	-	1	-	3
CO2	2	3	3	3	3	3	2	-	2	-	2	-	2
CO3	2	2	3	2	3	3	3	-	3	-	3	-	2
CO4	1	2	1	2	1	1	1	-	2	-	1	-	3
CO5	2	3	2	2	3	3	3	-	3	-	3	-	2
Avg	2	2	2	2	2	2	2	-	2	-	2	-	2.4

**MCA SEMESTER – III**  
**SUBJECT : BIG DATA ANALYTICS**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course gives an overview of technologies used for Big Data storage, retrieval and its processing. It covers working with Apache Hadoop, Map Reduce, programming tools PIG & HIVE in Hadoop ecosystem.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	Cos
[1]	Big Data and Its Importance, Big Data Characteristics, Types of Big Data, Differentiate: Traditional and Big Data Approach, Traditional Data Warehouse Approach, Big Data Approach, Advantages of Big Data Analytics, Big Data Applications, Overview of Data Analytics Life Cycle.	5	CO1
[2]	Introduction to Hadoop, Core Hadoop Components: HDFS, Hadoop Common Package, MapReduce, YARN, Overview of Hadoop Ecosystem: Hbase, Hive, HCatalog, Pig, Sqoop, Oozie, Mahout, ZooKeeper, Physical Architecture, Comparing SQL Data Bases and Hadoop, Hadoop Limitations.	7	CO2
[3]	Distributed File Systems, Physical Organization of Compute Nodes, Large Scale File-System Organization, Grouping by Key, Coping with Node Failures Anatomy of Map Reduce Program: Hadoop Data Types, Mapper, Reducer, Partitioner- Redirecting Output from Mapper, Combiner - Local Reduce, Word Counting Example with Predefined Mapper and Reducer Class Map Reduce Patterns: Count, Min, Max, Average, Top N, Filter, Distinct, Sorting, Joins Algorithms Using Map Reduce: Matrix Multiplication, Relational Operators (Selection, Projection, Union, Intersection), Computing Natural Join, Grouping and Aggregation.	15	CO5
[4]	The Design of HDFS, HDFS Concepts: Blocks, Name Node, Data Node, Block Caching, Command Line Interface, Basic File System Operations, Hadoop File Systems, Interfaces, The Java Interface: Reading data, Writing Data, Directories, Querying the File System, Deleting Data, Data Flow: Anatomy of File Read, Anatomy of File Write, Coherency Model, Parallel Copying With distcp.	10	CO3 CO4
[5]	Apache Sqoop: Getting Sqoop, Sqoop Connectors, A Sample Import, Working With Imported Data, Imported Data and Hive, A Sample Export.	5	CO3 CO4
[6]	Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators.	6	CO3 CO4
[7]	Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined	7	CO3 CO4

	Functions.		
[8]	Hbase : HBasics, Concepts, Clients, Example, Differentiate: Hbase and RDBMS.	5	CO3

### C. TEXT BOOKS

1. Arshdeep Bahga & Madisetti, *Big Data Science and Analytics - A Hands On Approach*;
2. Tom White,,*Hadoop: The Definitive Guide*; 4th ed.; O'Reilly Media
3. Chuck Lam , Manning, *Hadoop in Action*
4. Radha Shankarmani, M Vijayalakshmi , *Big Data Analytics*; 2nd ed.; Wiley

### D. REFERENCE BOOKS

1. Venkat Ankam, *Big Data Analytics*; Packt Publishing Ltd.,
2. Seema Acharya, Subhashini Chhellaappan, *Big Data and Analytics*; Wiley
3. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, and Marcia Kaufman, *Big Data for Dummies*
4. EMC Education Services, *Data Science & Big Data Analytics Discovering, Analyzing, Visualizing and Presenting Data*; Wiley

### E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand the fundamentals of Big Data Analytics
CO2	Understand	Explain working of Hadoop ecosystem.
CO3	Understand	Differentiate various big data technologies like Hadoop, MapReduce, Sqoop, Pig, Hive, Hbase.
CO4	Apply	Develop Big Data solutions using Hadoop ecosystem
CO5	Apply	Apply Map Reduce programming model to access and process data on Distributed File System.

### F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	1	2	2	-	-	2	-	2	-	1	-	3
CO2	2	1	2	2	1	-	2	-	2	-	1	-	3
CO3	2	2	-	2	3	-	2	-	2	-	2	-	2
CO4	2	3	3	2	3	-	2	-	2	-	3	-	1
CO5	2	3	3	2	3	-	2	-	2	-	3	-	1
Avg	2	2	2	2	2	-	2	-	2	-	2	-	2



**MCA SEMESTER – III**  
**SUBJECT : ADVANCED JAVA PROGRAMMING**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
4	-	2	6	5	60	40	25	25	150

### A. COURSE OVERVIEW

This course provides the knowledge necessary to understand J2EE architecture and develop dynamic web pages using java servlets and java server pages. It enables learners to develop data centric Web Application using Hibernate. Learners will understand how to develop RESTful web services using Java.

### B. COURSE CONTENT

NO	TOPIC	L+T (hrs)	COs
[1]	Introduction to J2EE Platform, Challenges and Requirements for Enterprise Application Development, Introduction to Enterprise Architecture Styles, J2EE Container Architectures, J2EE Server and Containers, J2EE Architecture, Introduction to Web Containers and microservices.	10	CO1 CO2
[2]	Introduction to Java Servlet, Servlet Lifecycle, Servlet Implementations, Servlet Configuration, Servlet Exceptions, Requests & Responses, Servlet Session Tracking, Servlet Context & Collaboration, Introduction to Events and Event Handling [Context Level Events and Session Level Events] Introduction to Filter: Filter and Filter Chain, Filter API, Deployment Descriptor for Filter, Sample Filter in Web Application.	14	CO1 CO2 CO3
[3]	Introduction, JSP Directives, Scripting Elements, Introduction to Java Beans, Standard JSP Actions, JSP Implicit Objects, Scopes, Expression Language, JSP Tag Extensions: Tag Handlers, Library Descriptors, using with JSP Page, Deploying and Packing, Integrating JSPTL into JSP Pages, Introduction to XML and XML Usage, Developing MVC Application Using Servlets, JSP and POJO Beans.	12	CO1 CO2 CO3
[4]	Define REST, Restful Architecture, Restful Clients, Accessing Restful Services, Restful Web Service Design, Introduction to JAX-RS and Jersey, Annotations, Web Service Architecture, Implementation with JAX-RS – Jersey, Securing Web Service, Performance	12	CO2 CO5
[5]	Understanding Persistence and Paradigm Mismatch, Introduction to Object-Relational Mapping, Java Hibernate, Hibernate Architecture, Hibernate Object Life Cycle, Hibernate Configuration File and Mapping Files, Working with Hibernate Objects, Session Operations, Hibernate Strategies, Mapping of Relations, Introduction to Fetching Strategies, Querying Using HQL.	12	CO2 CO3 CO4

### C. TEXT BOOKS

1. Subrahmanyam Allamaraju, Cedric Buest, Daniel O'Connor Et Al. *Professional Java Server Programming J2EE 1.3 Edition*; Apress Publications.
2. Jose Sandoval, *Restful Java Web Services*; Packt Publication.
3. Christian Bauer, Gavin King, Manning, *Hibernate in Action*.



## D. REFERENCE BOOKS

1. *Java Server Programming Java EE 7 (J2EE 1.7) Black Book*; Dreamtech Press
2. Daniel O'Connor, Gordon Van Huizen, Jason Diamond Et Al, *Professional Java Server Programming J2EE Edition*; Wrox Publications.
3. Bryan Basham, Kathy Sierra, Bert Bates, *Head First Servlet and JSP*; O'Reilly Publication

## E. COURSE OUTCOMES

CO Number	Skill	Statement
CO1	Understand	Understand Components of Advanced JAVA Technology: Servlet, JSP and Java Bean
CO2	Apply	Work with Web Containers
CO3	Create	Develop & Deploy Database Driven Multitier Enterprise Applications Using J2EE
CO4	Apply	Map classes and object association to relational database with hibernate
CO5	Apply	Demonstrate RESTful API using Java's JAX-RS framework.

## F. COURSE MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	2	2	2	-	2	-	2	-	1	-	2	-	2
CO2	2	2	1	-	3	-	2	-	2	-	2	-	2
CO3	3	2	3	-	3	-	2	-	3	-	3	-	2
CO4	2	2	2	-	1	-	2	-	2	-	2	-	2
CO5	1	2	2	-	2	-	2	-	2	-	1	-	2
Avg	2	2	2	-	2.2	-	2	-	2	-	2	-	2

**MCA SEMESTER – IV****SUBJECT : PROJECT**

Teaching Scheme (Hours/Week)				Credits	Examination Scheme				
Lect	Tut	Prac	Total		Ext	Sess.	TW	Prac	Total
-	-	40	40	20	-	-	300	400	700

**A. COURSE OVERVIEW**

The purpose of this course is to let the learners gain wholistic insight and practicum experience by building required technological solutions in the domain of Computer Science & Applications at industry/research organization. The learners will be expected to demonstrate and sharpen various skills in the domain of - existing & contemporary computer science & applications, communication, project management and report writing - individually and in team.

Upon successful course completion, for earning the academic credit, the learner will be required to submit a project report/dissertation about the work performed.

**E. COURSE OUTCOMES**

CO Number	Skill	Statement
CO1	Analyze	Critically formulate problem statement and analyze its requirements for a software/research problem
CO2	Apply	Design project/research timeline
CO3	Create	Prepare software/research design for the given requirements in context of current practices
CO4	Apply	Practice project development life cycle ethically
CO5	Create	Develop robust software/research solutions using modern tools, technologies and methodologies
CO6	Apply	Evaluate quality & performance of software/research outcomes

**F. COURSE MATRIX**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	1	3	3	2	2	2	3	3	3	2	-
CO2	2	2	3	1	2	1	2	3	3	2	3	2	-
CO3	3	3	3	3	3	2	3	2	3	3	3	2	-
CO4	2	1	2	2	2	3	3	3	1	2	3	2	-
CO5	3	2	3	3	3	2	3	2	2	3	3	2	-
CO6	2	1	2	3	2	3	2	1	2	2	3	2	-
Avg	2.5	2	2.3	2.5	2.5	2.1	2.5	2.1	2.3	2.5	3	2	-