



# SACRED HEART COLLEGE (AUTONOMOUS)

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Ready for  
Every Good Work

A Don Bosco Institution of Higher Education, Founded in 1951 \* Affiliated to Thiruvalluvar University, Vellore \* Autonomous since 1987

Accredited by NAAC (4<sup>th</sup> Cycle – under RAF) with CGPA of 3.31 / 4 at 'A+' Grade

## Master of Computer Applications (MCA) Program Structure (from 2021 – 2022 onwards)

### MCA Programme Structure

Sem	Code	Subject Name	L	T	TCP	P	IM	SM	TM	CD
I	MCA160T	Enterprise Applications with JAVA	4	1			50	50	100	4
	MCA161T	Scripting Technology	3	1			50	50	100	3
	MCA162T	Optimization Techniques	3	1			50	50	100	4
	MCA163T	Software Testing and Quality Assurance	4		1		50	50	100	4
	MCA164I	Pure Practical : Open Source Database Management System				4	100		100	4
	MCA165P	Practical : JAVA				4	50	50	100	3
	MCA166P	Practical : Scripting Technology				4	50	50	100	3
			<b>14</b>	<b>3</b>	<b>1</b>	<b>12</b>	<b>400</b>	<b>300</b>	<b>700</b>	<b>25</b>
II	MCA260T	Enterprise Applications with .Net	4				50	50	100	4
	MCA261T	Computer Graphics	4	1			50	50	100	4
	MCA262T	Design and Analysis of Algorithms	3	1			50	50	100	3
	MCA263#	Elective I	3				50	50	100	3
	MCA264I	Pure Practical : Android Application Development				4	100		100	3
	MCA265P	Practical : .Net				4	50	50	100	3
	MCA266P	Practical : Computer Graphics				4	50	50	100	3
	VE804	Human Rights in India	2				100		100	1
			<b>16</b>	<b>2</b>	<b>0</b>	<b>12</b>	<b>450</b>	<b>350</b>	<b>800</b>	<b>24</b>
III	MCA360T	Python Programming	4				50	50	100	4
	MCA361T	Blockchain Technology	3	1			50	50	100	4
	MCA362T	Open Source Frameworks	3		1		50	50	100	4
	MCA363#	Elective II	3				50	50	100	3

	MCA364#	Elective III	3				50	50	100	3
	MCA365P	Practical : Python				6	50	50	100	3
	MCA366J	Software Project I				6	50	50	100	4
			<b>16</b>	<b>1</b>	<b>1</b>	<b>12</b>	<b>350</b>	<b>350</b>	<b>700</b>	<b>25</b>
IV	MCA460#	Elective IV	3				50	50	100	3
	MCA461#	Elective V	3				50	50	100	3
	MCA462J	Software Project II				24	50	50	100	10
			<b>6</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>150</b>	<b>150</b>	<b>300</b>	<b>16</b>
<b>Total Credits</b>										<b>90</b>

### List of Theory Combined Practical Papers

Semester	Course Code	Course Title
I	MCA163T	Software Testing and Quality Assurance
III	MCA362T	Open Source Frameworks

### List of Pure Practical Papers

Semester	Course Code	Course Title
I	MCA164I	Open Source Database Management System
II	MCA264I	Android Application Development

**Note:** Marks for the Internal Assessment will be given from the lab work for Pure Practical Papers. No End Semester Practical Examination will be held.

### List of Elective Subjects

(Conducted in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Semesters, Students has to choose from the below course)

Semester	Course Code	Elective I
II	MCA263A	Artificial Intelligence
	MCA263B	Internet of Things
	MCA263C	Research Domain I
<b>Elective II</b>		
III	MCA363A	Cloud Computing
	MCA363B	Social Network Analysis
	MCA363C	Research Domain II
	<b>Elective III</b>	
	MCA364A	Enterprise Resource Planning
	MCA364B	Big Data
<b>Elective IV</b>		
IV	MCA466A	Data Analytics with R Programming
	MCA466B	Data and Information Security

Elective V	
MCA467A	Data Mining Techniques
MCA467B	Game Programming

### 7.1 CODING SCHEME

MCA	X	X	X	X
Programme Code	Semester Number 1-4	Curriculum Revision Number 0-9	Course Serial Number 0-9	Course Type*

\*Course Type: T–Theory, P–Practical, J–Project, A to E – Electives, I – Internal Papers, S – Skill Papers.

### 7.2 ADDITIONAL COURSES

#### a) Life and Employability Skill Courses

Semester	Course Code	Course Title	Credits
I		Soft Skills	2
II		Technical Aptitude	2
III		Quantitative Aptitude	2

**Note:** Life and Employability skill courses are organized by the Placement cell.

#### b) Certificate Courses

Semester	Course Title	Credits
I	Web Authoring Tools	2
II	Natural Language Processing	2
III	Smart Device Technologies	2

**Note:** These certificate courses are intended to be conducted through training and placement consultancies of high repute and each course will be conducted for a minimum period of 30 conduct hours including theory and practicals. The concept behind these certificate courses is to enable the students to craft themselves employable and avail placement. These courses need not require an end semester examination. The cost incurring to conduct these certificate courses will be borne by the students. The list of certificate courses are listed below, however can be considered for including new courses and revising the content of the courses according to the industry requirements which varies from time to time. The course can be conducted during the semesters or during the summer/winter vacation.

#### c) SELF LEARNING COURSE

Since the certificate courses involve cost, to enable the economically deprived students to provide a chance to acquire the additional technical skills required for employment. The students can take up a Self-learning course (1 credit each), they are expected to learn the technologies through self-learning based on the online tutorials and other related resources.

However, they have to prove themselves to have undergone the mentioned syllabus through an end term examination, which the department will conduct. **The students are advised to take up three MOOC courses recognized by AICTE and UGC for credit transfer, such as NPTEL and SWAYAM.**

A student has to acquire 90 credits by successfully undergoing the mandatory courses to get qualified for the M.C.A degree. The mandatory courses are compartmentalized into Theory, Practical, Theory Combined Practicals (TCP), Pure Practical and Project courses. However, further to cater to the needs of the advanced learners, flexibility is provided in the curriculum in the form of certificate courses in the semester I, II and III, the Life and Employability courses handled from first semester to third semester, and Self Learning courses. The minimum number of credits to be acquired to become eligible for the MCA degree, is 90, The Life and Employability skills, Certificate and Self learning courses add up the credits tally to a maximum of 105. The Life and Employability skills, Certificate and Self learning credits will not be included for the CGPA calculation.

#### **d) PURE PRACTICAL PAPERS**

To enable the students to have more practical experience, considering the limitation in number of practical sessions that can be conducted proportionate to the workload. A new type of paper is introduced which is named as Pure Practical paper in semester I and II. In these papers, the course teacher will demonstrate and teach the technical concepts required to complete a practical exercise, in the computer laboratory itself before students begin their work. The teacher will then guide the students to complete the laboratory sessions.

#### **TOTAL CREDITS**

<b>S.No</b>	<b>Type</b>	<b>Credits</b>
1	<b>Mandatory Credits</b>	<b>90</b>
2	Life and Employability Skills (not included for CGPA)	6*
3	Certificate Courses (not included for CGPA)	6*
4	Self -Learning Courses (not included for CGPA)	3*
<b>MAXIMUM CREDITS (90+15*)</b>		<b>105</b>

## 7.3 SYLLABI IN DETAIL

### I SEMESTER

**MCA160T  
0:100**

**ENTERPRISE APPLICATIONS WITH JAVA**

**4-1-0-**

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#### OBJECTIVES

- To understand methods of the Applet and UI Component classes of the AWT.
- To create a well-structured MVC web application using Servlet, JSP and Struts Framework.

#### 1. ADVANCED JAVA

Java Collections: Collection Interface, List, Set, ArrayList, LinkedList, HashSet, Map, HashMap – Applet: Life Cycle, Applet Class, Execution of a Simple Applet – AWT : Events, Listeners, UI Component Classes, Layout, Windows and Frames, Menus, Dialogs, Mouse Events and Listeners- Swing – Swing Components, Swing with JDBC.

#### 2. SOCKET, OVERVIEW OF J2EE, RMI AND SERVLET

Sockets: Ports, TCP, Server Socket Class with examples, UDP approach with examples – RMI: Introduction, Remote Interface, RMI Server Package, Naming Class, RMI Security Manager Class, Exception, Steps to create RMI application, Example Programs- Servlet: Servlet Basics, Handling the Client Request, Servlet with JDBC- Handling Cookies - Session Tracking.

#### 3. JAVA SERVER PAGES

Overview of JSP Technology - JSP Scripting Elements - The JSP page Directive - Including Files and Applets – Java Beans - Integrating Servlets and JSP using MVC Architecture, Program using JSP, Servlet, MVC with JDBC.

#### 4. JSTL, ENTERPRISE JAVA BEAN

JSTL Tags : Core Tags, SQL Tags – Enterprise Java Bean : Introduction to Enterprise Beans: Session Bean, Entity Bean, Message driven Bean, clients access with interfaces, life cycle of enterprise Bean, Creation of Enterprise Bean with example programs.

#### 5. STRUTS 2.0

Struts 2 Framework - Declarative architecture - Simple Struts 2 program - Struts 2 actions- Struts tags-Exploring the validation framework– Internationalization - Advanced action using JDBC connection.

#### TEXT

1. Muthu C, “Programming with Java”, Second Edition, McGraw-Hill Education, 2010.  
UNIT 1, 2
2. Marty Hall, Larry Brown, “Core Servlets and Java Server Pages”, Second Edition, Pearson Education, 2004.  
UNIT 3
3. Stephanie Bodoff etl, “The J2EE™ Tutorial”, Pearson Education, 2005.  
UNIT 4
4. Donald Brown, Chad Michael Davis, Scott Stanlick, “Struts 2 in Action”, 2008.  
UNIT 5

## WEB REFERENCE

[www.roseindia.net](http://www.roseindia.net), [www.javapassion.com](http://www.javapassion.com), [www.r4r.co.in](http://www.r4r.co.in), [www.java2.com](http://www.java2.com),  
[www.javatutorial.com](http://www.javatutorial.com)

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

- Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit] 6 x 2 = 12
- Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18
- Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit] 2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

- Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20
- Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35
- Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**OBJECTIVES**

- To Learn the basic concepts in HTML, CSS, JavaScript, jQuery
- To Understand the responsive design and development
- To Design a Website with HTML, JS, CSS, jQuery

**1. WEB DESIGN – GETTING STARTED**

Working of Web - The Internet Versus the Web. - Web Page Addresses - Sticking with the Standards -HTML Markup for Structure - Creating simple page- A Web Page, Step by Step- Marking up text- Paragraphs - Headings. Lists - Organizing Page Content

**2. HTML MARKUP FOR STRUCTURE**

Adding Links - Pages on the Web - Mail Links- Adding Images - The img Element- A Window in a Window- Table Markup - Minimal Table Structure- Spanning Cells- Wrapping Up Tables- Forms- The form Element- Variables and Content- Form Layout and Design - HTML5-XHTML 2. Video and Audio.

**3. CASCADING STYLE SHEETS**

CSS - Benefits of CSS -Formatting text - Colours and Background - Padding, Borders and Margins - Floating and positioning - Page Layout with CSS - Transition, Transforms and Animation.

**4. CLIENT SIDE SCRIPTING**

Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-in Objects-JavaScript Debuggers.

**5. JQUERY**

Expanding Your Interface- jQuery UI - Adding Messages, Dialog Boxes- Tooltips- Pannel- Menus to a Page-Forms Revisited. -Stylish Dates, Menus, Buttons, Radio Buttons and Checkboxes- UI Form Widget Tutorial -Customizing the Look of jQuery UI- Theme Roller- New them -overriding styles. Interaction and Efforts - Draggable Widget - Drag-and-Drop Tutorial - Sorting Page Items - jQuery UI Effects.

**TEXT**

1. Jennifer Niederst Robbins, "Learning Web Design", Forth Edition, O'Reilly, 2012.

UNIT 1 : Ch : 2 – 5

UNIT 2 : Ch : 6 – 10

UNIT 3 : Ch : 11 – 17

2. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2011.

UNIT 4 : Ch: 4

3. David Sawyer McFarland “.JavaScript & jQuery: The Missing Manual”, O’Reilly Media, 2014.

UNIT 5 : Ch: 9-12

## REFERENCE

1. Paul Deitel , Harvey Deitel & Abbey Deitel, “Internet and World Wide Web:How to Program”, Fifth Edition, Pearson Education, 2018.
2. “HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)”, Second Edition, DT Editorial Services, Dreamtech Press, 2016.
3. Ryan Benedetti & Ronan Cranley, "Head First jQuery", O’Reilly Media, 2011.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b>Section A</b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b>Section B</b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b>Section C</b> Answer <b>ANY TWO</b> Questions out of THREE Questions. [Atleast one question from each unit]	2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b>Section A</b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b>Section B</b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b>Section C</b> Answer <b>ANY THREE</b> Questions out of FIVE Questions. [Atleast one question from each unit]	3 x 15 = 45

**MCA162T**

**OPTIMIZATION TECHNIQUES**

**3-1-0-0:100**

## OBJECTIVES

- To obtain knowledge on linear programming problems, transportation problems, assignment problems, inventory models, queuing models, project management and Game theory problems.

## 1. LINEAR PROGRAMMING



Introduction – Concept of Linear Programming Model – Graphical Method – Linear Programming Methods (Simplex Method and Big M Method) – Duality.

## 2. TRANSPORTATION AND ASSIGNMENT PROBLEM

Transportation: Introduction – Mathematical Model – Types of Transportation Problem (Balanced and Unbalanced) – North West Corner Method, Least Cost Method, Vogel's Approximation Method, UV Method.

Assignment: Introduction – Zero-One Programming Model – Types of Assignment – Hungarian Method (Balanced and Unbalanced Problem).

## 3. INVENTORY CONTROL AND QUEUING THEORY

Inventory: Introduction – Models of Inventory (Only Problems Using Models) – Queuing: Introduction – Terminology – Empirical Queuing Models. (Only Problems Using Models).

## 4. PROJECT MANAGEMENT

Introduction – Phases of Project Management – Guidelines for Network Construction – Critical Path Method – Project Evaluation and Review Technique.

## 5. DECISION THEORY AND GAME THEORY

Decision Theory: Introduction – Decision under Certainty – Decision under Risk – Decision under Uncertainty – Game Theory: Introduction – Game with Pure Strategies – Game with Mixed Strategies – Dominance property – Graphical Method for  $2 \times n$  or  $m \times 2$ .

### TEXT

R. Panneerselvam, "Operations Research", 2<sup>nd</sup> edition, Prentice Hall of India, New Delhi, 2011.

UNIT 1: (Chapter 2: Sections 2.1, 2.2, 2.4, 2.5 (2.5.1, 2.5.2) and 2.7 (2.7.1))

UNIT 2: (Chapters 3 & 4: Sections 3.1 - 3.4 and 4.1 - 4.4)

UNIT 3: (Chapters 7 & 9: Sections 7.1 - 7.2 and 9.1 - 9.3 (9.3.1-9.3.3))

UNIT 4: (Chapter 10: Sections 10.1-10.4, 10.6)

UNIT 5: (Chapters 11 & 12: Sections 11.1 - 11.4 (11.4.1-11.4.3) and 12.1-12.5)

### REFERENCE

1. Kanti Swarup, P.K.Gupta, Manmohan, "Operations Research", Sultan Chand & Sons, New Delhi, 2008.

2. Sasieni, Arthur Yaspan, Lawrence Friedman, "Operations Research Methods and Problems", Wiley International Edition, 1959.

3. S.D. Sharma, "Operations Research", 15-e, Kedarnath RamNath & Co Publishers, 2007.

4. Hamdy A.Taha, "Operations Research", Prentice Hall of India, New Delhi, 2007.

### WEB REFERENCES

<http://mathworld.wolfram.com>

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit] 2 x 10 = 20

**End-Semester Examinations**

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**OBJECTIVES**

- To be aware of essential concepts of software quality.
- To understand fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods.
- To identify the Systematic approach to the development, operation, maintenance, and retirement.
- To apply software testing knowledge and methods in testing software projects.

**1. INTRODUCTION TO TESTING AN QUALITY**

Principles of Testing - Software Development Lifecycle Models: – Phases of software project – Quality, Quality Assurance and Quality Control – Testing verification and validation-Process model to represent different phases – life cycle models - Spiral or Iterative model - The V Model - Modified V Model – Comparison of Various life cycle models.

**2. WHITE BOX TESTING**

Software Testing Types: White box testing – What is white box testing – Static testing – Structural testing – Challenges in White box testing.

**3. BLACK BOX TESTING**

Black box testing - What is black box testing – Why black box testing – When to do black box testing – How to do black box testing - Integration testing - What is integration testing integration testing as a type of testing - integration testing as a phase of testing – Scenario testing.

**4. SYSTEM AND ACCEPTANCE TESTING**

System and acceptance testing – System testing overview – Functional Versus Non Functional testing – Functional System testing – Non Functional testing - Acceptance testing – Summary of Testing Phases.

**5. NON – FUNCTIONAL TESTING**

Performance testing – Factors Governing Performance testing - Methodology for Performance testing – Tools for Performance testing – Process for Performance testing - Regressing testing – What is regression testing – Types of regression testing - When to do regression testing – How to do regression testing.

**TEXT**

Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing Principle and Practices”, Sixth Impression, 2008, ISBN: 978 – 81 – 7758 – 121 – 8.

**REFERENCE**

1. Illene Burnstien, “Practical Software Testing”, First Edition, Springer International Edition, 2004, ISBN: 81-8128-0 89-X.
2. William E Perry, “Effective Methods for Software Testing”, Second Edition, John Wiley & Sons, 2005, ISBN: 9971–51–345–5.

3. Sandeep Desai and Abhishek Srivastava, “Software Testing a Practical Approach”, PHI Learning, 2012, ISBN: 978-81-2034-534-8.
4. S.A. Kelkar, “Software Quality and Testing - A Concise Study”, PHI Learning Private Limited, 2012, ISBN: 978-81-203-4628-4.
5. Dorothy Graham, Erik van Veenendaal, Isabel Evans and Rex Black, “Foundations of Software Testing ISTQB Certification”, Cengage Learning India Private Limited, 2007, ISBN-13: 978-81-315-0218-1.
6. Jason Germbi, “Developing Secure Software”, Cengage Learning India Private Limited, 2008, ISBN 13: 978-81-315-0888-6.

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### **SOFTWARE TESTING AND QUALITY ASSURANCE (TCP)**

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1. Writing Test Scenario
2. Creating Test Cases
  - a. Boundary Value Analysis
  - b. Equivalence Class Partitioning
3. Preparing Test Plan
4. Testing Tools
  - a. Selenium IDE
  - b. JUNIT

### **QUESTION PAPER PATTERN**

**CA Tests****Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b><u>Section B</u></b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b><u>Section C</u></b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions. [Atleast one question from each unit]	2 x 10 = 20

**End-Semester Examinations****Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b><u>Section B</u></b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b><u>Section C</u></b> Answer <b>ANY THREE</b> Questions out of <b>FIVE</b> Questions. [Atleast one question from each unit]	3 x 15 = 45

**MCA164I      OPEN SOURCE DATABASE MANAGEMENT SYSTEM      0-0-0-  
4:100**

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**OBJECTIVES:**

- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To understand the role of the database administrator.

**PREPARATIVE STUDY:**

- SQL Data Types, SQL Constraints
- SQL Statements (DDL, DML, DRL, DCL and TCL)
- Database Normalization
- Database Users Privileges, Roles and Rights

**LIST OF PROGRAMS**

1. Creating and Managing Tables

- a) Constraints

2. SQL Statements – 1

- a) Basic SQL SELECT Statements
- b) Restricting and Sorting Data
- c) Single-Row Functions

3. SQL Statements – 2

- a) Displaying Data from Multiple Tables
- b) Aggregating Data Using Group Functions
- c) Subqueries

4. Manipulating Data

- a) INSERT statement
- b) DELETE statement
- c) UPDATE statement

5. Creating and Managing Views

- a) Creating Views
- b) Implementing DML Statements on views

6. Using SET operators, Date/Time Functions, GROUP BY clause (advanced features) and advanced subqueries

7. PL/SQL Basics

- a) Declaring Variables
- b) Writing Executable Statements
- c) Interacting with the Oracle Server
- d) Writing Control Structures

8. Composite data types, cursors and exceptions

- a) Working with Composite Data Types
- b) Writing Explicit Cursors
- c) Handling Exceptions

9. Procedures and Functions

- a) Creating Procedures
- b) Creating Functions

- c) Managing Subprograms
- d) Creating Packages

10. Triggers

- a) Creating Triggers
- b) Creating Triggers

11. DBA Commands

- a) Creating Database
- b) Users Creations and Privileges
- c) Grand and Revoke

**REFERENCE**

1. Shio Kumar Singh, “Database Systems Concepts, Designs and Applications”, 2<sup>nd</sup> Edition, 2011, Dorling Kindersly (India) Pvt.Ltd.
2. Kogent Solutions, “Oracle 10g Administration in Simple Steps”, First Edition, 2008, Dreamtech.

**Evaluation Scheme**

- There will be no term-end semester examination. But the students will be evaluated at the end of semester for 50 marks.

Content	Internal Marks
Test	30 Marks
Viva Voce	20 Marks
<b>Total</b>	<b>50 Marks</b>

**MCA165T**  
**4:100**

**PRACTICAL: JAVA**

**0-0-0-**

1. Java Collections
2. Applet, AWT

3. Swing Components
4. Socket programming, RMI
5. Servlet to manage http request and response, Servlet with JDBC
6. Handling Cookies, Session Tracking,
7. JSP Scripting Elements
8. JSP tags, JSP with Bean
9. Integrating Servlet, JSP with MVC and JDBC
10. JSTL Tags
11. Creating Session Bean
12. Creating Entity Bean
13. Struts 2 actions
14. Struts 2 Tags
15. Struts 2 with Validation
16. Struts 2 with JDBC Connection

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

Time duration is 2 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **End Semester Examinations**

**Max. Marks: 100**

Time duration is 3 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*



- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

**MCA166T**

**PRACTICAL : SCRIPTING TECHNOLOGY**

**0-0-0-**

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**4:100**

1. Creation of interactive web sites - Design using HTML and authoring tools
  - a. basic HTML tags, different styles, links and with all Basic control elements.
2. Create a webpage with two tables. First one should have 1 row and 5 columns and the

second one with 3 rows and 4 columns. The contents of the first table should be center aligned and contents of the second table should be right aligned. Each column of the first table should have separate colors and each row of the second table should have separate colors.

3. Create a framed webpage with different frames.
4. Collect of Personal Information using forms.
5. Create a web page with all types of Cascading style sheets.
  - a. Inline
  - b. Internal
  - c. External
6. Handling multimedia content in websites.
7. Client-Side Scripts for Validating Web Form Controls using DHTML.
8. Create webpage with following using jQuery.
  - a. Selectors
  - b. Events
  - c. Hide and Show
  - d. Fade
  - e. Slide
  - f. Animate
9. Generate jQuery Programs using CSS.
10. Create Custom animations with jQuery.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

Time duration is 2 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **End Semester Examinations**

**Max. Marks: 100**

Time duration is 3 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*

- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

## II SEMESTER

**MCA260T  
0:100**

**ENTERPRISE APPLICATIONS WITH .NET**

**4-0-0-**

### **OBJECTIVES**

- To Learn the fundamental structured and object oriented features of the C# programming language.
- To develop a stand-alone windows applications in the .NET framework using C#.
- To learn and build an applications with WPF control, styles and resources using C#.
- To create web-based applications using ASP.NET using C#.
- To learn the usage and application of LINQ.

### **1. FUNDAMENTALS OF C#**

.NET Framework Architecture – C# Language– Literals, Variables and Data Types – Operators and Expressions – Decision Making and Branching – Decision Making and Looping – Methods in C# - Handling Arrays – Structures and Enumerations – Classes and Objects – Inheritance and Polymorphism –Interface – Operator Overloading – Delegates and Events – Managing Errors and Exceptions –Multithreading in C#.

### **2. WINDOWS FORMS**

Introducing the Form Class – Performing Common Form Operations – Creating Message Boxes – Creating Input Boxes – Creating Dialog Boxes – Handling Events — Using the Label Control, Using the TextBox Control, Using the Button Control, Using the RadioButton Control, Using the CheckBox Control, Using the ComboBox Control, Using the ListBox Control, Using the GroupBox Control, Using the Panel Control, Using the PictureBox Control,

Using the Timer Control, Using the Progress Control - Using the ToolStrip Control- Using the MenuStrip Control – Using the StatusStrip Control – Working with Dialog Boxes.

### **3. WINDOWS PRESENTATION FOUNDATION**

Using XAML in WPF – Working with WPF Controls: Textbox, label, Button, listbox, ComboBox, radio button , Check Box, PasswordBox, TextBlock, Border, Grid, GridSplitter, Canvas, StackPanel, DataGrid, Calendar, DatePicker Controls – Working with Resources and Styles.

### **4. ASP.NET**

Standard Controls: Introducing the WebControl Class – Using the Label Control – Using the TextBox Control – Using the Button Control – Using the ImageButton Control – Using ListBox Control – Using the RadioButton Control – Using the CheckBox Control – Using the Table Control – Using the Wizard Control – Using the Calendar Control – Using the AdRotator Control – Navigation Controls : Working with the SiteMapPathControl – Working with Menu Control – Working with TreeView Control – Validation Controls: Introducing the BaseValidator Control – Using the RequiredValidator Control – Using RangeValidator Control – Using RegularExpressionValidator Control – Using the CompareValidator Control – Using the CustomValidator Control – Using the ValidationSummary Control.

### **5. LINQ AND ADO.NET**

LINQ: Create a Simple LINQ Query – Working with Standard Query Operators – Implementing LINQ to ADO.NET – Using Anonymous Types in Queries – Using Lambda Expressions in Queries – Exploring PLINQ – Working With ADO.NET: Introducing ADO.NET – Accessing Data in ADO.NET – Implementing Data Binding: Data Binding in Windows Forms – Data Binding in WPF – ASP.NET Database Controls: Working with ADO.NET – Introducing DataSource Controls – Working the Data-Bound Controls.

### **TEXT**

1. E.Balagurusamy, “Programming in C#”, Third Edition, McGrawHill Higher Education, New Delhi, 2010.  
UNIT 1: Chapter – 4,5,6,7,8,9,11,12,13,14,15,16,18,19
2. VikasGupta, “Comdex .NET 4.5 Programming”, Dream Tech Press, New Delhi, 2014.  
UNIT 1: Chapter 2  
UNIT 2: C# 2012 - Chapter 2 and 3  
UNIT 3: Visual Basic – Chapter 5  
UNIT 4: ASP.NET 4.5 – Chapter 1, 2, 3, and 4  
UNIT 5: C# - Chapter – 4, 5, 6 and ASP.NET 4.5 – Chapter 6

### **REFERENCE**

1. Kogent Solutions, “C# 2008 Programming Black Book”, Dream Tech Press, New Delhi, 2009.
2. David S.Platt, “Introducing Microsoft .Net”, Prentice Hall of India, Private Limited, New Delhi, 2008.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit] 2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**MCA261T**

**COMPUTER GRAPHICS**

**4-1-0-**

**0:100**

### OBJECTIVES

- To provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
- To learn the principles and commonly used paradigms and techniques of computer graphics.
- To impart a thorough knowledge on 2D and 3D transformations, modeling, image synthesis, and rendering.
- To gain a proficiency with OpenGL for writing applications that produce 2D and 3D computer graphics.
- To gain a proficiency in DIRECTX for writing applications that produce 2D and 3D computer graphics.

### 1. LINE-DRAWING ALGORITHMS

DDA, Bresenham Technique, Circle-Generating Algorithms: Properties of Circles, Midpoint Circle Algorithm–Filled Area Primitives: Boundary-Fill Algorithm, Flood-Fill Algorithm.

### 2. 2D TRANSFORMATIONS, VIEWING AND GRAPHICAL USER INTERFACE

Two Dimensional Transformations: Basic Transformations, Matrix representations and Homogenous Coordinates, Composite Transformations: Translation, Rotation, Scaling, Other Transformations: Reflection, Shear – Window to Viewport Coordinate Transformation – Line Clipping: Cohen-Sutherland Algorithm, Liang - Barsky Line Clipping, Nicholl – Lee – Nicholl Line Clipping– Polygon Clipping: Sutherland Hodgeman Algorithm, Weiler-Atherton Polygon Clipping – Text Clipping – Input of Graphical Data - Interactive Picture Construction Techniques.

### 3. INTRODUCTION TO OPENGL

OpenGL Command Syntax – Drawing Geometric Objects – Viewing and Modeling Transformations – Specifying a Color and a Shading Model – Lighting: Real world OpenGL Lighting – Selecting a Lighting Model – Defining Material Properties – Blending, Antialiasing, Fog Techniques.

### 4. 3D TRANSFORMATIONS, VIEWING AND METHODS

Three Dimensional Geometric Transformations: Translation–Rotation: Coordinate-Axes Rotations, Scaling, Other Transformations: Reflections, Shears - Composite Transformations. Three Dimensional Display Methods – Projections: Parallel Projection, Perspective Projection – Visible Surface Detection Methods: Classification, Back-Face Detection, Depth-Buffer, Scan-Line, BSP-Tree Methods, Area Sub-Division and Octree Methods – Polygon Rendering Methods.

### 5. INTRODUCTION TO DIRECTX

Directx history – Architecture – Using Directx – DirectInput – Initializing DirectInput – Using Directinput – Action Mapping – Bulding the Input Sub-System – Input Sample Program.

### TEXT

1. Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, “OpenGL Programming Guide: The Official Guide to Learning OpenGL”, Addison-Wesley Professional, 2008.  
UNIT 1: Chapter 1.4, 2.2.3, 3.2, 4.4, 5.2, 5.3, 5.5, 5.6, 6.1, 6.2, 6.3.
2. Kevin Hawkins, “OpenGL Game Programming” First Edition, Prima Publishing, 2001.  
UNIT 2: Chapter 1 and Chapter 16.
3. Hearn D and Baker M.P, "Computer Graphics – C Version", Second Edition, Pearson Education, 2004.  
UNIT 3: Chapter 5.1, 5.2, 5.3.1, 5.3.2, 5.3.3, 5.4, 6.3, 6.7.1, 6.8.1, 6.10, 8.2, 8.5.  
UNIT 4: Chapter 11.1, 11.2.1, 11.3, 11.4, 9.1, 12.3, 13.2, 13.3, 13.5, 13.7, 13.8, 13.9, 14.5.

### REFERENCE

R. Stuart Ferguson, “Practical Algorithms for 3D Computer Graphics”, First Edition, AK Peters, 2001.

### WEB REFERENCES

[www.glprogramming.com/red](http://www.glprogramming.com/red)

### QUESTION PAPER PATTERN

#### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit] 2 x 10 = 20

**End-Semester Examinations** **Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 =

35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**MCA262T** **DESIGN AND ANALYSIS OF ALGORITHMS** **3-1-0-**  
**0:100**

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## **OBJECTIVES**

- To learn the basics of Algorithms design and analysis.
- To understand the divide & conquer and greedy methods with applications.
- To understand the dynamic programming and backtracking methods with applications.
- To learn the mode of randomized and approximation algorithms with applications.
- To learn about reduction, non-deterministic and parallel algorithm with applications.

### **1. INTRODUCTION TO ALGORITHMS**

Basics of Algorithm: Introduction – Upper Bound of Polynomial Form of Time Complexity – Divide and Conquer: Introduction – Merge Sort - Multiplication of Two n Bit Numbers – Greedy Method: Introduction – Minimum Cost Spanning Tree – Dijkstra's single source shortest path.

### **2. DYNAMIC PROGRAMMING, BACKTRACKING AND BRANCH AND BOUND**

Dynamic Programming: Introduction – Travelling Salesperson – 0/1 Knapsack Problem – Backtracking: Introduction – Four Queens Problem – Branch and Bound – Assignment Problem.

### **3. RANDOMIZED AND APPROXIMATION ALGORITHMS**

Randomized Algorithm: Introduction – Primality Testing – Majority Element – Approximation Algorithms: Introduction – Job Scheduling – Bin Packing.

### **4. REDUCTION METHOD AND NON DETERMINISTIC ALGORITHMS**

Reduction Method: Non Deterministic Algorithms – Non Deterministic Searching – Non Deterministic Sorting – Satisfiability.

### **5. PARALLEL ALGORITHMS**

Introduction – PRAM Algorithms: List Ranking – Finding Maximum of an Array of Elements – Bounded Degree Network Algorithms: Networks – Network Algorithms – Summation on Multiprocessors.

**Note:** Analysis is included for Merge Sort, Multiplication of two  $n$  bit numbers, Minimum Cost Spanning Tree, Travelling Salesperson problems.

### TEXT

S.K.Basu, “Design Methods and Analysis of Algorithms”, Prentice Hall of India, New Delhi, 2013.

### REFERENCE

1. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Galgotia Publications Pvt. Ltd, New Delhi, 2019.
2. Alfred Aho, John Hopcroft, Jeffrey Ullman, “The Design and Analysis of Computer Algorithms”, Pearson Education, Delhi, 2003.
3. Thomas Cormen, Charles Leiserson, Ronald Rivest, “Introduction to Algorithms”, Prentice Hall of India, New Delhi, 2009.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions

[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.

[Atleast one question from each unit]

2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.

[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.

[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.

[Atleast one question from each unit]

3 x 15 = 45



**OBJECTIVES**

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.

**1. CONCEPT AND SYMBOLIC LOGIC**

What is AI, Importance of AI, AI and Related Fields – Knowledge: Definition and Importance of Knowledge, Knowledge Based Systems, Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, Acquisition of Knowledge – Symbolic Logic: FOPL, Syntax and Semantics for Propositional Logic, Syntax and Semantics for FOPL, Properties of Wffs, Conversion to Clausal Form, Inference Rules, Resolution principle.

**2. KNOWLEDGE REPRESENTATION**

Structured Knowledge: Introduction, Associative Networks, Frame Structure, Conceptual Dependencies and Scripts – OO Representation: Introduction, Overview of OO Systems, Objects, Classes, Messages, Methods, Simulation Using OOS Program – Fuzzy Logic and Natural Language Computations.

**3. KNOWLEDGE ORGANIZATION AND MANIPULATION**

Control Strategies: Preliminary Concepts, Uniformed or Blind Search, Informed Search, Searching And-Or Graphs, Examples of Search Problems – Matching Techniques: Introduction, Structures used in Matching, Measure for Matching, Matching Like Patterns, Fuzzy Matching Algorithms – Indexing and Retrieval Techniques.

**4. EXPERT SYSTEM**

Natural Language Processing: Overview of Linguistics, Grammars and Languages, Basic Parsing Techniques, Sematic Analysis and Representation, Natural Language Generation, Natural Language Systems – Pattern Recognition: Recognition and Classification Process, Learning Classification Patterns – Expert System Architecture: Introduction, Rule Based System Architectures, Nonproduction System Architecture, Dealing with Uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.

**5. LEARNING BY INDUCTION**

Intelligent Editors – Basic Concepts, Some Definitions, Generalization and Specialization, Inductive Bias, Example: Inductive Learner – ID3 System – LEX System – INDUCE System – Learning Structure Concepts.

**TEXT**

Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education, 2<sup>nd</sup> Edition, 2015.

## REFERENCE

1. Peter Jackson, “Introduction to Expert Systems”, Third Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig, “AI – A Modern Approach”, Second Edition, Pearson Education 2007.
3. Deepak Khemani, “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit]

2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit]

3 x 15 = 45

**OBJECTIVES**

- To understand the different architectures of IoT.
- To learn various protocols at the different layers for IoT.
- To develop prototypes systems using Arduino / Raspberry Pi.
- To apply the use of data analytics in IoT.

**1. ARCHITECTURES AND MODELS**

IoT Architectures – IoT Functional Stack, Sensors, and Actuators Layer, Communications Network Layer, Applications and Analytics Layer – IoT Data Management and computer Sack, Fog Computing, Edge Computing, Cloud Computing - Smart Objects, Sensor Networks.

**2. CONNECTIVITY**

Communication Criteria – Access Technologies – IP as IoT Network Layer – Profiles and Compliances – Application Protocols – Transport Layer – Application Transport Methods.

**3. SYSTEM DEVELOPMENT**

Design Methodology – Case study – Basic blocks of IoT device – Arduino – Raspberry Pi – Board, Interfaces, Setting up, Programming – Other IoT Devices.

**4. DATA ANALYTICS**

Data Analytics for IoT – Big Data Analytics Tool and Technology, Edge Streaming Analytics – Network Analytics.

**5. IoT IN INDUSTRY**

Manufacturing Industry, Architecture and Use cases - Smart Cities, Architecture and Use cases – Transportation, Architecture and Use cases.

**REFERENCE**

Jan Ho'ller, VlasiosTsiatis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsever, 2014.

Olivier Hersent, David Boswarthick, Omar Eloum, "The Internet of Things-Key applicaions and Protocols", Wiley Publication, 2012.

Arshdeep Bahga, Vijay Madiseti, "Internet of Things- A hands-on-approach", Universities Press, 2015.

Michael Miller, "The Internet of Things", Pearson Education, 2015.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit] 6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of THREE Questions.  
[Atleast one question from each unit] 2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of FIVE Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**OBJECTIVES**

- To understand the design issues in the development of mobile applications.
- To design the right user interface for mobile application.
- To understand the development procedure for mobile application.
- To develop mobile applications using various tools and platforms.

**PREPARATIVE STUDY**

- Mobile Application Model, Frameworks and Tools.
- Multimodal and Multichannel UI, Screen Elements and Layouts, Voice XML.
- Work flow for Application Development, Java API, Plug-ins and Rule of Thumb for using DLLs.
- Android Application Architecture, Android basic Components, Storing and Retrieving Data, Packaging and Deployment.

**LIST OF PROGRAMS**

1. Develop an application that uses GUI components, Fonts, and Colours.
2. Develop an application that uses Layout Managers and Event Listeners.
3. Develop a native calculator application.
4. Develop an application that makes use of database.
5. Develop a native application that uses GPS location information.
6. Write an application that creates alarm clock.

**REFERENCE**

Reto Meier, "Professional Android 4 Application Development", Wiley Publication, 2012.

**Evaluation Scheme**

- There will be no term-end semester examination. But the students will be evaluated at the end of semester for 50 marks.

Content	Internal Marks
Test	30 Marks
Viva Voce	20 Marks
<b>Total</b>	<b>50 Marks</b>

**CONSOLE APPLICATION**

1. Branching, Looping and Methods
2. Handling Arrays, Structures and Enumerations
3. Classes and Objects, Inheritance and Polymorphism, and Interface
4. Delegates and Events, Managing Errors and Exceptions, and Multithreading

### **WINDOWS APPLICATION**

5. Message Box, Input Box and Dialog Box
6. Label, TextBox, Button, Radio Button, CheckBox, GroupBox, and Panel Controls
7. ComboBox, ListBox, Timer, Progress Controls
8. Tool Strip and Menu Strip Controls
9. Working with Dialogs

### **WINDOWS PRESENTATION FOUNDATION**

10. Grid, Button, TextBox, PasswordBox, TextBlock, Border, GridSplitter, and Canvas
11. StackPanel, DataGrid, Calendar, and DatePicker Controls
12. Working with Resources and Styles

### **WEB APPLICATION**

13. Label Control, TextBox Control, Button Control, and ImageButton Control
14. ListBox Control, RadioButton Control, and CheckBox Control
15. Calendar Control and AdRotator Control
16. Working with Navigation Controls
17. Working with Validation Controls

### **ADO.NET**

18. Implementing LINQ to ADO.NET
19. Working with Windows Forms and ADO.NET
20. Working with WPF and ADO.NET
21. Working with ASP.NET and ADO.NET

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

Time duration is 2 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

**End Semester Examinations**

**Max. Marks: 100**

Time duration is 3 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

**MCA266P  
4:100**

**PRACTICAL: COMPUTER GRAPHICS**

**0-0-0-**

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**OPENGL**

1. Drawing Geometric Objects with Animation.
2. Viewing and Modeling Transformations.
3. Using Colors for the Objects.
4. Using Flat Shading.
5. Using Smooth Shading.
6. Using Lighting Effect.
7. Using Material Properties.
8. Using Blending.
9. Using Antialiasing.
10. Using Fog Techniques.

### **DIRECTX**

11. Mouse Activity.
12. Robot Example.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

Time duration is 2 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **End Semester Examinations**

**Max. Marks: 100**

Time duration is 3 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*



- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

## **8. RESEARCH DOMAIN [II and III SEMESTER]**

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### **ELECTIVE I: RESEARCH DOMAIN I**

### **ELECTIVE II: RESEARCH DOMAIN II**

#### **8.1. OVERVIEW**

As the Department specializes on selected technologies such as Different Types of Computing, Open Source Software Technology, Language Technology, and e-Learning, students are invited to join these research groups and they are provided an intensive training in 1<sup>st</sup> semester.

Each group of students is assigned a problem in the area of their research and asked to develop a solution or the papers to be published in Conference / Journals during 2<sup>nd</sup> and 3<sup>rd</sup> semesters.

For their final project, these students may continue their research project or be directly placed in related Research Centre's or Companies for project work and recruitment.

Based on the research focus and problems posed, the students are expected to prepare an individual technical report (at least 50 pages) on the field of their study. Theme for Technical Report in 2<sup>nd</sup> and 3<sup>rd</sup> semesters will be different. Based on the technical report, a written and oral examination is conducted.

Each student is expected to publish a paper in one of the national conferences or journals. In these research papers, they will present the outcome of their experiments and analysis.

This course aims to achieve an understanding of the research challenges by assigned readings, technical report writing, discussions and presentations on the qualitative and quantitative aspects of the subject under study. Two research outputs shall be submitted by the students as their Research Portfolio namely Technical Report and Research Survey. An input session is given on research methodology for the selected students.

## **8.2. COURSE ELEMENTS**

### **a. RESEARCH METHODOLOGY**

Input Sessions shall be given for the students in the 2<sup>th</sup> semester (fixed days or hours) to know the methodology for research work and to apply the same.

#### **Semester II**

**INTRODUCTION:** Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question – Choice of a problem – Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

**QUANTITATIVE METHODS:** Statistical Modeling and Analysis, Time Series Analysis, Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods – Research Planning – Reflections on research – Designing experiments – Measurements and coding – Contribution – Evaluation of papers.

**REPORTING:** Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing - Plagiarism.

### **b. TECHNICAL REPORT**

Based on the research focus and problems posed, the students are expected to prepare the individual Technical Report (at least 50 pages) on the field of their study. The Technical Report (TR) is a comprehensive understanding of the subject through which students communicate their study of the subject. TR should present core understanding of the subject developed logically along clearly identified perspective. The TR must include the Concepts, Technology, Tools, and Application of the expounded topic. This report is worth 50% of the course. Theme for Technical Report in 2<sup>nd</sup> and 3<sup>rd</sup> semesters are different.

### c. RESEARCH SURVEY

Research Survey (RS) focuses on a research problem related to the selected field of work. Students should pick a problem, gather materials on the research done in the field, discuss the current state of understanding on the topic and describe particular areas where progress appears possible. This paper is worth 50% of the course. The evaluation of the research paper is done by external reviewers along with the internal supervisor. Each student is encouraged to publish the survey paper in one of the national conferences or journals.

### 8.3. TOPICS FOR RESEARCH STUDY

To facilitate students into the area of research, potential topics for study in each chosen field are given below. The students can choose one of these topics or suggest a relevant topic in consultation with the Research Supervisor, however, since the number of faculty getting into research is on the rise every year, the research areas are not limited to the below, they can be chosen according to the specialization of the supervisor.

#### Semester II and III

- a) *eLearning*
- b) *Data Quality Assurance*
- c) *Network and Security*
- d) *Data Analytics*
- e) *Software Metrics*
- f) *Cloud Computing*
- g) *Ontology and Semantics*
- h) *Internet of Things*

Note: *The topics mentioned above are subject to change, any upcoming research area during the period of research can be considered after being passed in the standing committee of the respective academic years.*

### 8.4. EVALUATION SCHEME

The following guidelines shall be applied in evaluation of technical reports and Research Papers. For the Students admitted from the year 2021 – 2022 onwards:

#### Evaluation Components

<b>Internal Assessment (Research Guide)</b>	<b>Total 50 Marks</b>
Technical Report (TR)	15 Marks
Research Survey (RS)	15 Marks
CA Tests	15 Marks
Regularity	5 Marks
<b>External Assessment</b>	<b>Total 50 Marks</b>
Technical Report (TR)	10 Marks
Research Survey (RS)	10 Marks
Paper Publication	15 Marks
Viva Voice	15 Marks

Evaluation of Technical Report and Research Survey are done on the basis of their scientific merit, effective presentation, and appropriateness for assignment. Student is rewarded based

on thorough analysis, originality, and insightfulness found in the Technical Report. Scientific merit includes correctness, significance, novelty, non-triviality, and completeness.

Students shall individually and periodically meet their Research Guide and shall maintain a record describing their following activities: Review of Task, Points for Discussion, Resource Document (Output) and Action Item.

The Technical Report and Research Survey Paper shall be sent for blind review to at least two external subject experts. A Research Paper should be prepared from the output of TR and SP and is recommended to be presented in a Conference or published in a Journal. The Head of the Department nominates the external subject experts (who are interested in the area of study) to review the students' work by sending the work to them by email.

Research Domain subjects will not have term-end examination, instead they have viva voce conducted by a committee of two examiners (Internal and External) after the review of their works by the Internal Examiner. Remuneration for the committee members will be as per the university norms. The viva voce will be conducted on the same day/time while the other Domain elective semester examinations are being conducted. The duration of viva voce for each student shall be at least 15 minutes. (8 minutes for presentation and 7 minutes for question and answers)

The Head of the Department will finally submit the cumulative of the following marks to the COE: Technical Report, Research Survey, and Viva Voce.

*If a candidate fails he/she has to redo the course by paying for the examination fee along with the students of next batch and select a topic from the list of topics published by the department.*

## 10. INTERNAL COURSES

### SOFT SKILLS

2-0-0-0:100

Content	Topics	Hours
<b>Introductory Module</b>	Being someone and knowing someone Setting expectations Non-verbal Communication Move like a Machine	6 Hours
<b>Understand self</b>	Brief account of life My life roles rainbow Who am I Communication skills SWOT Conflict resolution Decision making Time management	10 Hours
<b>Understand career</b>	Life after college/ITI Career and me Understanding career Interests & Abilities Multiple Intelligence	6 Hours

<b>Preparing for work</b>	Workplace expectation (Digital lesson) Resume & Interview (Digital lesson) LinkedIn Week (Digital lesson) My Image (Digital lesson) Preparing for interview (Digital lesson) Mock Interview	8 Hours
<b>TOTAL HOURS</b>		<b>30 HRS</b>

## 11. EVALUATION & CERTIFICATION

### 11.1 Continuous Assessment

S. No.	Course Type	Internal Components	Marks	Total
1	Theory	2 CA Tests	30	50
		Online Test / Quiz	5	
		*Other Components	15	
		Paper Work		
		Problem Solving / Group Discussion / Discussion Forum		
		Technical reports		
		Application Development		
		Seminar		
		Demonstration		
		Open Book Assignment		
2	Theory Combined Practical	2 CA Tests	30	50
		Online Test / Quiz	5	
		Paper Work	5	
		Demonstration/Technical Report		
		Lab Exercises	10	
3	Practicals	Assessment of Lab Exercises	30	50
		Record Work	10	
		Test	10	
4	Pure Practicals	Assessment of Lab Exercises	30	50
		Application Development	20	

**Note:** \*Other components can be fixed up by the course teacher with the endorsement of the HOD.

## 11.2 CA Tests

### 11.2.1 Theory

The time duration for the examination is 2 Hrs. The question paper format is:

<b>Max. Marks : 50</b>	
<b>Section A</b>	
Answer ALL the Questions [atleast 3 questions from each unit]	6 X 2 = 12 Marks
<b>Section B</b>	
Answer ALL the Questions [atleast 3 questions from each unit, Either or Type ]	3 X 6 = 18 Marks
<b>Section C</b>	
Answer ANY TWO Questions out of Three Questions [atleast 1 question from each unit]	2 X 10 = 20 Marks

### 11.2.1 Practical

**Time: 2 Hrs.**

**Max. Marks: 50**

Each student will get a single question to be answered. The question will have two subdivisions.  
(2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

## 11.3 End-Semester Examinations

### 11.3.1 Theory

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b>Max. Marks : 100</b>	
<b>Section A</b>	
Answer ALL the Questions [atleast 2 questions from each unit]	10 X 2 = 20 Marks
<b>Section B</b>	
Answer ALL the Questions [Either or Type, atleast 1 question from each unit]	5 X 7 = 35 Marks
<b>Section C</b>	
Answer ANY THREE Questions out of FIVE Questions [atleast 1 question from each unit]	3 X 15 = 45 Marks

### 11.3.2 Practical

- For each practical course, a question bank is prepared at the introduction of the course by a committee of utmost three staff members.

- The Committee prepares the questions and reviews them through regular meetings in consultation with the Controller of Examinations. Utmost 3 meetings can be conducted for a single course.
- Office of the Controller of Examinations will provide sitting charges for the members of the committee.
- The Head of the Department will submit the Question Bank to the controller of Examinations within three months of the introduction of the course from the beginning of the new academic year.
- The Controller can select the questions for every batch of the practical examinations as per the number of candidates.
- Each question must be separated from the given questions provided by the Controller and must be pasted on the answer paper in such a way that, each answer paper is pasted with only one question.
- The answer paper pasted with question must be displayed, without showing the questions to the students. The students should select only one answer paper pasted with question and solve the problem.
- No question must be prescribed by the examiner, other than the questions provided by the Controller.
- All questions given for batch must be used for that batch only.

### **Practical Question Paper Pattern**

**Time: 3 Hrs.**

**Max. Marks: 100**

Each student will get a single question to be answered. The question will have two subdivisions.  
(2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **11.3.3 Pure Practical**

##### **Evaluation Scheme**

- There will be no term-end semester examination. But the students will be evaluated at the end of semester for 50 marks.

<b>Content</b>	<b>Internal Marks</b>
Test	30 Marks
Viva Voce	20 Marks
<b>Total</b>	<b>50 Marks</b>

#### **11.3.4 Research Domain**

Refer Section 8 for the Evaluation scheme.

### **11.3.5 Software Project Work [III, IV]**

Refer Section 9 for the Evaluation scheme.

### **11.3.6 Certificate, Self Learning, Life and Employability courses**

There will not be an end semester examination, however, the students will be evaluated internally to become eligible to acquire the credits.



**List of Theory Combined Practical Papers**

Semester	Course Code	Course Title
I	MCA163T	Software Testing and Quality Assurance
III	MCA362T	Open Source Frameworks

**List of Pure Practical Papers**

Semester	Course Code	Course Title
I	MCA164I	Open Source Database Management System
II	MCA264I	Android Application Development

**Note:** Marks for the Internal Assessment will be given from the lab work for Pure Practical Papers. No End Semester Practical Examination will be held.

**List of Elective Subjects**

(Conducted in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> Semesters, Students has to choose from the below course)

Semester	Course Code	Elective I
II	MCA263A	Artificial Intelligence
	MCA263B	Internet of Things
	MCA263C	Research Domain I
<b>Elective II</b>		
III	MCA363A	Cloud Computing
	MCA363B	Social Network Analysis
	MCA363C	Research Domain II
	<b>Elective III</b>	
	MCA364A	Enterprise Resource Planning
	MCA364B	Big Data
<b>Elective IV</b>		
IV	MCA466A	Data Analytics with R Programming
	MCA466B	Data and Information Security
	<b>Elective V</b>	
	MCA467A	Data Mining Techniques
	MCA467B	Game Programming

**7.1 CODING SCHEME**

MCA	X	X	X	X
Programme Code	Semester Number 1-4	Curriculum Revision Number 0-9	Course Serial Number 0-9	Course Type*

\*Course Type: T–Theory, P–Practical, J–Project, A to E – Electives, I – Internal Papers, S – Skill Papers.

## 7.2 ADDITIONAL COURSES

### a) Life and Employability Skill Courses

Semester	Course Code	Course Title	Credits
I		Soft Skills	2
II		Technical Aptitude	2
III		Quantitative Aptitude	2

**Note:** Life and Employability skill courses are organized by the Placement cell.

### b) Certificate Courses

Semester	Course Title	Credits
I	Web Authoring Tools	2
II	Natural Language Processing	2
III	Smart Device Technologies	2

**Note:** These certificate courses are intended to be conducted through training and placement consultancies of high repute and each course will be conducted for a minimum period of 30 conduct hours including theory and practicals. The concept behind these certificate courses is to enable the students to craft themselves employable and avail placement. These courses need not require an end semester examination. The cost incurring to conduct these certificate courses will be borne by the students. The list of certificate courses are listed below, however can be considered for including new courses and revising the content of the courses according to the industry requirements which varies from time to time. The course can be conducted during the semesters or during the summer/winter vacation.

### c) SELF LEARNING COURSE

Since the certificate courses involve cost, to enable the economically deprived students to provide a chance to acquire the additional technical skills required for employment. The students can take up a Self-learning course (1 credit each), they are expected to learn the technologies through self-learning based on the online tutorials and other related resources. However, they have to prove themselves to have undergone the mentioned syllabus through an end term examination, which the department will conduct. **The students are advised to take up three MOOC courses recognized by AICTE and UGC for credit transfer, such as NPTEL and SWAYAM.**

A student has to acquire 90 credits by successfully undergoing the mandatory courses to get qualified for the M.C.A degree. The mandatory courses are compartmentalized into Theory, Practical, Theory Combined Practicals (TCP), Pure Practical and Project courses. However, further to cater to the needs of the advanced learners, flexibility is provided in the curriculum in the form of certificate courses in the semester I, II and III, the Life and Employability courses handled from first semester to third semester, and Self Learning courses. The minimum number of credits to be acquired to become eligible for the MCA degree, is 90, The Life and Employability skills, Certificate and Self learning courses add up the credits tally to a maximum of 105. The Life and Employability skills, Certificate and Self learning credits will not be included for the CGPA calculation.

#### d) PURE PRACTICAL PAPERS

To enable the students to have more practical experience, considering the limitation in number of practical sessions that can be conducted proportionate to the workload. A new type of paper is introduced which is named as Pure Practical paper in semester I and II. In these papers, the course teacher will demonstrate and teach the technical concepts required to complete a practical exercise, in the computer laboratory itself before students begin their work. The teacher will then guide the students to complete the laboratory sessions.

#### TOTAL CREDITS

S.No	Type	Credits
1	<b>Mandatory Credits</b>	<b>90</b>
2	Life and Employability Skills (not included for CGPA)	6*
3	Certificate Courses (not included for CGPA)	6*
4	Self -Learning Courses (not included for CGPA)	3*
<b>MAXIMUM CREDITS (90+15*)</b>		<b>105</b>

#### 7.3 SYLLABI IN DETAIL

	<b>III SEMESTER</b>	
<b>MCA360T</b>	<b>PYTHON PROGRAMMING</b>	<b>4-0-0-0:100</b>

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#### OBJECTIVES

- To understand the fundamentals of writing Python scripts, Python scripting elements.
- To create a dynamic web page using Python.

#### 1. PYTHON OBJECTS

Introduction to Python, Comparison, Comments, Operators, Variables, Classes, Modules Syntax and Style Statements, Variable Assignment, Identifiers, Basic Style Guidelines. Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types, Numbers and Strings, Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions. Sequences: Strings, Lists, and Tuples, Sequences, Strings, Strings and Operators, String-only Operators, Built-in Functions, String Built-in Methods.

## **2. LISTS AND DICTIONARIES**

Operators, Built-in Functions, List Type Built-in Methods, Special Features of Lists, Tuples, Tuple Operators and Built-in Functions, Special Features of Tuples Introduction to Dictionaries, Operators, Built-in Functions, Built-in Methods, Dictionary Keys, Conditionals and Loops: if statement, else Statement, while Statement, for Statement, break Statement, continue Statement, pass Statement, else Statement.

## **3. FILES, REGULAR EXPRESSION AND EXCEPTION HANDLING**

File Objects, File Built-in Function, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules. Regular Expression: Introduction/Motivation, Special Symbols and Characters for REs, REs and Python. What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions.

## **4. DATABASE INTERACTION**

SQL Database connection using python, creating and searching tables, Reading and storing config information on database, Programming using database connections, Python Multithreading: Understanding threads, Forking threads, synchronizing the threads, Programming using multithreading.

## **5. DJANGO: WEB DEVELOPMENT WITH PYTHON**

Introduction, Creating a Django Project, Working with Templates, Working with Models, Getting a Model's Data with Querysets, Working with Django Forms.

## **TEXT**

1. R. NageswaraRao, "Core Python Programming", Second Edition, Dreamtech Press, 2018
2. Dr. M. Suresh Anand, Dr. R. Jothikumar, Dr. N. Vadivelan, "Python Programming", First Edition, Notion Press, 2020
3. Martin C. Brown, "The Complete Reference Python", Fourth Edition, McGraw Hill Education, 2018
4. Samuel Dauzon, Aidas Bendoraitis, Arun Ravindran, "Django: Web Development with Python", Packt Publishing Ltd, 2016.

## **REFERENCE**

1. Allen B. Downey, "Think Python", O'Reilly Media, 2016.
2. Amit Ashok Kamthane, Ashok NamdevKamthane, "Programming and Problem Solving with Python", First Edition, McGraw Hill HED, 2017.

3. SakisKasampalis, Quan Nguyen, Dr Gabriele Lanaro, “Advanced Python Programming”, Ingram short title, 2019.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b><u>Section B</u></b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b><u>Section C</u></b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions. [Atleast one question from each unit]	2 x 10 = 20

#### **End-Semester Examinations**

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b><u>Section B</u></b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b><u>Section C</u></b> Answer <b>ANY THREE</b> Questions out of <b>FIVE</b> Questions. [Atleast one question from each unit]	3 x 15 = 45

**MCA361T  
0:100**

**BLOCK CHAIN TECHNOLOGY**

**3-1-0-**

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#### **OBJECTIVES**

- To understand the concepts of a public digital ledger to share information in a trustworthy and secure way.
- To discuss and cover both the conceptual as well as application aspects of Block chain.

#### **1.BLOCKCHAIN**

Introduction to Blockchain – Various technical definitions of blockchain- generic elements of a blockchain – features of a blockchain – types of blockchain – decentralization – decentralization using blockchain – methods of decentralization.

#### **2. SYMMETRIC AND PUBLIC KEY CRYPTOGRAPHY**

Cryptography – confidentiality – integrity – authentication – non-repudiation – cryptographic primitives- symmetric cryptography – stream cipher – block cipher – Data Encryption Standard

(DES) – Asymmetric cryptography – public and private keys – RSA – Encryption and Decryption using RSA.

### 3. INTRODUCING BITCOIN

Bitcoin definition – Transaction – Transaction Life cycle – Transaction structure – Blockchain – structure of a block – structure of a block header – the Genesis Block – Mining.

### 4. BITCOIN NETWORK AND PAYMENTS

The Bitcoin network- wallets – wallet types - Bitcoin payments- bitcoin investments and buying and selling bitcoins.

### 5. BLOCKCHAIN-OUTSIDE OF CURRENCIES

Internet of Things – Physical object layer – Device layer – Network layer – Management layer – Application layer – Government – Border control – voting – Citizen identification – Health – Finance – Insurance – Financial Crime Prevention.

### TEXT

Imran Bashir, “Mastering Blockchain”, Second Edition, PACKT Publication.

### REFERENCE

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction”, Princeton University Press, 2016.
2. Roger Wattenhofer, “The Science of the Blockchain”, CreateSpace Independent Publishing Platform, 2016.
3. Melanie Swan, “Blockchain - Blueprint for a New Economy”, O’Reilly Media, Inc., 2015.
4. Abhijit Das and VeniMadhavan C. E., “Public-Key Cryptography: Theory and Practice”, Pearson Education India, 2009.

### QUESTION PAPER PATTERN

#### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions

[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.

[Atleast one question from each unit]

2 x 10 = 20

#### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of FIVE Questions.  
[Atleast one question from each unit] 3 x 15 = 45

**MCA362T**  
**0:100**

**OPEN SOURCE FRAMEWOKS**

**3-0-1-**

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## **OBJECTIVES**

- To understand the web technology and be able to architect, write, debug, and run complete web applications using PHP, MySQL and Angular JS.
- To create and develop the web applications with Laravel Framework.
- To use the Spring framework container to develop in any Java environments.

### **1. PHP WITH MYSQL AND ANGULAR JS**

Accessing Your MySQL Database from the Web with PHP – Introduction to AngularJS - Angular Modules and Controllers - Input Validation - Data Binding and Templates - AngularJS Services - Interacting with Server - AngularJS, PHP and MySQL.

### **2. LARAVEL BASICS**

Setting Up a Laravel Development Environment: System Requirements, Composer, Local Development Environments, Creating a New Laravel Project, Laravel's Directory Structure, Configuration An Introduction to Artisan, Basic Artisan commands .Router and Controllers: Route Definitions, Route Groups, Views, Controllers, Route Model Binding, Route Caching, Form Method Spoofing, CSRF Protection, Redirects, Aborting the Request, Custom Responses

### 3. ADVANCED LARAVEL AND API

Collecting and Validating User Data, Injecting a Request Object, Route Data, Uploaded Files, Validation, Form Requests, Eloquent Model Mass Assignment, versus Auth Controller Database Eloquent: configuration, Migration, Seeding, Query Builder, Advanced LARAVEL Request and Response: Laravel's Request Lifecycle, The Request Object, The Response Object, Laravel and Middleware Writing APIs : The Basics of REST - Like JSON APIs, Controller Organization and JSON Returns, Reading and Sending Headers, Eloquent Pagination, Sorting and Filtering, Transforming Results.

### 4. SPRING WITH MVC

Spring Framework Fundamentals: The Spring Framework, Dependency Injection, Application Context, Component-Scanning, Aspect-Oriented Programming (AOP) – Spring MVC Architecture: Simple Spring MVC Program – POJO Development - Implementing Controllers: Introducing Controllers, Interface-Based Controller, Annotation-Based Controller, Configuring View Controllers, Program using Controllers, ModelAttributes, PathVariable, Form Tags, Spring Tags, Type Conversion, Converter, Validating Model Attributes.

### 5. ADVANCED SPRING WITH MVC & REPORTING

Spring MVC with AJAX -Spring MVC with JDBC Template - Spring MVC with Hibernate - Jasper Report – Features – Reporting capabilities to java applications – Creating JRXML report – Creating Dynamic Database Report – Working Report Layout and Design Introduction to Junit.

#### TEXT

1. Luke Welling, Laura Thomson, “PHP and MySQL Web Development”, Fourth Edition, 2010.
2. Agus Kurniawan, “AngularJS Programming by Example”, Kindle Edition, 2014.  
UNIT I
3. Matt Stauffer, “LARAVEL Up and Running, A framework for building modern PHP Apps”, O'REILLY , Third Indian Reprint ( ISBN: 978-93-5213-485-4).  
UNIT II & III
4. Marten Deinum, Koen Serneels, “Pro Spring MVC: With Web Flow”, 2012.  
UNIT IV & V

#### QUESTION PAPER PATTERN

#### CA Tests

Max. Marks: 50

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer ALL the Questions.  
[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer ALL the Questions  
[Atleast three questions from each unit. Either or Type]

3 x 6 = 18



**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit]

2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit]

3 x 15 = 45

**MCA363A**  
**0:100**

**ELECTIVE II: CLOUD COMPUTING**

**3-0-0-**

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### OBJECTIVES

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

### 1. CLOUD COMPUTING BASICS

Cloud computing Overview – Cloud components, Infrastructure, Services - Applications – Storage, Database services - Intranets and the cloud – components, Hypervisor applications - First Movers in the Cloud - Your Organization and Cloud Computing - When you can use Cloud computing, Benefits, Limitations, Security Concerns, Regulatory Issues.

### 2. CLOUD COMPUTING SERVICE PROVIDER

Cloud Computing with the Titans -Google, EMC, NetApp, Microsoft, Amazon, Salesforce.com, IBM-The Business case for going to the Cloud -Cloud Computing services- Infrastructure as a Service, Platform as a Service, Software as a Service, Software plus services, How applications help your business, Deleting your data center.

### 3. CLOUD COMPUTING TECHNOLOGY I

Hardware and Infrastructure Clients – Mobile, thin, Thick – Security - Data leakage, Offloading work, Logging, Forensic, Development, Auditing - Network – Basic public Internet, The accelerated Internet, Optimized Internet overlays, Cloud providers, cloud consumers, Services - Accessing the Cloud- Platforms – Web Application framework, Web

hosting service, Proprietary methods - Web Applications, Web APIs - What are APIs, How APIs work, API Creators - Web Browsers.

#### **4. CLOUD COMPUTING TECHNOLOGY II**

Cloud Storage – Overview - The Basics, storage as a service, Providers, security, Reliability, advantages, cautions, Outages, Theft - Cloud storage providers - Standards - Application – Communication, Security - Client – HTML, Dynamic HTML, JavaScript - Infrastructure – Virtualization, OVF - Service – Data, Web service.

#### **5. CLOUD COMPUTING AT WORK**

Software as a Service -Overview -Advantages-Software Considerations-Vendor Advantages - Limitations -Driving Forces -Popularity -Virtualization Benefits -SaaS and SOA -Economic Impact-Company Offerings -Intuit -Google -Microsoft -IBM -Industries - Software plus Services-Overview-Pros -Cons -Vendors -Mobile Device Integration -Google Android - Providers-Adobe AIR -Apple iPhone SDK -Microsoft Online -Hybrid Model -Partnership - Active Directory.

#### **TEXT**

Anthony TVelte, Toby JVelteand Robert Elsenpeter, “Cloud Computing – A Practical Approach”, Tata McGraw Hill Education Pvt Ltd, 2010.

#### **REFERENCE**

1. Syed A.Ahson and Mohammed Ilyas, “Cloud Computing and Software Services: Theory and Techniques”, CRC Press, Taylor and Francis Group, 2010.
2. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, “Cloud Computing for Dummies”.Wiley- India Edition, 2010.
3. Ronald L. Krutz and Russell Dean Vines, “Cloud Security: A Comprehensive Guide to Secure Cloud Computing”. Wiley Publishing, Inc., 2012.
4. Barrie Sosinky, “Cloud Computing: Bible”, First Edition, Wiley Publishing, Inc.,2011.

#### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b><u>Section B</u></b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b><u>Section C</u></b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions. [Atleast one question from each unit]	2 x 10 = 20

## End-Semester Examinations

Max. Marks: 100

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.

[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.

[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of FIVE Questions.

[Atleast one question from each unit]

3 x 15 = 45

MCA363B

**ELECTIVE II: SOCIAL NETWORK ANALYSIS**  
**0:100**

3-0-0-

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### OBJECTIVES

- To learn knowledge representation using ontology.
- To understand the sources for network analysis.
- To understand the concept of semantic web and related applications.
- To understand knowledge representation on semantic web.
- To model and aggregate social networking of data.

### OUTCOMES

At the end of the course, the students will be able to

- Adopt to the concepts of semantic web.
- Perform social network analysis
- Represent knowledge in semantic web.
- Model social network data
- Aggregate and analyze social network data.

### 1. INTRODUCTION TO SEMANTIC WEB

Limitations of current Web, Development of Semantic Web, Emergence of the Social Web.

### 2. SOCIAL NETWORK ANALYSIS

Development of Social Network Analysis - pythonKey concepts and measures in network analysis.

### 3. ELECTRONIC SOURCES FOR NETWORK ANALYSIS

Electronic discussion networks, Blogs and online communities - Web-based networks.

#### **4. KNOWLEDGE REPRESENTATION ON THE SEMANTIC WEB**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation –  
Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology  
Language.

#### **5. MODELLING AND AGGREGATING SOCIAL NETWORK DATA**

State-of-the-art in network data representation - Ontological representation of social  
Individuals - Ontological representation of social relationships - Aggregating and reasoning  
with social network data.

#### **TEXT**

Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.

#### **REFERENCE**

1. Guandong Xu ,Yanchun Zhang and Lin Li, “Web Mining and Social Networking –  
Techniques and applications”, First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging  
Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet,  
2008.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions

[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.

[Atleast one question from each unit]

2 x 10 = 20

#### **End-Semester Examinations**

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b>Section A</b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b>Section B</b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b>Section C</b> Answer <b>ANY THREE</b> Questions out of FIVE Questions. [Atleast one question from each unit]	3 x 15 = 45

**MCA364A ELECTIVE III: ENTERPRISE RESOURCE PLANNING 3-0-0-0:100**

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## **OBJECTIVES**

- To provide a basic understanding and knowledge of the Enterprise Computing techniques used in industries.
- To understand basic concepts, tools and Techniques of Enterprise Resource Planning.
- To analyze and propose IT solutions for the integration of business process throughout the enterprise.
- To aim for careers in various ERP consultancies, ERP-support services and Software Developers.
- To understand the business model and ERP Implementation.

### **1. INTRODUCTION**

Enterprise - An Overview – Introduction to ERP – Basic ERP Concepts – Justifying ERP Investments – Risks of ERP – Benefits of ERP.

### **2. ERP AND TECHNOLOGY**

ERP and Related Technologies – Business Intelligence – E-Commerce and E-Business – Business Process Reengineering – Data Warehousing – Data Mining – On-line Analytical Processing – Product Life Cycle Management – Supply Chain Management – Customer Relationship Management – Advanced Technology and ERP Security.

### **3. BUSINESS MODULES AND ERP MARKET**

Business Modules of an ERP Package – Financials – Manufacturing (Production) – Human Resources – Plant Maintenance – Materials Management – Quality Management – Marketing – Sales, Distribution and Service – ERP Vendors: SAP AG – Oracle Corporation – JD Edwards – Microsoft Dynamics.

### **4. ERP IMPLEMENTATION AND POST IMPLEMENTATION**

ERP Implementation Life Cycle – Implementation Methodologies – ERP Project Teams – Process Definition – Employee and Employee Resistance – Training and Education – Success

& Failure Factors of an ERP Implementation – Operation and Maintenance of the ERP System – Measuring the Performance of the ERP System – Maximizing the ERP System.

## 5. ERP PRESENT AND FUTURE

Turbo Charge the ERP System – Enterprise Application Integration (EAI) – ERP and E-Business – ERP, Internet, and WWW – ERP II – ERP and Total Quality Management – Future Directions and Trends in ERP - ERP Case studies: SAP at Coca-Cola Hellenic Bottling Company S.A – SAP at TATA Iron and Steel Co Ltd (TISCO) – Oracle JD Edwards at OSPAP – Microsoft Dynamics at Godrej Infotech Ltd (GITL).

## TEXT

1. Alexis Leon, “ERP Demystified”, Third Edition Tata McGraw-Hill, 2014.

## REFERENCE

1. Jagan Nathan Vaman, “ERP in Practice”, Tata McGraw-Hill, 2008.
2. Alexis Leon, “Enterprise Resource Planning”, Second Edition, Tata McGraw-Hill, 2008.
3. Vinod Kumar Grag and N.K. Venkitakrishnan, “ERP- Concepts and Practice”, Prentice Hall of India, 2006.
4. Mahadeo Jaiswal and Ganesh Vanapalli, “ERP”, Macmillan India, 2006.
5. Summer, “ERP”, Pearson Education, 2008.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions

[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.

[Atleast one question from each unit]

2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.

[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.

[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of FIVE Questions.

[Atleast one question from each unit]

3 x 15 = 45

**MCA364B**

**ELECTIVE III: BIG DATA**

**3-0-0-0:100**

## **OBJECTIVES**

- To understand the basics and challenges of Big Data.
- To learn and practice NoSQL database MongoDB.
- To develop MapReduce jobs using Hadoop Frameworks and HDFS.

### **1. INTRODUCTION TO BIG DATA**

Types of Digital Data – Introduction to Big Data: Characteristics of Data - Big data Analytics – Classification of Analytics – Top Challenges facing in Big Data – Data Sciences – Few Top Analytics Tools.

### **2. BIG DATA TECHNOLOGY**

Basics of NoSQL – Basics of Hadoop – Introduction to MongoDB – Terms used in RDBMS and MongoDB – Data Types used MongoDB – MongoDB Query Language.

### **3. HADOOP**

RDBMS versus Hadoop – Distributed Computing Challenges – Hadoop Overview – Use Case of Hadoop – Hadoop Distribution – HDFS – Processing Data with Hadoop – Managing Resources and Applications with Hadoop YARN.

### **4. MAPREDUCE FRAMEWORKS**

The Configuration API – Configuring the Development Environment – Writing a Unit Test – Running Locally on the Unit Test – Running a Cluster – Turning a Job – How MapReduce Works : Anatomy of a MapReduce Job Run – Failures – Job Scheduling – Shuffle and Sort – Task Execution.

### **5. MAPREDUCE TYPES, FORMATS AND FEATURES**

MapReduce Types and Formats: MapReduce Types - Input Formats - Output Formats – Map Reduce Features – Counters – Sorting – Joins - Side Data Distribution – MapReduce Library Classes.

## **TEXT**

1. Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley Publications, 2015.

UNIT 1 - Chapter 1 - 3  
UNIT 2 - Chapter 4 and 6  
UNIT 3 - Chapter 5

2. Tom White, “Hadoop the Definitive Guide”, O’Reilly Publications, Second Edition. 2010.  
UNIT 4 - Chapter 5 and 6  
UNIT 5 - Chapter 7 and 8

## REFERENCE

1. Vignesh Prajapati, “Big Data Analytics with R and Hadoop”, Packt Publishing, 2013.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b>Section A</b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b>Section B</b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b>Section C</b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions. [Atleast one question from each unit]	2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b>Section A</b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b>Section B</b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b>Section C</b> Answer <b>ANY THREE</b> Questions out of <b>FIVE</b> Questions. [Atleast one question from each unit]	3 x 15 = 45



1. Installation of Python, and learning interactively at command prompt and writing simple programs.
2. Learning the conditions and iterations in Python by writing and running simple programs.
3. Random number generations, and problems based on random numbers.
4. Handling tuples and exercises based on tuples.
5. Functions and files.
6. Linear and binary search.
7. Handling tokens.
8. Finding unique, and duplicate items of a list.
9. Matrix addition, multiplications, and unity matrix.
10. Text processing using python.
11. Programs related to python libraries like Numpy, Pandas, Scipy etc.
12. Django with Templates and Forms.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

Time duration is 2 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **End Semester Examinations**

**Max. Marks: 100**

Time duration is 3 hrs. Each student will get a single question to be answered. The question will have two subdivisions. (2 x 50 =

100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

## IV SEMESTER

### **MCA466A ELECTIVE IV: DATA ANALYTICS WITH R PROGRAMMING 3-0-0-:100**

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#### **OBJECTIVES**

- In this course students will learn R. Programming language, data analytics, data visualisation and statistical model for data analytics.
- By completion of this course, students will be able to know about data analytics.

#### **1. INTRODUCTION TO DATA ANALYSIS**

Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics.

#### **2. R PROGRAMMING BASICS**

Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.

#### **3. DATA VISUALIZATION USING R**

Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts

#### **4. STATISTICS WITH R**

Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression, Survival Analysis

#### **5. PRESCRIPTIVE ANALYTICS**

Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning

#### **TEXT**

1. "An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics".
2. W. N. Venables, D.M. Smith and the R Development Core Team. Version 3.0.1 (2013-05-16). URL: <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf> 5.

#### **REFERENCE**

1. Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013
2. Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000.
3. G Casella and R.L. Berger, Statistical Inference, Thomson Learning 2002.
4. P. Dalgaard. Introductory Statistics with R, 2nd Edition. (Springer 2008)
5. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
6. Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: springer, 2009.
7. Montgomery, Douglas C., and George C. Runger. Applied statistics and probability for engineers. John Wiley & Sons, 2010
8. Joseph F Hair, William C Black et al , "Multivariate Data Analysis" , Pearson Education, 7th edition, 2013.
9. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
10. W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013.

### **QUESTION PAPER PATTERN**

#### **CA Tests**

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

- |   |             |
|---|-------------|
| <b><u>Section A</u></b> Answer <b>ALL</b> the Questions.<br>[Atleast four questions from each unit]                             | 6 x 2 = 12  |
| <b><u>Section B</u></b> Answer <b>ALL</b> the Questions<br>[Atleast three questions from each unit. Either or Type]             | 3 x 6 = 18  |
| <b><u>Section C</u></b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions.<br>[Atleast one question from each unit] | 2 x 10 = 20 |

#### **End-Semester Examinations**

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

- |  |             |
|--|-------------|
| <b><u>Section A</u></b> Answer <b>ALL</b> the Questions.<br>[Atleast two questions from each unit]                               | 10 x 2 = 20 |
| <b><u>Section B</u></b> Answer <b>ALL</b> Questions.<br>[Either or Type, atleast one question from each unit]                    | 5 x 7 = 35  |
| <b><u>Section C</u></b> Answer <b>ANY THREE</b> Questions out of <b>FIVE</b> Questions.<br>[Atleast one question from each unit] | 3 x 15 = 45 |

## **OBJECTIVES**

- To explain the key concepts in cryptography.
- To learn the concepts of security.
- To learn symmetric key cryptography.
- To understand asymmetric key cryptography.
- To understand internet security protocols.

### **1. ATTACKS ON COMPUTERS AND COMPUTER SECURITY**

Concepts of Security: Need for Security, Security Approaches, Principles of Security, Types of Attacks - Cryptography: Plain Text and Cipher Text, Substitution Techniques, Transposition Techniques, Encryption and Decryption.

### **2. SYMMETRIC KEY ALGORITHMS**

Algorithm Types and Modes, Data Encryption Standard (DES), RC4, RC5, Blowfish, - Asymmetric Key Algorithms: Brief History of Asymmetric Key Cryptography, Overview of Asymmetric Key Cryptography.

### **3. RSA, DIGITAL SIGNATURES AND PKI**

The RSA Algorithm, Symmetric and Asymmetric Key Cryptography Together, Digital Signatures, Attacks on Digital Signature - Public Key Infrastructure (PKI): Digital Certificates, Private Key Management, PKIX Model, Public Key Cryptography Standards (PKCS).

### **4. INTERNET SECURITY PROTOCOLS**

Basic Concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Hyper Text Transfer Protocol (SHTTP) , Secure Electronic Transaction (SET), SSL versus SET, 3-D Secure Protocol, Email Security.

### **5. USER AUTHENTICATION AND KERBEROS**

Authentication Basics, Passwords, Authentication Tokens, Certificate-based Authentication, Key Distribution Center (KDC), Security Handshake Pitfalls, Single Sign on (SSO) Approaches.

## **TEXT**

A. Kahate, "Cryptography and Network Security", Third Edition, Tata McGraw Hill, New Delhi, 2013.

## **REFERENCE**

1. B.A. Foronzan, "Cryptography & Network Security", Tata McGraw Hill, New Delhi, 2007.
2. S. Stalling, "Cryptography and Network Security", Pearson Education, New Delhi, 2006.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast four questions from each unit]	6 x 2 = 12
<b><u>Section B</u></b> Answer <b>ALL</b> the Questions [Atleast three questions from each unit. Either or Type]	3 x 6 = 18
<b><u>Section C</u></b> Answer <b>ANY TWO</b> Questions out of <b>THREE</b> Questions. [Atleast one question from each unit]	2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b><u>Section A</u></b> Answer <b>ALL</b> the Questions. [Atleast two questions from each unit]	10 x 2 = 20
<b><u>Section B</u></b> Answer <b>ALL</b> Questions. [Either or Type, atleast one question from each unit]	5 x 7 = 35
<b><u>Section C</u></b> Answer <b>ANY THREE</b> Questions out of <b>FIVE</b> Questions. [Atleast one question from each unit]	3 x 15 = 45

## **OBJECTIVES**

- To Learn the fundamentals of Data Mining.
- To Learn the concepts of clustering and classification.
- To understand the trends in Data mining.
- To analyze data, choose relevant models and algorithms for respective applications.
- To develop research interest towards advances in data mining.

### **1. INTRODUCTION TO DATA WAREHOUSING AND DATA MINING**

Data Warehouse – Definition – Multidimensional Data model – Data Cube – Dimensional Modelling – Lattice of Cuboids – Summary Measures – OLAP Operations – Slicing – Dicing – Drilling – Data Warehousing Architecture – Data Mining – Definitions – KDD Vs Data Mining – Stages of KDD – Selection – Preprocessing – Transformation – Data Mining – Interpretation and Evaluation – Data Visualization Data Mining Techniques – Verification Model – Discovery Model – Discovery of Association Rules – Clustering – Discovery of Classification rules – Frequent Episodes – Deviation Detection – Issues and Challenges in Data Mining.

### **2. ASSOCIATION RULES**

Introduction – Association rules - Definitions – Support- Association rule – Methods to discover association rules – Problem decomposition – Frequent set – Maximal Frequent set – Border set – A Priori Algorithm – Candidate generation – Pruning – Example of A Priori – Partition Algorithm – Pincer-Search Algorithm – Dynamic Item-set counting algorithm.

### **3. CLUSTERING TECHNIQUES**

Introduction – Clustering Paradigms – Hierarchical vs Partitioning – Numeric vs Categorical – Partitioning Algorithms – k-Mediod Algorithms- PAM- Iterative Selection of Mediods – CLARA – CLARANS – Hierarchical Clustering – DBSCAN – BIRCH – CURE- Categorical Clustering Algorithms – STIRR – ROCK.

### **4. CLASSIFICATION AND PREDICTION**

Classification – Basic Concepts – Decision Tree Induction – Attribute Selection Measures – Tree Pruning – Scalability and Decision tree induction – Visual mining for decision tree induction – Bayes' Classification methods – bayes' theorem – Naïve bayes' classification – Rule Based Classification – Using IF\_THEN rules for classification – Rule extraction from a decision tree- Rule induction using a sequential covering algorithm.

### **5. DATA MINING TRENDS**

Mining Complex Data Types – Mining Sequence Data, Time series, symbolic sequences and Biological sequences – Other methodologies of Data mining – Statistical Data Mining – Views on Data mining foundations – Visual and Audio Data mining – Data Mining Applications – Data Mining for Financial Data Analysis – Retail and Telecommunication industries – Science and Engineering – Intrusion detection and Prevention – Recommender Systems – Data mining and society – Ubiquitous and invisible data mining – Privacy, Security and Social impacts of Data mining.

## TEXT

1. Arun K Pujari, "Data Mining Techniques", University Press, 2001

UNIT 1: Chapter 2, 3

UNIT 2: Chapter 4

UNIT 3: Chapter 5

2. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier, 2011.

UNIT 4 : Chapter 8.1, 8.2, 8.4, 8.

UNIT 5: 13.1,13.2,13.3,13.4

## REFERENCE

Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2003.

## QUESTION PAPER PATTERN

### CA Tests

**Max. Marks: 50**

The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.

[Atleast four questions from each unit]

6 x 2 = 12

**Section B** Answer **ALL** the Questions

[Atleast three questions from each unit. Either or Type]

3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.

[Atleast one question from each unit]

2 x 10 = 20

### End-Semester Examinations

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.

[Atleast two questions from each unit]

10 x 2 = 20

**Section B** Answer **ALL** Questions.

[Either or Type, atleast one question from each unit]

5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.

[Atleast one question from each unit]

3 x 15 = 45

**MCA467B**

**ELECTIVE V: GAME PROGRAMMING**

**3-0-0-100**

## **OBJECTIVES**

- To learn about the gaming environment.
- To learn about the 3D programming concepts.
- To know about the client and server module in game programming.
- To create a model game.

### **1. INTRODUCTION TO 3D GAME DEVELOPMENT**

The Computer Game Industry - 3D Game Genres and Styles - Game Platforms - Game Developer Roles - Publishing Your Game - Elements of a 3D Game - Game Engine – Scripts- Graphical User Interface – Models – Textures - Sound – Music - Support Infrastructure - The Torque Game Engine – Descriptions.

### **2. INTRODUCTION TO PROGRAMMING**

Programming Concepts - Expressions - Variables - Operators – Loops – Functions - Conditional Expressions – Branching - Debugging and Problem Solving.

### **3. 3D PROGRAMMING CONCEPTS**

3D Concepts - Coordinate Systems - 3D Models - 3D Shapes - Displaying 3D Models- Transformation- Rendering - Scene Graphs - 3D Audio - 3D Programming - Programmed Translation - Programmed Rotation - Programmed Scaling - Programmed Animation - 3D Audio.

### **4. GAME PROGRAMMING**

Torque Script – Strings - Objects - DataBlocks - Game Structure - Server versus Client Design Issues - Common Functionality - Preparation -Root Main -Control Main –Initialization –Client -Server -Player -Running Emaga4.

### **5. GAME PLAY**

The Changes – Folders - Modules -Control Modules - control/main.cs - Client Control Modules - Server Control Modules  
Case study - Running Emaga5.

## **TEXT**

Kenneth C. Finney, “3D Game Programming”, Premier Press, 1<sup>st</sup> Edition, 2004

## **REFERENCE**

Fletcher Dunn, “3D Math Primer for Graphics and Game Development”, CRC Press, 2<sup>nd</sup> Edition, 2011, ISBN-13: 978-1568817231.

## **QUESTION PAPER PATTERN**

**CA Tests**

**Max. Marks: 50**



The time duration for the examination is 2 Hrs. The question paper format is:

**Section A** Answer **ALL** the Questions.  
[Atleast four questions from each unit] 6 x 2 = 12

**Section B** Answer **ALL** the Questions  
[Atleast three questions from each unit. Either or Type] 3 x 6 = 18

**Section C** Answer **ANY TWO** Questions out of **THREE** Questions.  
[Atleast one question from each unit] 2 x 10 = 20

### **End-Semester Examinations**

**Max. Marks: 100**

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

**Section A** Answer **ALL** the Questions.  
[Atleast two questions from each unit] 10 x 2 = 20

**Section B** Answer **ALL** Questions.  
[Either or Type, atleast one question from each unit] 5 x 7 = 35

**Section C** Answer **ANY THREE** Questions out of **FIVE** Questions.  
[Atleast one question from each unit] 3 x 15 = 45

## **8. RESEARCH DOMAIN [II and III SEMESTER]**

### **ELECTIVE I: RESEARCH DOMAIN I**

### **ELECTIVE II: RESEARCH DOMAIN II**

## 8.1. OVERVIEW

As the Department specializes on selected technologies such as Different Types of Computing, Open Source Software Technology, Language Technology, and e-Learning, students are invited to join these research groups and they are provided an intensive training in 1<sup>st</sup> semester.

Each group of students is assigned a problem in the area of their research and asked to develop a solution or the papers to be published in Conference / Journals during 2<sup>nd</sup> and 3<sup>rd</sup> semesters.

For their final project, these students may continue their research project or be directly placed in related Research Centre's or Companies for project work and recruitment.

Based on the research focus and problems posed, the students are expected to prepare an individual technical report (at least 50 pages) on the field of their study. Theme for Technical Report in 2<sup>nd</sup> and 3<sup>rd</sup> semesters will be different. Based on the technical report, a written and oral examination is conducted.

Each student is expected to publish a paper in one of the national conferences or journals. In these research papers, they will present the outcome of their experiments and analysis.

This course aims to achieve an understanding of the research challenges by assigned readings, technical report writing, discussions and presentations on the qualitative and quantitative aspects of the subject under study. Two research outputs shall be submitted by the students as their Research Portfolio namely Technical Report and Research Survey. An input session is given on research methodology for the selected students.

## 8.2. COURSE ELEMENTS

### a. RESEARCH METHODOLOGY

Input Sessions shall be given for the students in the 2<sup>th</sup> semester (fixed days or hours) to know the methodology for research work and to apply the same.

#### Semester II

**INTRODUCTION:** Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question – Choice of a problem – Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

**QUANTITATIVE METHODS:** Statistical Modeling and Analysis, Time Series Analysis, Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods – Research Planning – Reflections on research – Designing experiments – Measurements and coding – Contribution – Evaluation of papers.

**REPORTING:** Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing - Plagiarism.

### b. TECHNICAL REPORT

Based on the research focus and problems posed, the students are expected to prepare the individual Technical Report (at least 50 pages) on the field of their study. The Technical Report (TR) is a comprehensive understanding of the subject through which students communicate their study of the subject. TR should present core understanding of the subject developed logically along clearly identified perspective. The TR must include the Concepts, Technology, Tools, and Application of the expounded topic. This report is worth 50% of the course. Theme for Technical Report in 2<sup>nd</sup> and 3<sup>rd</sup> semesters are different.

### c. RESEARCH SURVEY

Research Survey (RS) focuses on a research problem related to the selected field of work. Students should pick a problem, gather materials on the research done in the field, discuss the current state of understanding on the topic and describe particular areas where progress appears possible. This paper is worth 50% of the course. The evaluation of the research paper is done by external reviewers along with the internal supervisor. Each student is encouraged to publish the survey paper in one of the national conferences or journals.

### 8.3. TOPICS FOR RESEARCH STUDY

To facilitate students into the area of research, potential topics for study in each chosen field are given below. The students can choose one of these topics or suggest a relevant topic in consultation with the Research Supervisor, however, since the number of faculty getting into research is on the rise every year, the research areas are not limited to the below, they can be chosen according to the specialization of the supervisor.

#### Semester II and III

- i) *eLearning*
- j) *Data Quality Assurance*
- k) *Network and Security*
- l) *Data Analytics*
- m) *Software Metrics*
- n) *Cloud Computing*
- o) *Ontology and Semantics*
- p) *Internet of Things*

Note: *The topics mentioned above are subject to change, any upcoming research area during the period of research can be considered after being passed in the standing committee of the respective academic years.*

### 8.4. EVALUATION SCHEME

The following guidelines shall be applied in evaluation of technical reports and Research Papers. For the Students admitted from the year 2021 – 2022 onwards:

#### Evaluation Components

<b>Internal Assessment (Research Guide)</b>	<b>Total 50 Marks</b>
Technical Report (TR)	15 Marks
Research Survey (RS)	15 Marks
CA Tests	15 Marks
Regularity	5 Marks
<b>External Assessment</b>	<b>Total 50 Marks</b>
Technical Report (TR)	10 Marks
Research Survey (RS)	10 Marks
Paper Publication	15 Marks
Viva Voice	15 Marks

Evaluation of Technical Report and Research Survey are done on the basis of their scientific merit, effective presentation, and appropriateness for assignment. Student is rewarded based

on thorough analysis, originality, and insightfulness found in the Technical Report. Scientific merit includes correctness, significance, novelty, non-triviality, and completeness.

Students shall individually and periodically meet their Research Guide and shall maintain a record describing their following activities: Review of Task, Points for Discussion, Resource Document (Output) and Action Item.

The Technical Report and Research Survey Paper shall be sent for blind review to at least two external subject experts. A Research Paper should be prepared from the output of TR and SP and is recommended to be presented in a Conference or published in a Journal. The Head of the Department nominates the external subject experts (who are interested in the area of study) to review the students' work by sending the work to them by email.

Research Domain subjects will not have term-end examination, instead they have viva voce conducted by a committee of two examiners (Internal and External) after the review of their works by the Internal Examiner. Remuneration for the committee members will be as per the university norms. The viva voce will be conducted on the same day/time while the other Domain elective semester examinations are being conducted. The duration of viva voce for each student shall be at least 15 minutes. (8 minutes for presentation and 7 minutes for question and answers)

The Head of the Department will finally submit the cumulative of the following marks to the COE: Technical Report, Research Survey, and Viva Voce.

*If a candidate fails he/she has to redo the course by paying for the examination fee along with the students of next batch and select a topic from the list of topics published by the department.*

## **9. SOFTWARE PROJECT**

### **9.1 SOFTWARE PROJECT [III SEMESTER]**

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- The Project work carried out by the students in the Third, and Fourth semester of MCA is individual work.
- Each student shall select a unique problem domain and develop and enhance the solution.
- Solution for the problem will be obtained by applying the technology they learnt in the previous semester.
- The solution is enhanced and stabilized by applying the technologies that they learn in the current semester.
- The solution for the problem should include DDL, DML, DCL, TCL, triggers, procedure, and function according to the need of their solution space.
- The solutions obtained in the Third, and Fourth will be considered as separate projects for evaluation. The report submitted at the end of each semester is an individual work and it has to be submitted as a PDF document.
- The student shall follow Team Software Process (TSP) model strictly for project development.
- Each student is assigned a faculty member as Project Mentor to monitor the progress of the project work.
- Different Phases of the Project work are Requirements, Analysis, Design, Implementation, Testing and Deployment
- Artifacts to be prepared during the Phases are:
  1. Software Project Initiation Statement
  2. User Requirement Specification (URS)
  3. Software Requirement Specification (SRS)
  4. Software Analysis and Design
    - Architecture Design
    - Database Design (Table Design, ER Diagram, Integrity Design)
    - Class Diagram

- Use Case Diagram
5. Test Case Design
  1. Reviews shall be conducted after every phase of which two shall be mandatory.
  2. Thirty minutes will be allotted for each team for the review:
    - 20 minutes for Presentation.
    - 10 minutes for Queries.

### Evaluation Components

<b>Internal Assessment (Project Mentor)</b>	<b>Total 50 Marks</b>
Lab Preparation	20 Marks
Two Reviews	10 Marks
Artifacts Submission	20 Marks

<b>External Assessment</b>	<b>Total 50 Marks</b>
Product Demonstration	20 Marks
Project Report	20 Marks
Viva Voice	10 Marks

- The external assessment team comprises of an external examiner and an internal examiner.
- If a student fails in the in-house software project then the student has to perform the set of activities required for it outside the class hours. The student has to appear for the review fixed by the department and should also appear for the semester exam viva voce.

### 9.2. SOFTWARE PROJECT – FINAL SEMESTER

- The project work can be either carried out in a R&D section of any Industry/University / Institute.
- A Coordinator will be appointed by the Head of the Department to coordinate the Project Work.
- Internal guides from the department will be assigned to the students.
- On joining an institution for the project work, the student shall furnish the details required by the department
- The duration of the project should be at least four months
- Periodically (weekly) the students should be send project Task Report to their internal guide through mail
- Two Reviews will be conducted before the Final Viva-Voce.
- The Project work should be an independent one; if the project is a part of a bigger project, the student's work should have a few independent modules.
- If more than one student is working on parts of the same project (big enough to share) the report of each student should be different and not two copies of the same report.

### Evaluation Scheme

○ <b>Internal Assessment</b>	<b>50 Marks</b>
○ First Review	20 Marks
○ Second Review	20 Marks
○ Demo	10 Marks

- **External Assessment** **50 Marks**
- Project Report, Product Demonstration 30 Marks
- Viva voce 20 Marks

- An External Examiner will conduct the Viva Voce along with the respective Internal Guide.
- If a student fails in final semester software project then the student has to redo the project. The student has to appear for the review fixed by the department and should also appear for the semester exam viva voce.

## 10. INTERNAL COURSES

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### TECHNICAL APPTITUDE

2-0-0-0:100

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- C
- C++
- Java
- DBMS
- Data Structures
- .NET MVC Framework
- Software Quality Assurance
- Software Testing
- Computer Network
- Linux
- PHP
- Python

## QUANTITATIVE APTITUDE TECHNIQUES

2-0-0-0:100

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### OBJECTIVES

- To obtain aptitude skills and to solve quantitative problems.

**UNIT 1:** Averages – Problems on numbers – Problems on ages – Percentage.

**UNIT 2:** Profit and loss – Ratio and proportion – Time and work – Pipes and cisterns.

**UNIT 3:** Partnership – Time and distance – Problems on trains.

**UNIT 4:** Boats and streams – Simple interest – Compound interest.

**UNIT 5:** Calendar – Clocks – Permutations and Combinations – Probability.

### TEXT

R.S. Aggarwal, “Quantitative Aptitude for Competitive Examinations”, Revised Edition, S. Chand and Company Ltd., Ram Nagar, New Delhi, and Reprint 2015.

1. (Chapters – 6, 7, 8 and 10)
2. (Chapters – 11, 12, 15 and 16)
3. (Chapters – 13, 17 and 18)
4. (Chapters – 19, 21 and 22)
5. (Chapters – 27, 28, 30 and 31)

### WEB REFERENCE

[www.tcyonline.com/tests/mathematics-competitive-exam](http://www.tcyonline.com/tests/mathematics-competitive-exam)

## 11. EVALUATION & CERTIFICATION

### 11.1 Continuous Assessment

S. No.	Course Type	Internal Components	Marks	Total
1	Theory	2 CA Tests	30	50
		Online Test / Quiz	5	
		*Other Components	15	
		Paper Work		
		Problem Solving / Group Discussion / Discussion Forum		
		Technical reports		
		Application Development		
		Seminar		
		Demonstration		
		Open Book Assignment		
2	Theory Combined Practical	2 CA Tests	30	50
		Online Test / Quiz	5	
		Paper Work	5	
		Demonstration/Technical Report		
		Lab Exercises	10	
3	Practicals	Assessment of Lab Exercises	30	50
		Record Work	10	
		Test	10	
4	Pure Practical	Assessment of Lab Exercises	30	50
		Application Development	20	

**Note:** \*Other components can be fixed up by the course teacher with the endorsement of the HOD.

### 11.2 CA Tests

#### 11.2.1 Theory

The time duration for the examination is 2 Hrs. The question paper format is:

Max. Marks : 50	
<b>Section A</b>	
Answer ALL the Questions [atleast 3 questions from each unit]	6 X 2 = 12 Marks
<b>Section B</b>	
Answer ALL the Questions [atleast 3 questions from each unit, Either or Type ]	3 X 6 = 18 Marks



<b>Section C</b>	
Answer ANY TWO Questions out of Three Questions [atleast 1 question from each unit]	2 X 10 = 20 Marks

### 11.2.1 Practical

**Time: 2 Hrs.**

**Max. Marks: 50**

Each student will get a single question to be answered. The question will have two subdivisions.  
(2 x 25 = 50)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

### 11.3 End-Semester Examinations

#### 11.3.1 Theory

The time duration for the examination is 3 Hrs. The question paper format for the end-semester examination is:

<b>Max. Marks : 100</b>	
<b>Section A</b>	
Answer ALL the Questions [atleast 2 questions from each unit]	10 X 2 = 20 Marks
<b>Section B</b>	
Answer ALL the Questions [Either or Type, atleast 1 question from each unit]	5 X 7 = 35 Marks
<b>Section C</b>	
Answer ANY THREE Questions out of FIVE Questions [atleast 1 question from each unit]	3 X 15 = 45 Marks

#### 11.3.2 Practical

- For each practical course, a question bank is prepared at the introduction of the course by a committee of utmost three staff members.
- The Committee prepares the questions and reviews them through regular meetings in consultation with the Controller of Examinations. Utmost 3 meetings can be conducted for a single course.
- Office of the Controller of Examinations will provide sitting charges for the members of the committee.
- The Head of the Department will submit the Question Bank to the controller of Examinations within three months of the introduction of the course from the beginning of the new academic year.
- The Controller can select the questions for every batch of the practical examinations as per the number of candidates.

- Each question must be separated from the given questions provided by the Controller and must be pasted on the answer paper in such a way that, each answer paper is pasted with only one question.
- The answer paper pasted with question must be displayed, without showing the questions to the students. The students should select only one answer paper pasted with question and solve the problem.
- No question must be prescribed by the examiner, other than the questions provided by the Controller.
- All questions given for batch must be used for that batch only.

### **Practical Question Paper Pattern**

**Time: 3 Hrs.**

**Max. Marks: 100**

Each student will get a single question to be answered. The question will have two subdivisions.  
(2 x 50 = 100)

- *First part, shall contain questions from the exercise list.*
- *Second part will present an unexplored problem to be solved.*
- *The problem should be addressed using at least 3 technical features of the respective technology stream.*
- *No more than three candidates should get the same question in a batch.*

#### **11.3.3 Pure Practical**

##### **Evaluation Scheme**

- There will be no term-end semester examination. But the students will be evaluated at the end of semester for 50 marks.

<b>Content</b>	<b>Internal Marks</b>
Test	30 Marks
Viva Voce	20 Marks
<b>Total</b>	<b>50 Marks</b>

#### **11.3.4 Research Domain**

Refer Section 8 for the Evaluation scheme.

#### **11.3.5 Software Project Work [III, IV]**

Refer Section 9 for the Evaluation scheme.

#### **11.3.6 Certificate, Self Learning, Life and Employability courses**

There will not be an end semester examination, however, the students will be evaluated internally to become eligible to acquire the credits.