COURSES OF STUDY FOR 2-YEAR (FOUR SEMESTER) M.C.A.

Table 3: Subject Combinations Allowed for M. C. A. Programme (80 Credits)

Core Course	General Elective/Discipline Elective	Skill Enhancement Course	Foundation Course
CC	GE/DC	SE	FC
11 Papers	3 Papers	1 Paper	1 Paper

Table 4: Semester wise Examination Structure for Mid Sem & End Sem Examinations:

Group Code	Paper Code	Papers	Credit	Mid Sem Theory (F.M.)	End Sem Theory (F.M.)	End Semester Practical / Viva Theory (F.M.)
SEM I						
FC	FCMCA101	Computer System Architecture	5	30	70	
C1	CCMCA102	Programming Concepts Using Java	5	30	70	
C2	CCMCA103	Introduction to Management System	5	30	70	
C3	CPMCA104	A. Web Technology B. Java	5	30		70
SEM II						
SE-1	ECMCA201	Analysis of Algorithm and Data Structure	5	30	70	
C4	CCMCA202	Software Engineering	5	30	70	
C5	CCMCA203	Optimization Techniques	5	30	70	
C6	CPMCA204	Lab Based on ASP.Net and Case Tools	5	30		70
SEM III						
GE-1	CCMCA301	A. Automata Theory B. E-Commerce C. Networking Security and Cryptography D. PHP	5	30	70	
C7	CCMCA302	Soft Computing and Neural Network	5	30	70	
C8	CCMCA303	Data Science Using Python	5	30	70	
C9	CPMCA304	Lab Based On Python	5	30		70
SEM IV						
GE-II	ECMCA401	A. Numerical and Statistical Methods B. Management For IT Industries C. Cloud Computing D. CodeIgniter	5	30	70	
GE -III	ECMCA402	A. R B. Enterprise Resource Planning C. Mobile Computing With Android System D. Internet of Things	5	30	70	
C10	CCMCA403	Computer Graphics	5	30	70	
C 11	PRMCA404	Final Project/Internship	5			100
			80	450	840	310

Note:

1. **There are four papers in electives out of which one to be selected. Regular classes will be arranged for each paper opted by minimum of 30 students.**

SEMESTER I

I. COMPULSORY FOUNDATION COURSE: FC(FCMCA101)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for
Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

COMPUTER SYSTEM ARCHITECTURE

Theory: 60 Lectures; Tutorial: 15 Hours

GROUP A

COMPUTER ARCHITECTURE

Unit I - Parts Of A Computer: Processor (CPU), Memory Subsystem, Peripheral Subsystem. The Memory Interface: Memory Subsystem, Hierarchy of Memory: Static RAM, DRAM Magnetic and Optical Disks. On–Chip and Off–Chip Cache Memories, Redundant Arrays of Independent Disks (RAID). Parts of The Interfaces Integrated with the Processor. Parts of the Processor: Data Path and Control Path.

Unit II - Instruction Set Formats: General – Purpose Register Architecture (The Classic RISC) and Accumulator Architecture, Zero – Address Instructions and The Stack Architecture, Two – Address Instructions.

Unit III - Introductory Machine: Modern Computer Design, Machines Dating Back to the 1980's, Reduced Instruction Set Computers (RISC), Complex Instruction Set Computers (CISC). Flip Flops, Edge- Triggered D-Flip Flops and Sequential Circuits. Implementation of Data – Path and Control.

Unit IV- Pipelining And Peripherals: Parallel Processing, Pipelining, Instruction Pipeline, Difficulties with Pipeline : Structural, Data and Branch Hazards. Branch Prediction, Interconnecting Peripherals with Memory and Processor.

GROUP B

OPERATING SYSTEM

Unit I- Introduction: OS and the Computer System, Classes of Operating Systems, Processes and Programs, Threads, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Real Time Scheduling, Scheduling in Unix, Scheduling in Linux, Scheduling in Windows. Basic Commands of LINUX Shell: pwd, cd, mkdir, rmdir, ls.

Unit II - Memory Management: Static and Dynamic Memory Allocation, Contiguous and Non contiguous Memory Allocation, Paging, Segmentation, Relocation, Linking. Virtual Memory: Demand Paging, Page Replacement Policies, Shared Pages, Segmentation.

Unit III - File Systems: Files and File Operations, Allocation of Disk Space, Implementing File Access, File Sharing Semantics, File System Reliability, Virtual File System. File System in UNIX, Linux and Windows. Security and Protection: Encryption, Authentication and Password. Basic shell commands in LINUX : cat, cp, rm, mv, more, wc, cmp, comm, diff, chmod, vi editor**.**

Reference Books:

1. Morish Mano, Computer System and Architecture PHI.
2. Galgotia, Modern Computer Architecture, Computer Systems Organisation and Architecture, John D. Carpinelli, Pearson
3. P.V.S. Rao , Computer System Architecture, , PHI
4. B.Ram Computer Fundamentals-Architecture and Organization, New Age International.
5. D.M. Dhamdhere- Operating Systems: A Concept-Based Approach, TMH,
6. A. Silberschatz et.al-Operating System Concepts, 6thEdn, John Wiley, Indian Reprint.
7. H.M .Deitel-Operating Systems, 2ndEdn, Pearson Education.
8. A.S. Tanenbaum-Operating System: Design and Implementation, PHI, New Delhi.
9. Y. Kanetkar,UNIX Shell Programming, BPB.
10. Sumitabha Das UNIX Concepts & Applications, Tata McGraw Hills.

II. CORE COURSE : C 1 (CCMCA102) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

PROGRAMMING CONCEPTS USING JAVA

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Fundamentals of Java programming: Introduction to Object Oriented Programming Language, Difference with C and C++. Introduction to Java, Basic features of Java, Java Architecture, JDK Tools, Java standard Library (JSL), Keywords, Identifiers Data Types, Operators, Precedence Summary, Punctuation Symbols Unicode Characters. Condition and looping control statements for, for each, break continue

Unit II- Class and Object: Declaring a Class, Creating an Object, Methods, Exploring New Operator, constructor its types, Finalizes, this Keyword, Access Specifies, Recursion, Inheritance, Polymorphism, Overriding Methods, Runtime Polymorphism, Implementing Abstract classes, packages and interfaces.

Unit III- String: Concatenation and Changing Case, Sub strings Data Conversion String Buffer, Types of Array, Array of Objects, Wrapper Class, Vector Class, Exception Handling and Threads: Syntax for Exception Handling Mechanism, User Defined Introduction to Threads, Multi - tasking and Multi – threading, Exception handling.

Unit IV- File input and Output: File Class, Byte Stream Classes Reading from and Writing to a File, Character Stream Classes, Random Access File, Sequence Input Stream, Binary files. Data Base Connectivity: ODBC API, JDBC Application Architecture, Java. SQL, Obtaining a connection, step connecting Object, Working with Result, statement, Set Meta Data Interface.

Unit V – Advance JAVA : Introduction of web application and execution method, Introduction to Servlet JSP, MVC architechture, Designing a View Component, Designing a Model Component, Designing a Controller Component, Web container behavior, Dispatch from a controller servlet to a view servlet, Deploy a web application, Describe the purpose of Session management, Cookies implementation of session management, URL-rewriting, Filter API, Filter class, Configure a filter in deployment descripter file.

Unit VI – Java Data Base Connectivity: Design a web application to integrate with a DBMS, Configure a DataSource and JNDI API, JSP technology, Scripting elements, Page directive, Standard tags, Describe and implement expression language (EL)

Unit VII – Introduction to EJB: The Features of Enterprise Javabeans ,Various Components of EJB Architecture, Roles and Responsibilities Provided by EJB Specification, Different Types of Enterprise Javabeans, Components of Enterprise Javabeans, Create and Deploy Stateless Session Beans, Create Applications Using Stateless Session Beans.

Reference Books:

1. Richard A. Jhonson, "An Introduction to Java Programming and Object Oriented Application Development" . Detail-Java How to Program, Pearson Education, New Delhi.
2. E. Balagurusamy, Java Programming, TMH, New Delhi, 2005.
3. James M. Sleek, Programming and Problem Solving with Java, Thomson Learning, Indian Edition,
4. P.V.S. Rao, Computer system architecture, PHI
5. Herbert Schildt, The Complete Reference, TMH

III. CORE COURSE: C 2 (CCMCA103) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

INTRODUCTION TO MANAGEMENT SYSTEM

Theory: 60 Lectures; Tutorial: 15 Hours

GROUP A

INTRODUCTION TO MANAGEMENT CONCEPTS

Unit I: Introduction To Management & Organisational Behaviour

Management: Nature & Concept of Management; Evolution of Management Thought; Functions of Management, Organisational Behaviour: Nature and Concept, Personality, Motivation, Leadership, Group Dynamics, Conflict Management, Stress Management.

Unit II: Effective Communication Skills

Basics of Communication: Meaning and Definition, Objectives, Principles of Effective Communication, Flow of Communication, Types of Communication, Barriers to Communication. Channels of Communication: Verbal and Non-verbal Communication, Communication Network, Official Correspondence, Resume Preparation, Interview, Soft Skills: Extempore, Group Discussion and Presentation.

Unit III: Basics of Accounting & Finance

Basic Concepts of Accounting: Meaning and Definition, Objectives and Functions of Accounting, Accounting Principles, Concepts and Conventions, Double Entry System, Journal Entry, Ledger Posting, Trial Balance, Final Account and Tally ERP. Overview of Indian Financial System, Financial Market: Money Market and Capital Market, Primary Market and Secondary Market, Financial Instruments, Overview of Indian Banking System.

GROUP B

DATABASE MANAGEMENT SYSTEM(DBMS)

Unit I - Introduction: Data Models, Conceptual Model, ER Model, UML Logical Data Model, Relational Data Model, Network Data Model, Hierarchical Data Model, Object Oriented Data Model. Relational Database Design: Schema Design, Normalization Theory, Functional Dependencies, Higher Normal Forms, Integrity Rules, Relational Operators.

Unit II - Database System Architecture: Centralized Systems, Client-Server Systems, Parallel Systems, Distributed Systems, Network Types. Concurrency Control, Recovery Mechanisms, Integrity, Views & Security, Integrity Constraints, Views Management, Data Security.

Unit III - Advanced Topics: Distributed Databases, Parallel Database, Temporal And Spatial Databases. Big Data Systems: Types Of Big Data, Big Data Architecture, Querying In NOSQL.

Unit IV - Data Mining: Introduction to Data Mining, Knowledge Discovery Process, Counting Co-Occurrence, Iceberg Queries, Mining For Rules, Association, Clustering, Classification and Regression Rules. Data Warehousing Architecture, Data Warehouse Scheme On-Line Analytical Processing (OLAP), Multi Dimensional Data Model, Metadata.

Unit V - Case Study: Oracle, MySQL & NoSQL Packages: Understanding The Transaction Processing Concurrency And Recovery Protocols, Query Processing And Optimization Mechanisms.

Reference Books:

1. Koontz and Weihrich , Management :Global Perspectives
2. Prasad, L.M., Principles and Practices of Management, Sultan Chand & Sons
3. Bhole L.M. & Jitendra Mahakud, Financial Institutions and Markets, McGraw Hill Publication, India
4. Machchhiraju H.R., Indian Financial System, Vikas Bharti Publication
5. Silberschtz, Korth And Sudershan, Database System Concept,.
6. C.J.Date, A.Kannan, S.Swamynathan, An Introduction To Database System, Pearson
7. Database Modelling And Design, Tobyteorey, Samlightstone, Tomnodeau, Elsevier
8. Elmasri & Navathe, Fundamental Of Database System, Fourth Edition, Pearson, Principal of James Martin, Database Management, PHI,
9. Ramkrishnan, Gohrke, Database Management System, McGrawhill,

IV. CORE COURSE: C 3 (CPMCA104) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Semester Internal Assessment (SIA):

*There will be **two** questions in Practical Examination of 3Hrs.out of which **any one** is to be answered. The questions in practical examination will be of equal to 20 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce.*

End Semester Practical Examination (ESE Pr):

***Lab**: There will be **four** questions in Practical Examination of 3Hrs.out of which **any two** are to be answered. Student have to Answer the given questions on Answer booklet and execute the answered programs/steps in computer with standard output.*

The questions in practical examination will be of equal to 50 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

***Assignment**: The Assignment should be hand written (preferred)/ typed in A4 size paper. First three pages (i.e. front page + acknowledgment + index) & Bibliography may be printout. No Xerox copy is allowed.*

(A) WEB TECHNOLOGY Practical: 30 Lectures; Tutorial: 7 Hours

Unit I- Introduction: HTML5 tags, paired & singular tags (html, head, title, meta, links, body, h1, h2, h3, h4 , h5, h6, i, b, u, em, p, br, hr, a, img, table, thead, tbody, th, tr, td, ol, ul, dl, li, span, div, blockquate, q, abbr, cite, code, pre small, mark, del, ins, sub, sup, video, audio, iframe, object, canvas, form, input, button, label, select, textarea, fieldset)

Unit II- Introduction to CSS3: Importing style sheet, Inline CSS, Internal CSS, External CSS, CSS Units, CSS Attributes - margin, padding, width, height, min-width, min-height, border, font, line-height, text, float, align, flexbox, color, background, display, position, overflow, opacity, pseudo classes, animations), Transformations, 3D transformations, Transitions, Box Sizing, Shadows

Unit III- Introduction to Bootstrap: Container, Grid System, Typography, Colors, Tables, Images, Jumbotron, Alerts, Buttons & Button-groups, Badges, Progress Bars, Spinners, Pagination, List Groups, Cards, Dropdowns, Collapse, Navs, Navbar, Forms, Inputs & Input Groups, Carousel, Modal, Tooltip, Popover, Toast, Scrollspy, Flex, Utilities, Filters.

Unit IV- Introduction to jQuery & Angular JS: Syntax, Selectors, Events, Effects, jQuery Traversing, jQuery HTML, jQuery AJAX, jQuery Filters. Angular JS: Angular Directives, Model, Data Binding, Controller, Events.

Unit V- Introduction to HTML5: The canvas, Audio and video, Forms, Location storage, Web workers, Web applications, Microdata, Creating and accessing a canvas, Writing text to canvas, Using paths, Filling areas, Clip method, The is Point In Path method, Working with curves, Manipulating images, Editing at pixel level, Advanced graphical Effects, Transformations.

(B) JAVA **Practical: 30 Lectures; Tutorial: 8 Hours**

Write a program in Java for following:

1. To illustrate Arithmetic, Relational, Boolean, Bitwise, Shift Operators.
2. To illustrate Precedence Rule.
3. To use "If-else" & "Switch Cases"
4. To use "For Loop" , "While Loop" & "Do- While loop".
5. To use "Break" & "Labeled Break" .
6. For class declaration & object initialization.
7. For calculating "simple interest" using class, object & methods.
8. For method overloading.
9. For finding volume of cuboid by using Constructor & Parameterized Constructors.
10. For Static initialization block, Instance initialization block & Constructor.
11. For creation, initialization, setting values and then sorting in 1 dimension array
12. For matrix multiplication.
13. For Nested classes.
14. For method of overriding.
15. For Inheritance.
16. For Encapsulation.
17. For Abstract Class & Abstract Methods.
18. For class implementing interface.
19. For using inbuilt packages. E.g. Fact, Static, Import etc.
20. For Wrapper classes.
21. For Declaration, Creation, Finding Length, Comparison, Region Matching, Index of Character, occurrence of particular string, character at particular position, Test for Equality related to string.
22. For Try-Catch, Multiple Catch, Throw & Rethrow Exception, Finally, User Defined Exception, Exception Encapsulation.
23. For creating Thread.
24. File Handling
25. Database Connectivity
26. Programming with the Java Tools: Javaap, Jcmd, Jhat, Jdb, Jar
27. Java API Components AWT to create Components, Containers- window, frame, dialog, panel.
28. Swing J components Class, Dialog boxes, Panels, Labels, Checkboxes, Menus, Toolbars and Actions, Sliders, Spinners, Progress bars, Scrollbars, List and Combo boxes, Text-

entry Components, Colour and File Choosers, Tables and Trees, Printing with 2D API, Java Print Service API.

29. JDBC Drivers for RDBMS, SQL to Java type Mapping, Use of **java.sql**
30. XML structure, XML example document, Node interface, Document Node Methods, Element Node properties, Text Nodes. Parsing an XML Document with DOM tree, Generating an XML document with DOM, Validating XML Documents using DTD and XML schema, Transforming XML using XSLT.
31. Introduction, Working with URL connections, URL encoders and decoders.
32. Application Packaging, Servlets, The Servlet API, The User Experience, Building a Web App with Continuity, Framework for Building Web Applications, Building Robust Web Apps.
33. Developing a simple Bean, create a source file for the new Bean, Create an instance of the colour Bean, Bean interfaces, Message Driven Beans, EJB-Based Application.

Reference Books:

1. David karlins, Dreamweaver CSS.5 Mobile and Web Development with HTML5, CSS3, and JQuery, SPD
2. Richard C.LEE, William M. tepfenhart, UML and C++, PHI
3. E. Balagurusamy, Java Programming, TMH, New Delhi, 2005.
4. James M. Sleek, Programming and Problem Solving with Java, Thomson Learning, Indian Edition

SEMESTER II

I. SKILL ENHANCEMENT COURSE: SE - 1(ECMCA201) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

ANALYSIS OF ALGORITHM AND DATA STRUCTURE

Theory: 60 Lectures; Tutorial: 15 Hours

GROUP A

ANALYSIS OF ALGORITHM

Unit I - Elementary Algorithmic & Asymptotic Notation: The Efficiency of Algorithms, Average and Worst-Case Analyses, Amortized Analysis, A Notation For "The Order Of", Asymptotic Notations: Conditional, With Parameters, Operations: Asymptotic Notation.

Unit II - Algorithms: Greedy Algorithm's: Characteristics, Graphs: Minimum Spanning Trees, Shortest Paths, The Knapsack Problem, Scheduling Concepts.
Divide-And-Conquer: Multiplying Large Integers, Binary Search, Sorting, Finding the Median, Matrix Multiplication, Exponentiation.

Unit III - Dynamic Programming: Calculation of Binomial Coefficient, The World Series,

Making Change, The Principle of Optimality, The Knapsack Problem, Shortest Paths, Chained Matrix Multiplication.

GROUP B

DATA STRUCTURE

Unit I - Array and Linked Applications: Array and Linked list and the applications. Stack Array Implementation and Linked List Implementation, Applications of Stack, Stack ADT, Queue: Array Implementation and Linked Implementation, Applications of queue, Queue ADT. Recursion**:** Factorial numbers, Fibonacci numbers, Towers of Hanoi.

Unit II- Trees Concepts: Basic Tree Concepts, Binary Trees, Operations of Binary Tree. Binary Search Trees, AVL Trees, AVL Tree Implementation, AVL Abstract Data Type.

Heap Definition, Heap Structure, Basic Heap Algorithms, Heap Data Structure, Heap Algorithms, Heap Applications. M-Way Search Trees, B-Trees, Simplified B-Trees.

Unit III - Searching & Sorting Concepts: List Searches, Hashed List Searches, Collision Resolution. General Sort Concepts, Insertion Sorts, Selection Sorts, Exchange Sorts, External Sorts.

Reference Books:

1. E. Horowitz. et.al., Fundamentals of Computer Algorithms, Galgotia Publication Pvt. Ltd., New Delhi.
2. S. Sahani et.al – Data Structures, Algorithms and Applications in C++ ,Universities Press.
3. J. Kleinberg & E. Tardos, Algorithm Design, Pearson Education, New Delhi.
4. T.H. Cormen et.al., Introduction to Algorithms – PHI, New Delhi.
5. G Brassard & P Bratley - Fundamentals of Algorithmics PHI, New Delhi.
6. S. Dasgupta et.al., Algorithm, TMH, New Delhi
7. R.F.Gilberg & B.A. Forouzan, Data Structures: A Pseudocode Approach with C++, 2nd Edn, Brooks/Cole-Thomson Learning, Indian Reprint.
8. E.Horowitz, Fundamentals of Data Structures in C++, Galgotia Publication, New Delhi
9. M.T.Goodrich, Data Structures and Algorithms in C++, John Wiley, Inc. Indian
10. Anuj Bhardwaj & Parag Verma, Design & Analysis of Algorithm, Narosa Publication

II. CORE COURSE: C 4 (CCMCA202) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

SOFTWARE ENGINEERING

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I - Basics : Evolving Role of Software, Changing Nature of Software, Legacy Software, Software Engineering – A layered Technology.

Unit II – Process Model : Process Frame work, Process Patterns, Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Unified Process Model, Agile Process Model.

Unit III- Requirement Engineering: An approach to design and construction, Requirement specification, Initiating the Requirement Engineering Process, Functional and Non Functional Requirements, Developing Use case, Building the Analysis Model, Negotiating Requirements, Validating Requirements.

Unit IV- Design Engineering: Design Process Approaches, Design Concepts, Quality, Design Models, Pattern Based Software Design. Cohesion and Coupling, Software Design Object oriented vs Function Oriented designs. User Interface Design –Input and Output Interfaces, Component –Based GUI Development, a User Interface design Methodology

Unit V: Testing Strategies and Testing Tactics: Strategic Approach to software Testing, Test Strategies for conventional and Object Oriented Software, Validation

Testing System Testing, White Box Testing, Basis Path Testing Control Structure Testing, Black Box Testing, Object Oriented Testing Methods. Test coverages, Test plan

Unit VI- Metric for process and Estimation Techniques: Process metrics, Software Measurement, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Estimation for Object Oriented Projects Specialized Estimation Techniques, COCOMO models.

Unit VII- Software Quality and Configuration Management: Quality Concepts, Software Quality Assurance, Software Reliability, Software Configuration Management, SCM Repository, SCM Process. Computer Aided Software Engineering (CASE) Tools, Types of CASE tools. Current trends in Software Engineering – Software engineering for projects and products. Introduction to web engineering and Agile process.

Reference Books:

1. Roger S. Pressiman, Software Engineering – A Practitioner's Approach, TMH, 7th Ed.
2. R. Fairley, Software Engineering – Concepts , TMH, 2nd Ed.
3. Rajib Mall, Software Engineering, PHI.
4. P. Jalote, An Integrated Approach to Software Engineering, Narosa.
5. R.Khurana, Software Engineering, Vikas Publishing House
6. Ian Sommerville, Software Engineering, 7thEdn., Pearson Education.

III. CORE COURSE: C 5 (CCMCA203) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

DISCRETE MATHEMATICS AND OPTIMIZATION TECHNIQUES

Theory: 60 Lectures; Tutorial: 15 Hours

GROUP A

DISCRETE MATHEMATICS

Unit I - Mathematical Logic: Propositions, Connectives, Equivalence of Formula, Well Formed Formula, Tautulogies, Principle Of Duality, Logic Gates & Units, Normal Form, Rule Of Inference, The Predicate Calculus.

Unit II - Relation & Function: Product Sets, Partition, Binary Relation in a Set, Domain & Range, The Matrix of Relation & Digraph, Path in Relation & Digraph, Boolean Matrices, Adjacency Matrix of a Relation, Properties of Relation, Equivalence Relation, Warshall's Algorithm. Sum & Product of Function, Types of Functions, Compositions of Function, Inverse of Functions, Hashing Function, Characteristic Function of a Set, Permutation Function.

Unit III - Lattice Theory: Partial Order Set- Hasse Diagram, Isomorphism, Duality, Product Of Two Sets, Lattice As Poset- Lattices As Algebraic System, Complete Lattice, Bounded Lattice, Sub Lattice.

GROUP B

OPTIMIZATION TECHNIQUES

Unit I- Introduction: Meaning & Definition of OR, Decision Making, Scope and Applications, Formulation of Linear Programming Problem,

Methods of L.P.P. : The Graphical Method **:** Definition, Graph of Linear Inequality, Graphical Method of Solution of Linear Programming Problems
The Simplex Method : Definition, Fundamental Theorem, General Formulation, Matrix Form, Standard Form, Maximisation, Minimization & Mixed Constraint Problems, Special Cases in Simplex Method.
Unit II: Transportation & Assignment Problems: Definition, Transportation Algorithm, Methods for Finding Initial Solution, Test for Optimality, Trans-shipment Problem. Introduction to Assignment Problem, Mathematical Model, Solution Methods of Assignment Problems, Cases in Assignment Problems, Travelling Salesman Problem.

Unit III - Decision Theory: Introduction, Different Criteria for Decision Making,
Decision Trees.
Unit IV- Project Management: Network Analysis Concept, Critical Path Analysis, Program Evaluation and Review Technique (PERT), Network Crashing (Time-Cost Trade-off), Updating Network.
Unit V- Computational Aspects of Optimization Techniques: Implementation of Optimization Techniques through Computer Programming, Solution of Optimization Technique through Existing Software.

Reference Books:

1. Discrete Mathematics With Graph Theory, S.K. Yadav, Ane's Books Pvt. Ltd.
2. Kolman, Busby, Ross, Rehmann: *Discrete Mathematical Structures*, 5/E, Pearson Education, 2006.
3. Discrete Mathematics, Swapan Kumar Chakraborty, Bikash Kantisarkar, Oxford University Press
4. R.K. Gupta, Operations Research, Krishna's Educational Publication
5. J.P. Singh, N.P. Singh- Operations Research, Ane's Books Pvt. Ltd.
6. Kanti Swarup, P.K. Gupta, Man Mohan, Operation Research, Sultan Chand & Sons, New Delhi
7. Ronald L. Rardin, Optimization in Operations Research, pearson Education, New Delhi.
8. Rao, Optimization Theory & Application, Wiley Eastern Ltd.

IV. CORE COURSE: C 6 (CPMCA204) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Semester Internal Assessment (SIA):

*There will be **two** questions in Practical Examination of 3Hrs.out of which **any one** is to be answered. The questions in practical examination will be of equal to 20 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce.*

End Semester Practical Examination (ESE Pr):

***Lab**: There will be **four** questions in Practical Examination of 3Hrs.out of which **any two** are to be answered. Student have to Answer the given questions on Answer booklet and execute the answered programs/steps in computer with standard output.*

The questions in practical examination will be of equal to 50 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

***Assignment**: The Assignment should be hand written (preferred)/ typed in A4 size paper. First three pages (i.e. front page + acknowledgment + index) & Bibliography may be printout. No Xerox copy is allowed.*

LAB BASED ON ASP. NET & CASE TOOLS

Practical: 60 Lectures; Tutorial: 15 Hours

Unit I - Web Application Programming Using ASP.NET : Web Application Architecture, Static Web Page, Application Life Cycle ,Dynamic Page, Page Life Cycle & Event Method, HTML & Server Control ,Server Control Event Life Cycle, State Management, URL Rewriting, Hidden Form Field, View State, Session, Cookies & Application. Global Class & Event Method.

Uploading & Downloading, Page Directives, Data Source, SQL Data Source, XML Data Source, Site Map Data Source & Object Data Source. Data Control, Data List, Details View, Form View, Grid View, List View & Repeater. Validation Control, Compare Validator, Custom Validator, Range Validator, Regular Expression Validator & Validation Summary. Navigation, Menu, Site Map Path & Tree View.

Login Control & Membership, Login, Login Name, Login Status, Login View, Password Recovery, Change Password, Create User Wizard. Ajax Extensions, Script Manager, Update Panel, Update Progress & Timer.

Globalization & localization. Master Page & Style them. Mail, SMTP, POP3

Unit II - MVC3: Introduction to MVC3, The Model-View-Controller Pattern, Differences Between, MVC and Web Forms Applications, Building a Simple MVC Application with Visual Studio Working with Controllers and Actions.

Introduction to Controllers: Using a Controller to Manage the Application, Controller Actions, Returning Action Results.
Creating MVC Models: Data and Business Rules in MVC Applications, Creating a Custom Data Model. Data Validation and Data Annotations, Using MVC Views, Views in ASP.NET MVC, Creating Views, Adding Content to a View, HTML Helpers and Action Filters ,Using HTML Helpers in MVC ,Creating a Custom Helper Using Action Filters, Creating a Custom Filter , Routing and URLs , Customizing Application URLs , Creating Route Constraints , Routing and Web Forms Using MVC and AJAX and JQuery ,Integrating Client-Side Script with MVC Using the MVC AJAX Helpers, Working with JSON Data.

Unit III - LINQ: Introduction to LINQ, LINQ expressions, Using via extension methods, Filtering Sorting, Aggregation, Skip and Take operators, Joins, Extension methods , Object initialization syntax, Anonymous type, Lambda expressions, Deferred Execution, Benefits and drawbacks , IEnumerable vs IQueryable , Using acrosstiers, Data Projection , Single result value , Existing types, Anonymous types, Grouping, LINQ to XML, New XML classes , Generating XML, Querying XML, Using data projection, Combining with XPath , LINQ to SQL, Attributes and mapping, Creating a Data Context, Deferred loading, Saving changes, Inserts and deletes , Transactions.

(B) LAB BASED ON CASE TOOLS

Unit IV: Case Tools: UML Diagram, Activity, Sequence, Collaboration, Deployment, State Machine, Class, Object, DFD.

Reference Books:

1. Beginning .Net 3.5 in c# and VB, Wrox
2. Bradley, Anitac & Mellspaugh, Programming in VB.net, Julia case, McGraw Hill
3. Adam Freeman, Pro ASP.NET MVC5, 5th edition, A Press Publication.
4. Black Book, .NET 4.5 programming (6-in-1) , Dreamtech Press.
5. Blaha & Rumbaugh, Object Oriented Modelling and Design with UML, Pearson
6. M.P. Matha, Object Oriented Analysis and Design Using UML, An Introduction to Unified Process and Design Patterns, PHI

SEMESTER III

I. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - 1(ECMCA301A)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

AUTOMATA THEORY

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Finite Automata : Finite Automata, capability & limitations of FSM, Deterministic Finite Automata , Non-Deterministic Finite Automata, NFA with e-moves, regular sets & regular expressions, Equivalence of DFA and NDFA, NFA from regular expressions, regular expressions from DFA, Moore versus Mealy m/c , Kleen's Theorem.

Unit II- Regular Languages & Regular Grammars : Regular Expressions- Formal Definition & Language associated with It. Criterion for Regularity, Relation between Regular expression & Regular Language , Closure properties of Regular Grammar. Identifying Non-regular Language using Pigeonhole Principle, Pumping Lemma.

Unit III - Context Free Grammars : Introduction, Definition, Regular Grammar, Derivation trees, Ambiguity, Simplified forms and Normal Forms, Applications.

Unit IV- Pushdown Automata : Definition, Moves, Instantaneous Descriptions, Language recognised by PDA, Deterministic PDA, Acceptance by final state & empty stack, Equivalence of PDA , Pumping lemma for CFL, Interaction and Complements of CFL,Decision algorithms.

Unit V- Turing Machines: Definition and examples, Computing Partial Functions with Turing Machine(TM), Combining TMs, Variations of TMs, Multi-tape TMs, Non-deterministic TM, Universal TM, Church Thesis.

Unit VI- Recursively Enumerable Languages: Recursively Enumerable and Recursive, Enumerating Language, Context Sensitive and Chomosky Hierarchy.

Unit VII - Unsolvable Problems and Computable Functions: Nonrecursive Language and unsolvable Problems, Halting Problem, Rice Theorem, Post Correspondence Problem.

Reference Books:

1. Hopcroft JE. And Ullman JD, Introduction to Automata Theory, Languages & Computation, Narosa..
2. K.L.P Mishra & N. Chandrasekharan , Theory of Computer Science, PHI
3. Peter Linz , An Introduction to Formal Language And Automat, Narosa
4. C.K. Nagpal, Formal Language & Automata Theory, Oxford University Press
5. Vivek Kulkarni, Theory of Computation, Oxford University Press
6. Dasradh Ramaiah K., Introduction to Automata Theory & Compiler Design, PHI

II. GENERAL / DISCIPLINE CENTRIC ELECTIVE : GE/DC - 1(ECMCA301B)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

E-COMMERCE

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction: Electronic Commerce, Scope of Electronic Commerce, Key Factors of E-Commerce, Benefits and Limitations of E-Commerce, E-Business, Difference Between E-Commerce and E-Business.

Unit II- Business Strategy In An Electronic Age: Value Chain, Supply Chain, Porter's Value Chain Model, Inter Organizational Value Chains, Competitive Advantage, Competitive Strategy. Porte's Model, First Mover Advantage, Competitive Advantage Using E-Commerce.

Unit III - Applications: Direct Marketing And Selling, Value Chain Integration, Supply Chain Integration, Corporate Purchasing, Home Shopping, Recruitment, Travel, On-Line Payment, Impact of E-Commerce, Security Issues in E-Commerce and Payment Settlement System.

Unit VI- Classification: Framework for E-Commerce, Classifications, Barriers to E-Commerce,

Unit V- Electronic Market: Markets, Electronic Markets, Usage of Electronic Markets, Advantages and Disadvantages of Electronic Market.

Unit VI- Electronic Data Interchange (EDI): Definition, Benefits, EDI Technology, EDI Communications, EDI Implementations, EDI Security, Internet: Internet, TCP/IP Internet Components.

Reference Books:

1. David Whitley, E-Commerce: Strategy, Technologies and Applications, TMH
2. Ravi Kalakota & Andre Whinston, Electronic Commerce: A Manager's Guide, Pearson Education
3. P.T. Joseph, E-Commerce: A Managerial Perspective, PHI

III. GENERAL / DISCIPLINE CENTRIC ELECTIVE : GE/DC - 1(ECMCA301C)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

NETWORK SECURITY AND CRYPTOGRAPHY

Theory: 60 Lectures; Tutorial: 15 Hours

(A) BASICS OF NETWORKING

Unit I - Fundamental concept of Communications Model, Protocol and Architecture: A Basic Protocol Architecture, OSI, The TCP/IP Protocol Architecture, Types of Networks.

Unit II - Communication Techniques: Transmission of Data: Analog and Digital Data, Guided and Wireless Transmission, Asynchronous and Synchronous Transmission.

Unit III - Multiplexing: Frequency Division Multiplexing, Synchronous Time Division Multiplexing, Statistical Time Division Multiplexing. Switching Networks, Circuit-Switching Networks, Circuit-Switching Concepts, Packet-Switching Principles, X.25, Frame Relay.

(B) SECURITY AND CRYPTOGRAPHY

Unit IV - Attacks on Computers and Computer Security: Introduction, The Need for Security, Security Approaches, Principles of Security, Types of Attacks.

Unit V - Cryptography- Concepts and Techniques: Introduction, Plain Text and Cipher Text, Symmetric and Asymmetric Key Cryptography, Steganography. Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES). Asymmetric Key Algorithms: Digital Signatures and RSA algorithm.

Unit VI - Internet Security Protocols: Introduction, Basic Concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer Protocol (SHTTP) , Time Stamping Protocol (TSP) , Secure Electronic Transaction (SET), SSL versus SET, 3-D Secure Protocol, Electronic Money, Email Security, Wireless Application Protocol (WAP) Security, Security in GSM, Security in 3G.

Unit VII - User Authentication and Kerberos: Introduction, Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Kerberos, Key Distribution Center (KDC), Digital Certificates, Private Key Management, Public Key Cryptography Standards (PKCS),

Unit VIII - Network Security, Firewalls and Virtual Private Networks (VPN): Introduction, Brief Introduction to TCP/IP, Firewalls, IP Security, Virtual Private Networks (VPN), Intrusion.

Reference Books:

1. W. Stallings - Data and Computer Communications, Pearson Edu. PHI.
2. B. A. Frouzan - Data Communications and Networking, TMH.
3. A.S. Tanenbaum, Computer Networks, PHI
4. B.A. Frouzan – Cryptography & Network Security, TMH, New Delhi.
5. S. Stalling – Cryptography and Network Security Pearson Edu., New Delhi.
6. A. Kahate- Cryptography and Network Security, TMH, New Delhi.
7. Pfleeger, C.P., Security in Computing, 5e, Prentice Hall
8. Schneier Bruce, Applied Cryptography, 2e, John Wiley & Sons
9. Christofpaar, Jan Pelzel, Understanding Cryptography: A Textbook for Students and Practioners, 2e, Springer
10. Jahangiri A, Live Hacking: The Ultimate Guide to Hacking Techniques & Counter Measures for Ethical Hackers & IT Security Experts

IV. GENERAL / DISCIPLINE CENTRIC ELECTIVE : GE/DC - 1(ECMCA301D)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;

PHP

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction: Comments, Syntax, Variables, Constants, Commands, Scope Of Variable. Expressions, Operators, Conditional Statement, Looping Constructs, Casting, Dynamic Linking. PHP Functions, Including And Requiring Files, PHP Version Compatibility, PHP Objects. Numerically Indexed And Associative Arrays, Foreach Loop, Array Functions. Using Print –Precision Setting, String Padding, Using Sprint;, Date And Time Functions, File Handling.

Unit II- Introduction To MySQL: MySQL Basics, Database Design and Terms, Data Types, Functions, Accessing MySQL via Command Line, Indexes, Accessing MySQL via PHP My Admin, Normalization, Relationship, Transactions, Backing Up and Restoring.

Unit III- Accessing MySQL Using PHP: Process, Connecting to MySQL Database, Deleting a Record, Displaying Form, Querying Database, Running Program, Table Operation-Creation, Description, Drop; Operations On Data- Addition, Retrieving, Updating, Deletion; Preventing Hacking Attempts, Using MySQL Procedurally.

Unit IV- (a)Form Handling: Building Form, Retrieving Submitted Data, Various Attributes in HTML5- Autocomplete, Autofocus, Placeholder, Required, Override, Width and Height, Form, List, Min and Max, Step; Colour Input Type, Number And Range Input Types.
(b)Cookies, Sessions And Authentication: Using Cookies in PHP, HTTP Authentication Using Sessions.

Unit V- Implementation : Design a Web Application

Unit VI – Overview of Different PHP Frameworks: Introduction of Cake PHP, Overview, Installation, Folder Structure, Project Configuration, Routing, Controllers, Views, Extending Views, View Elements, View Events.

Reference Books:

1. Robin Nixon , Learning Php, Mysql & Java Script, O'reilly
2. James Mallison, Mastering PHP 7, Packt
3. Brad Traversy, Object Oriented PHP and MVC, O'reilly
4. Kevin Tatroe & Peter Mclntyre, Programming PHP, O'reilly
5. David Golding, Beginning CakePHP : From Novice to Professional
6. Radharadhya Dasa, Learn CakePHP, A Press

V. CORE COURSE : C 7 (CCMCA302) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;

SOFT COMPUTING AND NEURAL NETWORK

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction To Artificial Intelligence System: Introduction to AI ,Various Definitions of AI, Applications of AI techniques, Production Systems, Reasoning-Forward and Backward Chaining.

Unit II- Fuzzy Logic: Fuzzy Set Theory, Fuzzy versus Crisp, Crisp Set, Fuzzy Set, Crisp Relation, Fuzzy Relations. Genetic Algorithm Creation of offspring, Working Principle, Encoding, Fitness Function, Reproduction.

Unit III- Search and Game Playing: Breadth First Search, Depth First Search, Iterative Deepening, Uniform Cost Search, Hill Climbing, Simulated Annealing, Heuristic Search, Best First Search, A* Algorithm, Minmax , Alpha-Beta Pruning.

Unit IV- Knowledge Representation: Propositional Logic, First Order Predicate Calculus, Resolution, Unification, Semantic Networks, Frame System.

Unit V- Fundamentals of Neural Networks: Basic Concepts Of Neural Networks, Human Brain, Model of an Artificial Neuron, Neural Network Architectures, Characteristics Of Neural Networks, Learning Method.

Unit VI- Natural Language Processing: Component Steps Of Communication, Contrast Between Formal And Natural Languages In The Context Of Grammar, Parsing And Semantics.

Reference Books:

1. S. Russel and P.Norvig, Artificial Intelligence: A Modern Approach.
2. Elain Rich and Kelvin Knight, Artificial Intelligence.
3. Nils J Nilson, Artificial intelligence: A New Synthesis.
4. R. Akerkar, Introduction to Artificial intelligence.
5. S.Rajasekarn, G.A. Vijyalakshmi Pai, Neural Network, Fuzzy Logic and Genetic Algorithm, Synthesis and Application, PHI
6. Neuro-Fuzzy and Soft Computing, J.S.R. Jang ,C.T..Sun, E. Mizutani, PHI

VI. CORE COURSE : C 8 (CCMCA303) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks;

DATA SCIENCE USING PYTHON Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction: Keywords and Identifiers, Statements & Comments, Variables, Datatypes, Type Conversion, I/O and Import, Operators, Namespace

Unit II- Control Statement : if..else, for loop, while loop, break and continue, functions, function arguments, recursion, anonymous function, global, local and nonlocal, global keyword, modules, package

Unit III - Datatypes: Numbers, List, Tuple, String, Set, Dictionary, Files - File Operation, Directory, Exception, Exception Handling, User-defined Exception, Object & Class - OOP, Class, Inheritance, Overloading, Advanced Topics - Iterator, Generator, Closure, Decorators, Property, RegEx, Datetime Module

Unit IV- Data Processing: Data Operations, Data cleansing, Processing CSV Data, JSON Data, XLS Data, Relational Databases, NoSQL Databases, Data Wrangling, Data Aggregation, HTML Pages, Unstructured Data, Word tokenization, Stemming and Lemmatization

Unit V- Visualizing Data: Matplotlib, Barcharts, Line Charts, Scatterplots, Linear Algebra: Vectors, Matrices.

Unit VI- Statistics and Probability: Describing a Single Set of Data, Central Tendencies, Dispersion, Correlation, Simpson's Paradox, Hypothesis Testing, Confidence Interval,
P-Hacking : Running A/B Test Dependence and Independence, Conditional Probability, Baye's Theorem, Random Variables,
Distribution: Continuous and Normal Distribution. Central Limit Theorem. Linear Regression, Multiple Regression, Goodness of Fit.

Unit VII- Gradient Descent: Idea Behind Gradient Descent, Estimating the Gradient Descent, Using the Gradient Descent, Choosing The Right Step Size, Stochastic Gradient Descent.

Unit- VIII - Data: Stdin and Stdout, Reading the Files, Basics of Text Files, Delimited Files, Scrapping the Web HTML and Parsing Using APIS JSON and XML. Working With Data Exploring One Dimension, Two and Multi Dimension Data, Dimensionality Reduction.

Reference Books:

1. Mark Lutz , Programming Python, O'reilly
2. Joel Grus , Data Science from Scratch, O'reilly
3. Jake Vander Plas , Python Data Science Handbook, O'reilly
4. Wes McKinney, Python for Data Analysis, O'reilly
5. Wickham H. & Grolemund G., R for Data Science: import, tidy, transform, visualize, and model data, O' Reilley Media, Inc

VII. CORE COURSE : C 9 (CPMCA304) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Semester Internal Assessment (SIA):

*There will be **two** questions in Practical Examination of 3Hrs.out of which **any one** is to be answered. The questions in practical examination will be of equal to 20 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce.*

End Semester Practical Examination (ESE Pr):

***Lab**: There will be **four** questions in Practical Examination of 3Hrs.out of which **any two** are to be answered. Student have to Answer the given questions on Answer booklet and execute the answered programs/steps in computer with standard output.*

The questions in practical examination will be of equal to 50 marks and will be so framed that the students are able to answer them within the stipulated time. 10 marks will be awarded on the performance in viva voce whereas 10 marks will be awarded on cumulative assessment which is further subdivided as 5 marks for Practical record and 5 marks for Attendance.

***Assignment**: The Assignment should be hand written (preferred)/ typed in A4 size paper. First three pages (i.e. front page + acknowledgment + index) & Bibliography may be printout. No Xerox copy is allowed.*

LAB BASED ON PYTHON Practical: 60 Lectures; Tutorial: 15 Hours

Programming based on the following:-

1. Data types, Variables and Other References, Expression and Operators,
2. Numeric Operations, Sequence Operations, Strings, Tuples, List, Set Operations, Dictionary Operations,
3. The print, Control Flow Statements, while, for, break, continue for, pass try, raise, with
4. Functions, lambda expressions, generators, attributes.
5. Classes and Instances, bound, unbound, overriding, superclass Methods, Decorators, Metaclasses.
6. Try, raise, with exceptions, Exceptions objects, Standard and custom Exception classes.
7. Units, Import, from, import*, statements, Python built-in Units sys, copy, Collections Unit, Functional Unit, Bisect Unit, Heapq Unit, User Dict Unit, Optparse Unit, Itertools Unit.
8. Methods of String Objects, String Unit, String Formatting, Pprint Unit, Repr Unit, Unicode, Regular Expressions and the Re Units.
9. File and Text Operations: Creating aFiles object with open, Auxiliary Unit for File I/O, The String IO and cString IO Units, Text Input and Output, Richer-Text I/O, Interactive Command Sessions, Internationalization.

10. Persistence and Databases**:** marshal, pickle, any dbm Unit, The Python Database API
11. Time Operation**:** time, datetime, pytz, dateutil, sched, calender, mx. Date Time Unit.
12. Controlling Execution**:** exec Statement, co, _code, co_filename, code_object, gc Unit, weakref, proxy, register.
13. Thread and Processes**:** thread, Queue, Threading, map Unit.
14. Numeric Processing**:** The math and cmath Unit, operator Unit, Random and Pseudorandom numbers, Decimal, gmpy Unit.
15. Array Processing**:** array Unit, extensions for Numeric Array Computation, Numeric Package, Array Objects, Universal Functions (ufuncs), Auxiliary Numeric Units.

Reference Books:

1. Alex Martelli, Python in A Nutshell, O'REILLY, 2ND Edition, 2012
2. Mark Lutz , Programming Python, O'reilly
3. Wes McKinney, Python for Data Analysis, O'reilly

SEMESTER IV

I. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - II(ECMCA401A)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

NUMERICAL AND STATISTICAL METHODS

Theory: 60 Lectures; Tutorial: 15 Hours

NUMERICAL METHODS

Unit I- Errors in Numerical Calculations: Errors & Their Computation-Absolute, Relative & Percentage. Solution of Algebraic & Transcendental Equations: Introduction, Bisection Method, Iterative Method, False Position Method, Newton's Raphson Method, Lin Bairstows Method, Error Analysis & Convergence Study.

Unit-II Interpolation With Equal & Unequal Intervals: Introduction, Finite Differences-Forward, Backward & Central, Difference Tables, Differences of Polynomials, Newton's Formula for Interpolation, Gauss's Central Difference Interpolation Formula, Divided Difference & Their Properties-Newton's Divided Differences Formula, Lagrange's Interpolation Formula, Inverse Interpolation.

Unit-III Numerical Differential & Integration: Introduction, Derivatives Using Forward & Backward Difference Formula, Numerical Integration-Trapezoidal Rule, Simpson's 1/3 & 3/8 Rules Weddle's Rule.

Unit IV- Numerical Solution Of Linear System Of Equations: Direct Method-Gauss Elimination, Guass-Jordan, LU Decomposition Methods. Iterative Methods-Gauss-Jacobi & Gauss Seidel Methods.

Unit V- Numerical Solution Ordinary Differential Equations: Taylor Series Method, Euler's Method, Modified Euler's Method, Runga-Kutta Methods Of 2^{nd} & 4^{th} Order, Predictor-Corrector Methods (Milne's Method And Adam's Methods).

STATISTICAL METHOD

Unit VI – (a)Concept Of Probability: Experiment And Sample Space, Events And Operations With Events, Probability Of An Event, Basic Probability Rules, Application Of Probability Rules, Conditional Probability.

(b)Random Variables: How Random Variable Arise, Probability Distribution, Mean or Expected Value, Probability Histogram, Variance and Standard Deviation.

Unit-VII- Discrete and Continuous Distribution: Structure of a Binomial Experiment, Binomial Probability Distribution, Use of Binomial Probability Table.

Normal Curve and Normal Distribution: Motivation behind a Normal Curve, Properties of a Normal Curve, Normal Probability Distribution, Areas under a Normal Curve.

Application of the Normal Distribution: Approximating a Binomial Probability, The Normal Theorem, Central Limit Theorem.

Reference Books:

1. S.S Shastry Introductory Methods of Numerical Analysis, PHI
2. Kendall E.Atkinson , An Introduction to Numerical Analysis, Wiley
3. Dr.B.S. Goyel, Dr.S.K.Mittal , Numerical Analysis, Pragati Prakashan
4. Quazishoeb Ahmed, Numericals and statistical Techniques, Ane Books Pvt. Ltd.

II. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - II(ECMCA401B)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

MANAGEMENT FOR IT INDUSTRIES

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction : Nature & Concept of Management; Evolution of Management Thought; Concept of Functional Management; Management Styles, Productivity Measurement, Productivity Index, Types of Production System.

Unit II- Human Resource Management: Definition and Theories of Managing People for IT Industry, Human Resource Planning, Responsibility Assignment Matrix, Resource Management, Developing and Managing the Project Team, Case Studies

Unit III- IT Industry Supply Chain Management: Types, Business Processes, Strategic, Tactical and Operational Decisions in Supply Chains, Performance Measures, Inventory Management, Bullwhip Effect, E-Marketplaces, E-Procurement, E-Logistics, E-Fulfillment, Customer Relationship Management, Web Services, ERP and Supply Chains, Case Studies

Unit IV- IT Project Quality Management: Tools and Techniques for Quality Control (Pareto Analysis, Statistical Sampling, Testing), Process Control, SQC Control Charts, Single, Double And Sequential Sampling, TQM. ,CMM, ISO, Six Sigma ,Case Studies

Unit V - Introduction to Management Information System (MIS): Meaning and Definition of MIS, Objectives and Need of MIS, Role & Importance of MIS, Types of Information System, Decision Making with MIS, Development of MIS, MIS in Organisation – IT Interaction Model, MIS in Internet Era.

Unit VI- Environmental Acts: Environmental Issues, Pollution Control Acts, Green IT Practices, Establishing a Green IT Action Plan, Techniques and Technologies available to enable Green IT Case Studies

Reference Books:

1. Koontz and Weihrich , Management :Global Perspectives,
2. Prasad, L.M., Principles and Practices of Management, Sultand Chand & Sons
3. Michael Hugos, Essential of Supply Chain Management, 4th Edition, Wiley Publication
4. Jyothi, Human Resource Management, University Press
5. Noe, Hollenbeck, Gerhart & Wright, Fundamentals Of Human Resource Management, 7th Edition, McGraw Hill Publication India
6. Sahil Raj. Management Information System, 2nd Edition, Pearson Publication
7. Giridhar Joshi, Management Information System, Oxford University Press, India
8. Sharma B.R., Environmental and Pollution Awareness by

III. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - II(ECMCA401C)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

CLOUD COMPUTING

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction: Essentials, Benefits And Need For Cloud Computing - Business And IT Perspective - Cloud And Virtualization - Cloud Services Requirements - Cloud And Dynamic Infrastructure - Cloud Computing Characteristics Cloud Adoption.

Unit II- (a) Cloud Models: Cloud Characteristics - Measured Service - Cloud Models - Security In A Public Cloud Public Versus Private Clouds - Cloud Infrastructure Self Service.
(b) Cloud As A Service: Gamut Of Cloud Solutions - Principal Technologies - Cloud Strategy Cloud Design And Implementation Using SOA - Conceptual Cloud Model - Cloud Service Defined.

Unit III- Cloud Solutions: Cloud Ecosystem - Cloud Business Process Management – Cloud Service Management - Cloud Stack - Computing On Demand (Cod) – Cloud Sourcing.

Unit IV- Cloud Offerings & Management : Information Storage, Retrieval, Archive And Protection - Cloud Analytics Testing Under Cloud - Information Security - Virtual Desktop Infrastructure - Storage Cloud. Resiliency – Provisioning - Asset Management - Cloud

Governance - High Availability And Disaster Recovery - Charging Models, Usage Reporting, Billing And Metering.

Unit V- Cloud Virtualization Technology: Virtualization Defined - Virtualization Benefits - Server Virtualization - Virtualization For X86 Architecture - Hypervisor Management Software - Logical Partitioning (LPAR) - VIO Server - Virtual Infrastructure Requirements. Storage Virtualization - Storage Area Networks - Network-Attached Storage - Cloud Server Virtualization - Virtualized Data Center.

Unit VI- Cloud And SOA: SOA Journey To Infrastructure - SOA And Cloud - SOA Defined-SOA and Iaas - SOA-Based Cloud Infrastructure Steps - SOA Business And IT Services.

Unit VII- Cloud Infrastructure Benchmarking: OLTP Benchmark - Business Intelligence Benchmark - E-Business Benchmark - ISV Benchmarks - Cloud Performance Data Collection And Performance Monitoring Commands - Benchmark Tools.

Reference Books:

1. K. Saurabh, Cloud Computing, Wiley India, 2nd Edition, 2014.
2. T. Velte, A. Velte and R. Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill, India.
3. R. Buyya & J. Broberg, Cloud Computing: Principles and Paradigms, Wiley.
4. Derrick Rountree & Leana Castrillo – The Basics of Cloud Computing, Syngress
5. Arshdeep Bahga & Vijay Madisetti, Cloud Computing: A Hands on Approach, Universities Press

IV. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - II(ECMCA401D)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

CODEIGNITER **Theory: 60 Lectures; Tutorial: 15 Hours**

Unit I : Initial Setup and Configuration: Config Class, Database Configuration, Explanation of MVC Architecture, First CI Application - Loader Class, Libraries, Creating Static Pages, Creating First Controller, Model & View

Unit II : CodeIgniter URLs : , URI Routing - Passing Parameters in URLs, URI Class, Reserved Names, Auto Loading Functions, Form Handling - Input Class, Form Validation Class, File Uploading Class, Security Class, Page Redirection

Unit III : Helper Functions : Cookie Helper, Date Helper, Download Helper, URL Helper

Unit IV - Database : Database Configuration, Connecting to a Database, Running Queries, Generating Query Results, Query Helper Functions, Field Data

Unit V - Active Record Class : Selecting Data, Inserting Data, Updating Data, Deleting Data, Method Chaining

Unit VI: Session Handling : Session Class, Email Class - Sending Emails using CI, SMTP, Google, Image Manipulation Class - Resize Image, Aspect Ratio

Unit VII : Pagination Class : Pagination of large data, Caching, Cart Class - Simple shopping cart example, Encryption Class, User Agent Class - Identify user agent and display browser specific view, Zip Encoding Class - Create Zip files, Unzip files

Reference Books:

1. Thomas Myer, Professional CideIgniter, Wrox Publication
2. David Upton, CodeIgniter for Rapid PHP Application Development, Packt Publishing Limited
3. Dr. Girish R. Naik & Dr. Poornima G. Naik, Enhancing PHP Coding with CodeIgniter, Educreation Publishing
4. Adam Griffiths, CodeIgniter 1.7 Professional Development, Packt Publishing Limited
5. Eliahou Orr and Yehuda Zadik, Programming with CodeIgniter MVC, Packt Publishing House

V. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - III(ECMCA402A)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

R **Theory: 60 Lectures; Tutorial: 15 Hours**

Unit I - Introduction: Introduction & Basics R Programming Language, How to Download & Install R, RStudio, Anaconda on Mac or Windows, R Data Types, Arithmetic & Logical Operators with Example

Unit II - R Matrix Tutorial: Create, Print, add Column, Slice, Factor in R: Categorical & Continuous Variables

Unit III - Data Preparation: R Data Frame: Create, Append, Select, Subset, List in R: Create, Select Elements with Example, R Sort a Data Frame using Order(),R Dplyr Tutorial: Data Manipulation(Join) & Cleaning(Spread), Merge Data Frames in R: Full and Partial Match, Functions in R Programming (with Example)

Unit IV – Control Statement: IF, ELSE, ELSE IF Statement in R, For Loop in R with Examples for List and Matrix, While Loop in R with Example, apply(), lapply(), sapply(), tapply() Function in R with Examples, Import Data into R: Read CSV, Excel, SPSS, Stata,

SAS Files,How to Replace Missing Values(NA) in R: na.omit & na.rm, R Exporting Data to Excel, CSV, SAS, STATA, Text File, Correlation in R: Pearson & Spearman with Matrix Example, R Aggregate Function: Summarise & Group_by() Example, R Select(), Filter(), Arrange(), Pipeline with Example

Unit V - Data Analysis : Scatter Plot in R using ggplot2 (with Example), How to make Boxplot in R (with EXAMPLE), Bar Chart & Histogram in R (with Example), T Test in R: One Sample and Paired (with Example), R ANOVA Tutorial: One way & Two way (with Examples)

Unit VI - Machine Learning : R Simple, Multiple Linear and Stepwise Regression [with Example], Decision Tree in R with Example, R Random Forest Tutorial with Example, Generalized Linear Model (GLM) in R with Example, K-means Clustering in R with Example

Reference Books:

1. Sandip Rakshit, R for Beginners, McGraw Hill
2. Jeeva Jose, Beginner'S Guide For Data Analysis Using R Programming, Khanna Publishing
3. Seema Acharya, Data Analytics Using R , McGraw Hill
4. Zumel, N & Mount J., Practical Data Science with R, Manning Publications Co.
5. Peng R.D., R Programming for Data Science, Leanpub
6. P.S. Bishnu & V. Bhattacharya, Data Analytics with R, PHI

VI. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - III(ECMCA402B)

(Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

***Note:** There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

ENTERPRISE RESOURCE PLANNING Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction to ERP: Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, Advantages of ERP, Reasons of Failure.

Unit II- Enterprise An Overview: Integrated Management information, Business Modeling, Integrated Data Model.

Unit III- ERP and Related Technologies: BRP (Business Process Reengineering), MIS (Management Information System), DSS (Decision Support System), EIS (Executive Information system), OLAP, Supply Chain Management.

Unit IV- A Manufacturing Perspective: ERP, CAD/CAM, MRP (Material Requirement Planning), Bill of Material, Closed loop MRP, MRP-II, DRP (Distributed Requirement Planning),

Unit V- Product Data Management: Product Data Management, Data Management, Benefits of PDM, ERP Units, Finance, Plant Maintenance, Quality Management, Material Management.

Unit VI- Benefits of ERP & ERP Market: SAP, BAAN, Oracle Corporation, People Soft.

Unit VII- Vendors, Consultants & Users: In – house Implementation – pros & cons, Vendors, Consultants, End-users. ERP Implementation Life Cycle, ERP Case Studies.

Reference Books:

1. Alexis Leon , Enterprise Resource Planning, TMH Fourth Reprint 2001.
2. Bret Wagner Ellen F. Monk, Enterprise Resource Planning, Cengage Learning, 3rd Edition
3. Marianne Bradford, Modern ERP, Lulu.com, 3rd Edition
4. Brian Linuma & Eric Klauss , Enterprise Resource Planning Systems
5. Mary Summer, Enterprise Resource Planning, Pearson, 1st Edition

VII. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - III(ECMCA402C)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

***Note:** There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

MOBILE COMPUTING WITH ANDROID SYSTEM

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction: Fundamentals of Mobile App Development, Identifying Various Mobile Platforms. Identifying Various Mobile Development Environments, Exploring the Android Platform, Exploring the Android Architecture, Identifying the Building Blocks of an Android App, Exploring the Android Development Environment, Designing the UI

Unit II- Event Handling and Data Storage: Viewing the UI on a Device, Handling UI Events in the Activity Class, Activating App Components, Introducing Android Debugging Environment, Debugging Apps from Eclipse with ADT Plug-in, Using ADB, Identifying Data Storage Mechanisms, Using an SQLite Database for Data Storage, Using Content Providers for Data Access, Creating Tabs, Applying Styles and Themes, Customizing Views

Unit III-Shared Preferences and Services: Using Native Content Providers, Using Internal Data Storage, Using External Data Storage, Using Shared Preferences, Creating Shared

Preferences, Retrieving Shared Preferences, Working with Services, Implementing Services, Working with Broadcast Receivers, Creating Menus, Creating Tabs, Applying Styles and Themes, Customizing Views

Unit IV- Features and Map based services: Using Notifications, Creating Alarms, Identifying Location-based Services, Selecting a Location Provider, Implementing Location-based Services in an Emulator, Creating Map-based Apps

Unit V-Working with Graphics, Audio and Video: Working with Graphics, Adding the Audio and Video Elements, Identifying the Security Model of the Android Platform

Unit VI –Deployment : Using Permissions for Specific Operations, Deploying an Android App, Identifying Deployment Considerations, Publishing an Android App

Reference Books:

1. Prasant Kumar Pattnaik & Rajib Mall, Fundamentals of Mobile Computing, PHI. 2nd Edition
2. Ashok K. Talukder, Hasan Ahmed & Roopa R. Yavgai, Mobile Computing: Technology Applications and Service Creation, 2nd Edition
3. Raj Kamal, Mobile Computing, Oxford
4. Reto Meier, Professional Android Application Development, Wrox Publication
5. Uwe Hansmann, Lother Merk, Martin Nicklous & Thomas Stober, Principles of Mobile Computing, 2nd Edition, Springer

VIII. GENERAL/DISCIPLINE CENTRIC ELECTIVE: GE/DC - III(ECMCA402D)

(Credit : Theory– 05

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

Note: *There may be subdivisions in each question asked in Theory Examinations*

The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5

INTERNET OF THINGS

Theory: 60 Lectures; Tutorial: 15 Hours

Unit I- Introduction and Concepts : Definition and Characteristic, Physical Design- Things in IoT, IoT Protocols; Logical Design- IoT Functional Blocks, IoT Communication Models and APIs; IoT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems; IoT Levels & Deployment Templates.

Unit II- Introduction, Home Automation: Smart Lighting & Appliances, Intrusion Detection, Smoke/Gas Detectors; Cities- Smart Parking, Smart Lighting & Roads, Structural Health Monitoring, Surveillance, Emergency Response; Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection; Energy- Smart Grids, Renewable energy Systems, Prognostics;

Unit III – Retail: Inventory Management, Smart Payments, Smart Vending Machines; Logistics- Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics; Agriculture- Smart Irrigation, Green House Control; Industry- Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring; Health & Lifestyle- Health & Fitness Monitoring, Wearable Electronics;

Unit IV- IoT & M2M: Introduction, M2M, Differences between Iot and M2M, SDN (Software Defined Networking) and NFV (Network Function Virtualization) for Iot

Unit V – (a) IoT System Management with NETCONF-YANG: Need for IoT Systems Management, Simple Network Management Protocol (SNMP)- Limitations; Network Operator Requirements, NETCONF, YANG, NETOPEER.
(b)IoT Platforms Design Methodology: Introduction, IoT Design Methodology, IoT System for Weather Monitoring

Unit VI- IoT Physical Devices and Endpoints: Basic Building Block of IoT Device, Exemplary Device, Linux on Raspberry Pi, Raspberry Pi Interfaces- Serial, SPI, I2C; Programming Raspberry Pi with Python- Controlling LED with Raspberry Pi, Interfacing LED & Light Sensor(LDR) and Switch with Raspberry Pi; Other IoT Devices- pc Duino, Beagle Bone Black, Cubie board

Unit VII- IoT Physical Servers and Cloud Offerings: Cloud Storage Models & Communication APIs, WAMP Auto Bahn for IoT, Xively Cloud for IoT, Python Web Application Framework- Django Architecture, Starting Development with Django; Designing a RESTful Wen API, Amazon Web Services for IoT- EC2, Auto Scaling, S3, RDS, Dynamo DB, Kinesis, SQS, EMR; Sky Net IoT Messaging Platform.

Unit VIII- Illustrating IoT Design : Introduction, Home Automation- Smart Lighting, Home Intrusion Detection; Cities- Smart Parking; Environment- Weather Monitoring System, Weather Reporting Bot, Air Pollution Monitoring, Forest Fire Detection; Agriculture- Smart Irrigation; Productivity Application- Iot Printer.

Reference Books:

1. Arshdeep Bahga & Vijay Madisetti- Internet of Things: A hands-on Approach, 2015, Universities Press
2. T. Balaji , Introduction to Internet of Things(IoT) and Its Applications, T. Balaji
3. Jeeva Jose, Internet of Things, Khanna Publishing
4. An Introduction to Internet of Things, Cengage Publication

I. CORE COURSE: C 10 (CCMCA403) (Credit : Theory– 05)

Marks: 30 (SIA: 20Th. 1Hr + 5Attd. + 5Assign.) + 70 (ESE: 3Hrs) = 100
Pass Marks (SIA : 17 + ESE : 28) = 45

Instruction to Question Setter for

Mid Semester Examination (MSE):

*There will be **two** groups of questions in written examinations of 20 marks. **Group A is compulsory** and will contain five questions of **very short answer type** consisting of 1 mark each. **Group B will contain descriptive type five** questions of five marks each, out of which any three are to be answered.*

End Semester Examination (ESE):

*There will be **two** groups of questions. **Group A is compulsory** and will contain two questions. **Question No.1 will be very short answer type** consisting of five questions of 1 mark each. **Question No.2 will be short answer type** of 5 marks. **Group B will contain descriptive type six** questions of fifteen marks each, out of which any four are to be answered.*

***Note:** There may be subdivisions in each question asked in Theory Examinations. The Mid Semester Examination shall have three components. (a) Two Semester Internal Assessment Test (SIA) of 20 Marks each, (b) Class Attendance Score (CAS) of 5 marks and (c) Class Performance Score (CPS) of 5 marks. "Best of Two" system will be applicable for marking for SIA.*

(Attendance Upto75%, 1mark; 75<Attd.<80, 2 marks; 80<Attd.<85, 3 marks; 85<Attd.<90, 4 marks; 90<Attd, 5 marks).

COMPUTER GRAPHICS **Theory: 60 Lectures; Tutorial: 15 Hours**

Unit I- Introduction: Basic Raster Graphics Algorithms for Drawing 2D Primitives, Scan Converting Lines, Circles, Elipses, Filling Rectangles, Polygons, Ellipse, Pattern Filling, Clipping In Raster World-(Lines, Circles, Elipses, Polygons) , Antialiasing.

Unit II: Graphics Hardware And Input Devices: Hardcopy and Display Technologies, Raster Scan Display Systems, The Video Controller, Random Scan Processor, Input Devices for Operator Interaction, Image Scanners.

Unit III – Interaction: Input Devices, Interaction Techniques and Interaction Tasks: Interaction Hardware, Basic Interaction Tasks, Composite Interaction Tasks.

Unit IV - Geometrical Transformation: 2D Transformations, Homogeneous Coordinates and Matrix Representation of 2D Transformation, Composition of 2D Transformation, The Windows-To-View Port Transformation, Efficiency.

Unit V- 3D Transformation: Matrix Representation of 3D Transformation, Composition of 3D Transformation, Transformation As a Change in Coordinate System.

Unit VI- Viewing In 3D: Projections, Specifying an Arbitrary 3D View, Examples Of 3D Viewing ,The Mathematics Of Planar Geometric Projections ,Implementing Planar Geometric Projection and Coordinate Systems.

Unit VII- Achromatic And Coloured Light: Achromatic Light, Chromatic Colour, Colour Models for Raster Graphics, Reproducing Colour, Using Colour in Computer Graphics.

Unit VIII: Visible-Surface Determination: Functions of Two Variables, Techniques for Efficient Visible-Surface Algorithms, Algorithms for Scan-Line Determination, The Z-Buffer Algorithms, List-Priority Algorithms, Area-Subdivision Algorithms, Algorithms for Octress.

Reference Books:

1. D.Hearn And M.P.Baker, Computergraphics, PHI
2. J.D.Foley, A. Vann Dam, S.K. Feiner And J.F. Hughes, Computer Graphics: Principles And Practices
3. D.F.Rogerrs and A.J. Admas, Mathematical Elements in Computer Graphics.

X. PROJECT/ INTERNSHIP: C 11 (PRMCA404) **(**Credit : Theory– 05)

Marks : 70(OJT) + 30 (Viva) **Pass Mark : 45**

Guidelines to Examiners for End Semester Examination (ESE):

Overall project dissertation may be evaluated under the following heads:

- Motivation for the choice of topic
- Project dissertation design
- Methodology and Content depth
- Results and Discussion
- Future Scope & References
- Participation in Field Training Program
- Application of Research technique in Data collection
- Report Presentation
- Presentation style
- Viva-voce

	Distribution of Marks	
S.No.	**Particulars**	**Marks**
I.	**OJT Project Report by External:**	
	1. Formulation of Project Design	25
	2. Implementation of the Design	25
	3. Presentation of Report	20
	Total	**70**
II.	**Report Preparation and Internal Presentation**	
	1. Presentation of Report	20
	2. Internal Assessment	10
	Total	**30**
	TOTAL (I + II)	**100**

Note: There will be only one external examination for this paper.

FINAL PROJECT/ INTERNSHIP

A. On Job Training (OJT):

1. OJT is **ON JOB TRANING**. Student have to do Six months (**OJT Six Month**) industrial Training from IT organisation (**Reference letter for OJT must be issued from MCA Department**). Student has to produce daily report. In this daily report, Attendance sheet, Work culture and working hour list, day by day, must be listed.

2. Student alone or in a group of not more than three, shall undertake **One Project Dissertation** approved by the Subject Teacher/Director. of the Department concerned. The progress of the Project Dissertation shall be monitored by the faculty members at regular intervals, and followed by Internal assessment of 30 marks.

B. Academic Credits For Training Shall Be Based On Following:

A **Powerpoint presentation** (based on the report) for duration of **10/15 minutes** should be presented. This will be presented in front of external / internal examiners. Marks will be awarded on the basis of his/her presentation, dissertation submitted to the faculty coordinator and viva-voce conducted by the external/ internal examiners.

Students Have to Submit the Following on Completion of Training to the Concern Faculty at the Department/Institute:

1. Synopsis submission
2. Synopsis Approval will be given within a week from the date of submission.
3. Synopsis will be approved by concerned department faculty member.
4. Faculty members will be the internal supervisor of particular student/ group of Students.
5. The group size will be maximum of 3 candidates.
6. Group will make power point presentation in front of panel and submit the project status report within 15 to 20 days from the date of approval.
7. Final Project Submission contains Hard copy (Two Copy), Soft copy & leave letter.

Project Hard Copy Contains

a) Front page
b) Certificate of Authenticity
c) Certificate of job Training
d) Declaration
e) Acknowledgement
f) Table of content/index
g) Project guidelines (These points are mandatory)

(i).	Introduction with Company profile.
(ii).	Vision, mission & objective.
(iii).	SWOT Analysis.
(iv).	Chronology of Achievements.
(v).	Topic introduction & discussion.
(vi).	Its relevance & implication in company.
(vii).	Findings.
(viii.	Conclusion
(ix).	Further enhancement (Suggestion).
(x).	Bibliography
(xi).	Reference Website
(xii).	CD (compact Disc)

The Training / Project Report will be submitted in the specified form as under:

a. The typing should be done on both sides of the paper(instead of single side printing)
b. The font size should be12 with Times New Roman font.
c. The Training/ Project Report may be typed in 1.5 line spacing.
d. The paper should be A-4size.

Two copies meant for the purpose of evaluation may be hard bound in paper and submitted to the approved authority of the department/institute.

DISTRIBUTION OF CREDITS FOR P.G. PROGRAMME (SEMESTER-WISE) FOR POSTGRADUATE 'M.C.A.' PROGRAMME

Table 5: Semester wise Distribution of 80 Credits for MCA Papers

Semester	CC	FC	SE	GE/DC	Total Credit
Semester I	15	5			20
Semester II	15		5		20
Semester III	15			5	20
Semester IV	10			10	20
Total					**80**

CC=Core Course; FC=Foundation Compulsory/Elective Course; GE=Generic Elective; SE=Skill Enhancement Course; DC=Discipline Centric Elective

SAMPLE CALCULATION FOR SGPA & CGPA FOR 'P.G. M.C.A.' PROGRAMME

Table 6: Sample Calculation For SGPA For M.C.A. Programme

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)	SGPA (Credit Point/ Credit)
Semester I					
FC	5	A	8	40	
C 1	5	B+	7	35	
C2	5	B+	7	35	
C3	5	B	6	30	
Total	**20**			**140**	**7 (140 / 20)**
Semester II					
SE 1	5	B+	7	35	
C 4	5	C	5	25	
C 5	5	B	6	30	
C 6	5	A	8	40	
Total	**20**			**130**	**6.5 (130 / 20)**
Semester III					
GE/DC I	5	A	8	40	
C 7	5	B+	7	35	
C 8	5	B	6	30	
C 9	5	A+	9	45	
Total	**20**			**150**	**7.5 (150 / 20)**
Semester IV					
GE/DC II	5	A	8	40	
GE/DC III	5	A	8	40	
C 10	5	B+	7	35	
C11	5	A+	9	45	
Total	**20**			**160**	**8 (160 / 20)**
Total CGPA Grand Total	**80**			**580**	**7.25 (580 / 80)**

Table 7: Sample Calculation for CGPA for P.G. Vocational / M.Sc./M.A./M.Com Programme

Semester I	Semester II	Semester III	Semester IV
Credit- 20, SGPA - 7	Credit-20, SGPA- 6.5	Credit-20, SGPA-7.5	Credit- 20, SGPA - 8

Thus CGPA = (20 x 7 + 20 x 6.5 + 20 x 7.5 + 20 x 8) / 80 **= 7.25**