

## **MASTER OF COMPUTER APPLICATIONS (2 Years)**

### **1. Overview of MCA**

- a) The regulations herein specified are applied to Master of Computer Applications (MCA) program offered by the Women's College University.
- b) Master of Computer Application (MCA) has been restructured to be a two-year postgraduate course instead of the existing three-year postgraduate degree course. The change in the duration of the MCA course will not impact the existing curriculum and course structure severely.
- c) Master of Computer Applications is a two-year professional course offered for graduates wanting to learn modern programming language. A blend of theory and practical knowledge helps students to develop better and faster applications and designed to meet qualified professional for industry.

### **2. Time scale for academic activity**

- a) The basic units of time for academic activity for the MCA program shall be a semester (July to December and January to June).
- b) The department may schedule a summer program during vacation of the department. There will be in general no formal classes in the summer program.

### **3. Duration of Curriculum and Calendar**

- a) Master of Computer Applications (MCA) program is of Two years duration. Each year shall be divided into two semesters. First semester shall normally begin in July and ends in December. Second semester shall normally begin in January and ends in June.
- b) Each year, the university shall draw an academic calendar and the same shall be non-negotiable and strictly adhered to the academic calendar for the first year shall be handed over to each admitted student along with his/her university registration card. Second year academic calendar shall be made available during registration for third semester.
- c) The curriculum and syllabus shall be modified with approval of the academic council once in every two years to keep the same up to date. However, minor modifications can be done as and when necessary with the approval of Vice Chancellor. The modification so done shall be placed to the immediate next academic council meeting for rectification.
- d). A candidate may be permitted to complete MCA degree requirements in not more than 4 years i.e. maximum in 8 semesters.

#### 4. Eligibility Criteria for Admission

- a) The candidate must hold a bachelor's degree (with mathematics at 10+2 level) or BCA/B.Sc.(Computer Application)/B.Sc.(Information Technology) of a recognized University incorporated by an act of the central or state legislatures in India or other educational institutions established by an act of parliament registered under section (21)/12(B) of UGC act 1956 or declared to be deemed of an university under section 3 of UGC act, 1956 or passed an equivalent qualification recognized by the ministry of HRD, Government of India.
- b) The candidate must have secured at least 50% of marks (45% marks in case of candidates belonging to reserved category) in aggregate at the graduation level.
- c) Candidates appearing for the final examination of their bachelor's program can also apply and if selected can join the program provisionally. At the time of counseling they must bring the certificates in original.
- d) At the time of the counseling candidates will be required to show their original certificates and mark sheets of 10+2 and graduation level, MCA test admit card, caste certificate and any special category certificate, if any.

#### 5. Scheme of Instruction The scheme of instruction in Post-Graduate Program shall be of the following forms of academic activity:

- a) Theory
- b) Sessional
- c) Practical Training and Project Work
- d) Seminar and Tutorial

a) Theory -A theory type of academic activity shall involve concepts, fundamental ideas and techniques, as laid down in textbooks or literature and which can be grasped through lectures and assignments. A theory type of course with about 45 contact periods in a semester shall enable participating student to earn one unit of Master of Computer Application. Jamshedpur Women's University, Jamshedpur academic credit provided that he/ she fulfill the attendance and grade requirements as specified here in after.

#### b. Sessional

The following type of academic work will be covered in sessional:

- i) Laboratory Experiment
- ii) Assignment
- iii) Project
- iv) Term paper or any other academic work, the purpose of which would be to trained the student by practice, repeated use and hands on experience.
- v) Student must have to pass or clear external and Internal Sessional Individually.

**c. Practical Training and Project Work-** After second semester during summer break either student should undergo Practical Training or do Mini Project. During the fourth semester of study, a student will be examined in the course "Project work".

1. Mini Project work may be done individually or in groups. However, if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to see the progress of individual modules is independent of others.

2. Major Project work may be done individually or in gro.

3. Students should take guidance from an internal guide and prepare a Project Report on "Project Work" in 2 copies to be submitted to the Director of the Institute/Department by April. A separate file containing source-code listings should also be submitted. Before start of the project, every student should submit project synopsis in predefined format.

4. The Project Synopsis should contain an Introduction to Project, which should clearly explain the project scope in detail. Also, Data Dictionary, DFDS, ERDs, File designs and a list of output reports should be included.

5. The Project Work should be of such a nature that it could prove useful be relevant from the commercial/management angle.

6. The Project report will be duly assessed by the internal guide and marks The Project will be communicated by the Director to the University along with the marks of the internal credit for theory and practical.

7. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation.

8. The major project work carries 200 marks. Distribution of Marks: Documentation-50, Design-50, Coding-50, Presentation-25, Viva-25. The Project Evaluation shall be conducted by two external examiners.

9. Project work can be carried out in the Institute/Department or outside with prior permission of the Institute/Department.

10. Project viva-voce by the University panel will be conducted in the month of May.

#### **6)Attendance Requirement**

All students must attend every lecture, practical classes and other activities of the Department. However, the attendance requirement will be a minimum of 75% of theclasses actually held.

#### **Absence during the semester**

a. A student must inform the Co-coordinator concerned immediately of any instance of continuous absence from classes.

b. A student who is absent due to illness should approach the teachers concerned for makeup quizzes, assignment and laboratory work.

c. A student who remains absent from a Sessional test due to illness approach the teacher concerned for makeup test immediately on return to class. The request should be supported with a medical certificate issued by a registered medical practitioner.

d. If a student is continuously absent from the Institute/Department for more than four weeks without permission of the head of the department concerned, his/her name will be removed from Institute/Department rolls.

## **7) Examination Assessment**

### **1. Mid Semester Examination (MSE):**

Written Examination 20 marks of a paper. There will be two groups of questions in written examinations of 20 marks. Group A is compulsory and will contain five questions of very short answer type consisting of one mark each. Group B will contain descriptive type five questions of five marks each, out of which any

Three are to be answered.

Attendance - 5 marks

Assignment - 5 marks

### **2. End Semester Examination (ESE):**

Theory paper will be of 70 marks and divided into three groups:

**Group A:** This group consists of 10 multiple choice questions of 2 marks each ( $10 \times 2 = 20$  marks) from the entire syllabus uniformly

**Group B:** This group consists of 6 questions out of which 4 are to be answered, each carrying 5 marks ( $4 \times 5 = 20$ ).

**Group C:** This group consists of 4 questions, out of which 2 are to be answered each, carrying 15 marks ( $2 \times 15 = 30$ ).

In mathematical paper require scientific Calculator during exam.

## **8) Student Discipline**

Every student is required to observe a polite and disciplined behavior both inside and outside the campus and should not indulge in any activity which would tend to bring down the prestige of the Institute/Department or disturb the peaceful and congenial environment of the campus. An act of indiscipline on the part of the student may result into adequate discredit and a mention in his/her academic grade card and/or transcript.

Note: The department in consultation with the university shall have the right to change/modify any regulation or part thereof in the academic interest of the students.

**9. Eligibility for Appearing in Semester Examination**

1. A student shall be eligible in an examination provided he/she pursues a regular course of study and attends at least 75% of class in each theory and sessional subject during the semester. The attendance shall be considered from the date of admission of the candidate in the institution. Attendance record will be compiled at the time of each test and the students with poor attendance will be informed through notification. The guardian will also be informed through a letter before he/she is debarred for appearing in university examination due to shortage of attendance.

2. Concessions: A student who has been absent for short periods on medical ground or due to participation in cultural, sports, other academic/official assignments in the interest of the Department/University with prior written permission of the head of the institution shall be permitted a maximum of additional concession of 10% in attendance and shall be eligible for appearing in examination with a minimum 65% of attendance in semester..

3. A student shall be admitted to any examination in a subject only if he/she has been registered for that subject.

4. A candidate shall be allowed in an examination only if he/she is issued an admitcard for the relevant examination by the University/Department.

**10. Promotion:**

Promotion to the 2 years shall be permitted only with a maximum of four Backlog Papers from the preceding year (1 year). Further no entry to the next Semester.

**Provision of Special examination:**

Students keeping one or two backlogs in 3rd or 4th Semester can be given one special opportunity after declaration of 4th Semester result to clear their backlog papers so that they may go to job.

**Moderation of result:**

Notwithstanding anything contained elsewhere in the Regulations, the University shall have power to moderate the MCA results on the recommendations of the Examination Board and/or the academic council.

**11. Final Result****Cumulative Grade Point Average**

The Cumulative Grade Point Average (CGPA) will be calculated on the 10-point grading scale as follows:

GRADE POINT	PERCENTAGE OF MARKS	GRADE SYMBOL	GRADE MEANING
10	91-100	O	Outstanding
09	81-90	A+	Excellent
08	71-80	A	Very Good
07	61-70	B+	Good
06	51-60	B	Above Average
05	41-50	C	Average
04	40	P	Pass
00	BELOW 40	F	Fail or Absent

**a. For each Semester**

$$\text{Semester grade point Average (SGPA)} S(j) = \frac{\sum i C(i) \cdot G(i)}{\sum i}$$

Where, C(i) denotes the total credits of the  $i^{\text{th}}$  course. G(i) denotes the grade point earned by a student in course and indicates the semester.

**b. For full course**

$$\text{Cumulative Grade Point Average CGPA} = \frac{\sum j(j) \cdot S(j)}{\sum j(j)}$$

Where, C(J) denotes the total credits of the  $j^{\text{th}}$  semester.  
S(j) denotes the SGPA of the  $j^{\text{th}}$  semester.

**12. Conversion of Grades into Percentage and Equivalent Class/Distinction:**

For the purpose of awarding class, the CGPA shall be converted to percentage marks using the formula, Percentage Marks CGPA x 10

Category	CGPA	Class/Distinction
<b>Students who successfully complete the MCA program</b>	7.5 and above	First class with Distinction
	6.0 and above	First Class
	5.0 and above	Second Class
	4.0 and above	Pass

The concerned teacher shall maintain all records for inspection by the University for at Least one semester.

Others

a) other provisions not covered under the present regulations shall be governed by the regulation for Master Examination in Arts, Science and Commerce of the university and if needed may be reviewed.

b) Any dispute or case not covered under the above regulations shall be referred to the Vice Chancellor whose decision shall be **final**.

## Framework of MCA syllabus (Proposed for 2022-2023)

### MCA SEMESTER – I

MCA 101 Fundamentals of Computer and C Programming

MCA 102 Computer System Architecture

MCA 103 Scientific Computing

MCA 104 Discrete Mathematics

MCA 105 Soft Skills

#### **Practical**

MCA 106 Labs on C Programming

MCA 107 Labs on Scientific Computing

### MCA SEMESTER – II

MCA 201 Data Structure.

MCA 202 Object Oriented Programming using C++.

MCA 203 Operating System.

MCA 204 Theory of Computation.

MCA 205 Design and Analysis of Computer Algorithms.

#### **Practical**

MCA 206 Lab on Data Structure.

MCA 207 Lab on C++ Programming.

### MCA SEMESTER – III

MCA 301 Advanced Database Management System.

MCA 302 Internet and Web Technology (PHP, Java Script, CSS, DHTML).

MCA 303 Elective I: -

a) Python Programming

b) Computer graphic and multimedia.

MCA 304 Java Programming

MCA 305 Data Communication and Computer Networks

#### **Practical**

MCA 306 Elective I:

a) Python Programming Lab

b) Computer graphic and multimedia Lab

MCA 307 Lab on Java Programming

### MCA SEMESTER – IV

MCA 401 Elective I

a) Software Engineering

b) Internet of things

MCA 402 Network Security & Cryptography

MCA 403 Comprehensive Viva

MCA 404 Major Project

**List of Electives:**

- EL X01 Soft Computing
- EL X02 Mobile Computing
- EL X03 Software Project Management
- EL X04 Enterprise Resource Planning
- EL X05 Data Mining and Data Warehousing
- EL X06 E-Commerce
- EL X07 Cloud Computing
- EL X08 System Programming
- EL X09 Digital Image Processing & Multimedia
- EL X10 Neural Networks
- EL X11 Compiler Designing
- EL X12 Distributed System
- EL X13 Parallel System
- EL X14 Real Time System
- EL X15 Modeling & Simulation
- EL X16 Embedded System



Year	Sem	Code	Paper	Full marks	Mid Sem	End Sem	credit	Pass Marks
1 <sup>st</sup> Year	1stSem	MCA 101	Fundamentals of Computer and C Programming	100	30	70	6	45
		MCA 102	Computer System and Architecture	100	30	70	6	45
		MCA 103	Scientific Computing	100	30	70	6	45
		MCA 104	Discrete Mathematics	100	30	70	6	45
		MCA 105	Soft Skills	100	30	70	6	45
		MCA1 06 Lab	Lab on 'C' Programming	50	25 Internal	25 External	4	34
		MCA1 07 Lab	Lab on Scientific Computing	50	25 Internal	25 External	4	34
	2ndSem	MCA 201	Data Structure	100	30	70	6	45
		MCA 202	Object Oriented Programming using C++	100	30	70	6	45
		MCA 203	Operating System	100	30	70	6	45
		MCA 204	Theory of Computation	100	30	70	6	45
MCA 205		Design and Analysis of Computer Algorithm	100	30	70	6	45	

		MCA 206 Lab	Lab on Data Structure	50	25 Internal	25 External	4	34
		MCA 207La b	Lab on C++ programming	50	25 Internal	25 External	4	34
<b>2<sup>nd</sup> Year</b>	<b>3rd Sem</b>	MCA 301	Advance Database Management System	100	30	70	6	45
		MCA 302	Internet and Web Technology (PHP, Java Script, CSS, DHTML)	100	30	70	6	45
		MCA 303	Elective I:  a) Python programming b) Computer graphic and Multimedia	100	30	70	6	45
		MCA 304	Java Programming	100	30	70	6	45
		MCA 305	Data Communication Computer Networks	100	30	70	6	45
		MCA 306 Lab	Elective I:  a) Python programming Lab b) Computer graphic and Multimedia Lab	50	25 Internal	25 External	4	45
		MCA 307 Lab	Lab on Java Programming	50	25 Internal	25 External	4	34

4 <sup>th</sup> Sem	MCA 401	Elective I: - a) Software Engineering b) Internet of things.	100	30	70	6	45
	MCA 402	Network Security & Cryptography	100	30	70	6	45
	MCA 403	Comprehensive Viva	100	50	50	6	45
	MCA 404	Major Project	200		200	20	45

**Note: E: External, I: internal, P: practical & JT: Job Training**

**MCA-1st Year****SEMESTER-I (Paper-1)****MCA 101 Fundamentals of Computer and C Programming**  
**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**  
**Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Data and number representation- binary-complement representation, BCD-ASCII, conversion of numbers from one Number system to the other, (r-1)'s & r's complement representation, binary arithmetic. Boolean logic and Boolean algebra, tri-state logic; K-map, flip-flops, counters, shift registers, adders,

**UNIT II:**

Boolean logic and Boolean algebra, tri-state logic; K-map, flip-flops, counters, shift registers, adders, subtractor, encoders, decoders, multiplexers, demultiplexers.

**UNIT III:**

C language fundamentals: Character set, Key words, Identifiers, data types, Constants and variables, Statements, Expressions, Operators, Precedence and associativity of operators, Type conversion, Managing input and output Control structures: Decision making, branching and looping.

**UNIT IV:**

Arrays, Strings Functions, Recursive functions. Storage classes: Auto, Extern, register and static variables.

**UNIT V:**

Pointers: Pointer variable and its importance, pointer arithmetic and scale factor, Pointers and arrays, Pointer and character strings, Pointers and functions, Array of pointers, pointers to pointers, Dynamic memory allocation. Structure and union: declaration and initialization of structures, Structure as function parameters, Structure pointers, Unions. File Management, The Pre-processor directives, command line arguments, Macros.

**TEXTBOOKS**

1. Computer System Architecture, Morris Mano, PHI
2. E. Balguruswamy, "Programming in ANSI C", 4 edition, 2007, McGraw Hill Publication, New Delhi.

**REFERENCE BOOKS**

1. Computer Organization, Hamacher, MGH
2. Computer Architecture, Carter, Schaum Outline Series, TMH
3. Behrouz A. Forouzan and Richard F. Gilberg. Computer Science: A Structured Approach Using C, third edition, 2007, CANGAGE learning India Pvt. Ltd., New Delhi.

## MCA - 1st Year

### SEMESTER-I (Paper-2)

#### MCA 102 Computer System Architecture

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Introduction: Basic architecture of computer, Functional units, Operational concepts, Bus structures Von Neumann Concept.

Basic Processing: Instruction code, Instruction set, Instruction sequencing, Instruction cycle, format, addressing modes, Micro instruction, Data path, hardwired controlled unit, Micro programmed Controlled unit.

#### UNIT II:

Arithmetic: Design of ALU, Binary arithmetic, Addition and Subtraction of signed number, Multiplication of Positive number, Signed operand multiplication, Division, Floating point number Representation and arithmetic.

Memory: Memory Hierarchy, RAM, ROM, Cache memory organization, Mapping techniques, Virtual memory, Mapping technique, Associative memory, Memory Interleaving, Secondary Storage, Flash Drives.

#### UNIT III:

Input/Output: Accessing I/O devices, I/O mapped I/O, Programmed I/O, Memory Mapped I/O, Interrupt Driven I/O, Standard I/O interfaces, Synchronous and Asynchronous Data transfer, DMA data transfer. Introduction to Parallel processing: Flynn's Classification, Pipelining, Array processing, vectorprocessing.

#### TEXTBOOKS:

1. V. Rajaraman, and T. Radhakrishnan, "Computer Organization and Architecture", Prentice-hallof India
2. M. Murdocca, "Computer Architecture and Organization- An Integrated Approach", WilleyIndia Pvt Ltd.

#### REFERENCE BOOKS:

1. William Stalling, "Computer Organization and Architecture "Pearson Education
2. J. P. Hayes "Computer Architecture and Organization" McGraw Hill Education India.

## MCA-1st Year

### SEMESTER-I (Paper-3)

#### MCA 103 Scientific Computing

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Basic Statistics-measure of central tendency, dispersion, Probability, distribution introduction to mass function, density function, distribution function (Binomial, Poisson, Normal)

#### UNIT II:

Estimation of parameters (unbiasedness-concept of noise/error, consistency) Interpolation-Newton's Forward, Backward, Sterling & Bessel's Interpolation formula, Lagrange's Interpolation IntegrationTrapezoidal Rule, Simpson's  $1/3^{\text{rd}}$  Rule, Weddle's Rule

#### UNIT III:

Romberg Integration, Gauss- Legendre two- & three-point formula, Newton Cotes Formula, Gram-Schmidt orthogonalization, Tchebycheff polynomial Solution of transcendental equations-Method of Iteration, Method of Bisection, Newton-Raphson Method, Regula-Falsi method, Secant Method.

#### UNIT IV:

Solution of system of linear equations- Gauss Elimination Method, Gauss-Jacobi, Gauss- Seidel, LU factorization, Tri-diagonalization. Inverse Interpolation. Least Square Curve fitting linear & non-linear Solution of Differential Equations- Picard's method, Euler-modified method,Taylor's Series method, Runge-Kutta method, Milne's Predictor-Corrector method.

#### TEXTBOOKS:

1. Numerical Analysis, Shastri, PHI
2. Numerical Analysis, S. Ali Mollah
3. Numerical Analysis, James B. Scarborough

#### REFERENCE BOOKS:

1. Numerical Methods for Mathematics,Science&Engg., Mathews, PHI
2. Numerical Analysis, G.S. Rao, New Age International
3. Programmed Statistics (Questions - Answers), G.S. Rao, New Age International
4. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH
5. Computer Oriented Numerical Mathematics, N. Dutta, VIKAS

## MCA 1st Year

### SEMESTER-I(Paper-4)

#### MCA 104 Discrete Mathematics

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Logic, Relation & Functions: Logic: Propositions and logical Operations, Conditional statements; Predicate Calculus-First order logic, universal and existential quantifiers; Proof Techniques- methods of proof, Mathematical induction, recurrence relations. Relation and Diagraphs- Properties of relations, composition of relations, closure operation on relations, equivalence relations and partitions, paths in relation and diagraphs, Operations on relations, Transitive closure and Warshall's Algorithm.

Partial ordered sets (POSet), Hasse diagram, External elements of partially ordered sets Functions, Functions for computer science, Growth of functions, Permutation functions.

#### UNIT II:

Topics in Graph Theory: Directed and undirected graphs, basic terminology, paths and circuits, Eulerian paths and circuits, Hamiltonian paths and circuits, Transport Network, Graph coloring. Trees: definition and properties, rooted trees, tree traversals-Preorder, In order, Post order, binary trees, labeled trees, spanning trees, cut sets, Graph traversals - BFS and DFS, Minimum cost spanning trees-Prim's and Kruskal's algorithm, Shortest paths in weighted graphs- Dijkstra's algorithm.

#### UNIT III:

Algebraic Structures and Applications: Binary operations, semi-groups and groups, subgroups, cosets, Lagrange's theorem, Product and quotient semi-groups and groups, Normal subgroup, Homomorphism; coding of binary. information and error detection, group codes, decoding and error correction. Lattices, finite Boolean algebra, functions of Boolean algebra.

#### TEXTBOOKS:

Bernard Kolman, Robert Busby, Sharon C. Ross, "Discrete Mathematical Structures", Sixth Edition, 2008, Pearson Education Inc., New Delhi. / Prentice Hall of India (PHI) Pvt. Ltd., New Delhi.

#### REFERENCE BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", Sixth Edition, 2008, Tata McGraw-Hill (TMH) Publications Pvt. Ltd., New Delhi.

2. D. S. Malik & M. K. Sen, "Discrete Mathematical Structures", First Edition, 2005, CENGAGE Learning India Pvt. Ltd. New Delhi

## MCA-1stYear

### SEMESTER-I (Paper-5)

#### MCA 105 Soft Skills

**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

**Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### **UNIT I:**

The elements of communication (6 hours)

1.1 The importance of communication through English at the present time

1.2 The process of communication & factors that influence communication: a) Sender, receiver, channel code, topic, message, context, feedback, "noise. b) Filters and barriers

1.3 The importance of audience and purpose

1.4 The information gap principle: given and new information; information overload

1.5 Verbal and non-verbal communication: body language 1.6 Comparing general communication and business communication

#### **UNIT II:**

The sounds of English (14 hours) 1.1 Vowels, diphthongs, consonants, consonant clusters

1.2 The International Phonetic Alphabet (IPA): phonemic transcription

1.3 Problem sounds

1.4 Syllable division and word stress 1.5 Sentence rhythm and weak forms

1.6 Contrastive stress in sentences to highlight different words

1.7 Intonation: falling, rising and falling-rising tunes

1.8 Varieties of Spoken English: Standard Indian, American and British

(Note: This unit should be taught in a simple, non-technical manner, avoiding technical terms as far as possible.)

#### **UNIT III:**

Review of English grammar (10 hours)

3.1 Stative and dynamic verbs

3.2 The auxiliary system; finite and non-finite verbs

3.3 Time, tense and aspect

3.4 Voices: active and passive

3.5 Modality

3.6 Negation

3.7 Interrogation; reported and tag questions

3.8 Conditionals

3.9 Concord 3.10 Phrasal verbs

(Note: The teaching of grammar should be treated as a diagnostic and remedial activity and integrated with communication practice. The areas of grammar in which errors are common should receive special attention when selecting items for review Teaching need not be confined to the topics listed above.)



## **MCA-1stYear**

### **SEMESTER-I (Paper-6)**

#### **MCA 106 Lab on C Programming**

**Full Marks: 25 (MSE) +25 (ESE) 50, Time: 3 hrs., Pass Marks: 34**

#### **PRACTICAL**

1. C programming on variables and expressions.
2. Precedence of operators, Type casting.
3. Decision control structures- if and nested if-else.
4. Loop controls-do, while, for and case control structure.
5. Unconditional jumps-break, continue, goto.
6. Modular program development using functions.
7. Arrays and matrix operations-add, subtract, multiply.
8. Recursion
9. Pointers, address operators and pointer arithmetic.
10. Struct Structures and Unions, Accessing their members.
11. Self-Referential Structures and Linked lists.
12. Files and file operations, standard streams.
13. Dynamic memory allocation and deallocations.
14. Different mathematical operations using <math.h>.
15. Pointers to pointers, arrays, functions, structures and unions.
16. Command line arguments, enums and preprocessors.
17. International features and Code optimization.

## **MCA-1st Year**

**SEMESTER-I (Paper-7)**

**MCA 107 Lab on Scientific Computing**

**Full Marks: 25 (MSE) + 25 (ESE ) 50, Time: 3 hrs., Pass Marks: 34**

### **PRACTICAL**

Programs to be written through C-language.

## MCA-1st Year

### SEMESTER - II(Paper-8)

#### MCA 201 Data Structure

**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNITI:

Algorithms, Asymptotic notations and analysis, Measuring time and space complexities, Data structure and C: Functions, storage structures for arrays, sparse matrices, strings, pattern matching, structures and arrays of structures, Abstraction Mechanisms, Abstract data type, Stacks and Queues: representation and Linked Lists: Singly linked lists, Linked stacks and queues, Operation on polynomial, Linked dictionary, Applications. Doubly linked list, Circular linked list, Doubly circular linked lists,

#### UNITII:

Dynamic storage Management, Garbage collection and compaction, Hashing functions. Hash tables and collision resolution techniques. Trees: Binary trees, Terminologies and memory representation, Binary search trees, General trees, Tree traversing, Operations on binary trees, - Expression manipulations, Threaded binary trees, Height balancing balancing trees, Heaps, forest, File structures, Introduction to multi-way search trees, B-tree and B+trees.

#### UNITIII:

Graphs: Terminologies and representation, Path matrix, graph traversal, - DFS and BFS, shortest path sort.problems, Bi-connected graphs, Topological Sorting techniques: Bubble sort, selection sort, Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort, Linear search and binary search.

#### Textbooks:

1. Richard Gilberg, Behrouz A. Forouzan, "Data Structures: A pseudo code approach with C", Second Edition, 2007, CENGAGE India Pvt. Ltd., New Delhi, 2. G.A. V. Pai," Data Structure and Algorithms", McGraw Hills Education India

#### Reference Books:

1. Alfred V. Aho, John E. Hopcroft& Jeffrey D. Ullman, "Data Structures and Algorithm", First Edition, 1983, Pearson Education Inc., New Delhi.  
2. Ian Chai & J. White, "Structuring data and building Algorithms". McGraw Hill Education India  
3. Aaron M. Tenenbaum, YedidyahLangsam& Moshe J. Augenstein, "Data Structure Using C", 1st Edition, 1990, Prentice-Hall of India (PHI) Pvt. Ltd., / Pearson Education Inc., New Delhi.

## MCA – 1stYear

### SEMESTER II (Paper-9)

#### MCA 202 Object Oriented Programming using C++

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNITI:

Introduction to C++: C++ as multi-paradigm language, features supported by C++, syntax, datatype, const and bool qualifiers, variables, strings, operators

Control Structures, Decision and Loop Control Statements, Modular program design using functions, Top down program design with examples, parameter passing mechanisms, inline functions, recursion, comp Arrays and pointers, dynamic arrays, structures and unions in C++, Coding Style in C++ Object Oriented Programming in C++: Abstraction, OOP concepts, software life cycle, Abstraction

Mechanisms: Procedural Abstraction and data abstraction; Classes and objects, object creation, access specifier-private, public and protected, constructors, default constructors, copy constructors, destructors, member functions, static members, references; Message communication using objects

#### UNITII:

Inheritance: Is-a Vs. Has-a relationships, simple inheritance-Class hierarchy, derived classes, Multiple inheritance, multileveled and hybrid inheritance, Abstract Base Classes, Composition and aggregation with example, polymorphism-compile time & run time polymorphisms, object slicing, base class initialization, virtual functions and Dynamic Binding.

Overloading: Function overloading and Operator overloading, ambiguity, Overloading Restriction, friends' function, member operators, operator function, I/O operators, Automatic Conversions and Typecasts for Classes, Memory management in C++: new, delete, object copying-deep & shallow copy. this pointer.

#### UNITIII:

Exception Handling Mechanisms: Exceptions and exception class, exception declarations, unexpected exceptions, RTTI, Calling abort(), Returning an Error Code, Exception Mechanism, Using Objects as ExceptionsTemplates and Standard Template Library (STL): Generic Programming in C++, Template classes, declaration, Template functions, Template Classes and Friends, Namespaces and separate compilation; String class, Containers, Iterators, Vectors

Files in C++: Buffers, and the iostream File, redirection, streams and 1/0 streams classes, File Input and Output, Stream Checking and is open (). Opening Multiple Files, Command-Line Processing, File Modes

#### TEXTBOOKS:

1. B.A. Forouzan& R. F. Gilberg, " A structured approach using C++", CENGAGE learning India 2. E. Balguruswamy. Object-Oriented Programming with C++, 3rd Edition, 2007, Tata McGraw Hill (TMH) Publication Pvt. Ltd., New Delhi.

## MCA 1st Year

### SEMESTER - II

#### (Paper-10)

#### MCA 203 Operating System

**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

13/48 Introduction Early Operating Systems - Buffering & Spooling - Multiprogramming-1

Protection-Operating System Structures,

Process Management: Process Concept - Hierarchy of Process - Critical Section Problem - Semaphores

Process Coordination Problems - Inter Process Communication

#### UNIT II:

CPU Scheduling: Scheduling Concepts - Scheduling Algorithms - Algorithms - Algorithm Evaluation

Processor Scheduling Multiple

Deadlock: Deadlock Problem: Characterization-Prevention-Avoidance - Detection-Recovery

Command.

#### UNIT III:

Combined Approach to Deadlock Handling.

Memory Management: Introduction - Multiple Partition-Paging-Segmentation - Paged Segmentation Virtual Memory Concept - Overlays-DemandPaging and Performance - Page Replacement Algorithms - Allocation Algorithms - Trashing.

#### UNIT IV:

Device Management: Goals of I/O software, Design of device drivers.

File Management: Overview of file management system, disk space management, directory structures. Protection domains, access control lists, protection models.

#### UNIT V:

Secondary Storage Management: Physical Characteristics -Disk Scheduling-Disk Scheduling

Algorithms Sector Queuing File Systems: File Operations-Access Methods-Allocation Methods

Directory Systems - File Protection-Implementation Issues.

Case Studies: Linux and Windows 2000 Operating Systems.

#### TEXTBOOKS:

1. Silberschatz, Peter Baer Galvin & Greg Gagne, Operating System Concepts Seventh Ed., Addison Wesley Publications. 1. William Stallings, Operating Systems Internals and Design Principles, PHI India, Fourth Edition, REFERENCES: 2003.

**MCA-1st Year****SEMESTER II****(Paper-11)****MCA 204 Theory of Computation****Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45****Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Introduction to automata: Alphabet, String, Language, Grammar, Concepts of automata theory, some applications.

**UNIT II:**

Finite automata: An informal picture of finite automata, Deterministic and non-deterministic finite automata, Language recognized by finite automata, Equivalence of deterministic and non-deterministic finite automata, Finite automata with epsilon-transitions.

**UNIT III:**

Regular expression and languages: Regular expressions, Language associated with regular expressions, Connection between regular expression and regular languages, Finite automata and regular expressions, Regular grammars, Equivalence between regular languages and regular grammars, Chomsky classification of languages, Proving languages not to be regular, Pumping lemma and its applications, Properties of regular languages

**UNIT IV:**

Context free grammars and languages: Context free grammars, Context free languages and derivation trees, Ambiguity in grammars and languages, Properties of context free languages, Normal forms of context free grammars, Pumping lemma for context free languages

**UNIT V:**

Pushdown automata: Basic definition, Language recognized by pushdown automaton, Pushdown automata and context free languages, Context free grammars for pushdown automata, Deterministic pushdown automata.

**UNIT VI:**

Turing machines: Definition, Turing machine model, Representation of Turing machines, Design of Turing machines

**TEXTBOOKS:**

1. Introduction To The Theory Of Computation - Michael Sipser
2. The Theory of Computation" by Bernard M Moret, "Computational

## MCA-1st Year – II

### SEMESTER II

#### (Paper-12)

#### MCA 205 Design and Analysis of Computer Algorithms.

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Introduction:Algorithm - pseudo code for expressing algorithms - analysis - time complexity and space complexity - efficiency of algorithms - O-notation - Omega notation and Theta notation.

DIVIDE AND CONQUER: General method - binary search - merge sort - quick sort.

#### UNIT II:

GREEDY METHOD: General method- Knapsack problem - job sequencing with deadlinesminimum-cost spanning trees: Prim's and Kruskal's algorithms - Single source shortest paths: Dijkstra's algorithm.

#### UNIT III:

DYNAMIC PROGRAMMING: General method - Multistage Graphs-All pairs shortest paths, Single source shortest paths - optimal binary search trees - 0/1 Knapsack problem - Traveling salesperson problem.

#### UNIT IV:

BACK TRACKING: General method - n-queen problem - sum of subsets problem - graph coloring - Hamiltonian cycles - Knapsack problem.

#### UNIT V:

BRANCH AND BOUND: Least Cost (LC) search, Bounding - LC branch and bound - FIFO branch and bound- Travelling salesperson problem.

#### TEXTBOOKS:

1. E. Howrowitz and Sahni, Fundamentals of computer algorithms, Galgotia Publications, 1998. 2. T.H. Coremen, et. al, Introduction to Algorithm, PHI, 2001

#### REFERENCES:

1. Gilles Brassard and Paul Bratley, Fundamentals of Algorithm, Prentice Hall of India Pvt. Ltd. 1997.

## **MCA - 1st Year**

### **SEMESTER II**

**(Paper-13)**

#### **MCA 206 Lab on Data Structure**

**Full Marks: 25 (MSE) +25 (ESE ) 50, Time: 3 hrs.**

**Pass Marks: 34**

### **PRACTICAL**

1. Matrix Operations-Add, Multiply, Rank, Det, etc.
2. Stack & Queue operations using Arrays.
3. Self-referential structures & single linked list operations.
4. Implementing Stack and queues using linked lists.
5. Implementing Polish Notations using Stacks.
6. Circular and double linked list operations.
7. linear & binary search, bubble sort technique.
8. Insertion sort, selection sort & merge sort techniques.
9. Quick sort and counting sort techniques.
10. Radix (bucket) and address calculation sort methods.
11. Binary tree traversals (preorder, in order, post order).
12. Graph representation with matrix & adjacency lists etc.

## **MCA-1st Year**

### **SEMESTER II**

**(Paper-14)**

#### **MCA 207 Lab on C++ Programming**

**Full Marks: 25 (MSE) + 25 (ESE) 50, Time: 3 hrs. Pass Marks: 34**



## MCA-2nd Year

### SEMESTER III

(Paper 15)

**MCA 301 Advance Database Management System**

**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

**Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### **UNIT I:**

Transaction and schedules: Concurrent Execution of transaction, Conflict and View Serializability, Testing for Serializability, Concepts in Recoverable and Cascade less schedules.

Lock based protocols, time stamp-based protocols, Multiple Granularity and Multi-version Techniques.

#### **UNIT II:**

Distributed Transactions Management:Data Distribution, Fragmentation and Replication Techniques, Distributed Commit, Distributed Locking schemes, Long duration transactions.

#### **UNIT III:**

Issues of Recovery and atomicity in Distributed Databases: Traditional recovery techniques, Logbased recovery, Recovery with Concurrent Transactions, Recovery in Message passing systems, Checkpoints, Algorithms for recovery line, Concepts in Orphan and InconsistentMessages , Multiway Joins, Semi joins

#### **TEXTBOOKS:**

1. Silberschatz, Korth and Sudershan, Database System Concept', Mc GrawHill
2. Ramakrishna and Gehrke,' Database Management System, Mc GrawHill
3. Garcia-Molina, Ullman,Widom,' Database System Implementation' PearsonEducation

## MCA-2nd Year

### SEMESTER – III

#### (Paper-16)

#### MCA 302 Internet and Web Technology (PHP, Java Script, CSS, DHTML)

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Introduction to WWW: History, Protocols and programs, secure connections, application and development tools, the web browser, what is server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP.

#### UNIT II:

Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser. Style sheets: Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, border sand boxes, margins, padding lists, positioning using CSS.

#### UNIT III:

JavaScript: Client-side scripting, what is JavaScript, how to develop JavaScript, simple JavaScript, variables, functions, conditions, loops and repetition.

#### UNIT IV:

Advance script, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, forms and validations DHTML: Combining HTML, CSS and JavaScript, events and buttons, controlling your browser.

#### UNIT IV:

XML: Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT 36.

#### UNIT V:

PHP : Starting to script on server side, Arrays, function and forms, advance PHP Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database bugs.

#### Text books:

1. Steven Holzner Title : "Web Technologies, black book".Jan,2009, 5th edition, DreamtechPress
2. P.J. Deitel& H.M. Deitel Pearson. "Web Applications : Concepts and Real World Design", 2006Wiley-India.

## MCA-2nd Year

SEMESTER – III

(Paper-17)

MCA 303 ELECTIVE I

(a)Python Programming

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Introduction to Python, history of python. Two modes of using Python Interpreter, Variables and Data Types, Operators and their Precedence, Strings & Slicing, Python Lists, tuples and set, Input from the Keyboard.

**UNIT II:**

Conditional statements in python if, elif, Loops and Iterations: while and for loops, Python Syntax, Colon & Indentation, Syntax of for loops, Jump statements: break and continue.

**UNIT III:**

Functions, passing arguments and return values. Optional and Named Arguments, Storing functions in modules. Modules and Packages in Python, Different ways to import Packages.

**UNIT IV:**

Object Oriented Programming in Python, classes, creating and using a class. Working with classes and instances. Inheritance, importing classes, python standard library.

**UNIT V:**

File Input/output the pickle module, working with a file, File related modules in Python, File modes and permissions, Reading & Writing data from a file, redirecting output streams to files, working with directories, CSV files and Data Files, Exception Handling, Divide a zero error. Use of try except block, working with multiple files. Graphics, GUI, Writing GUI Programs.

**UNIT VI:**

Arrays and Matrices, The NumPy Module, Creating Arrays and Matrices, Copying, Arithmetic Operations, Cross product & Dot product, Saving and Restoring, Matrix inversion & 3D Data Visualization, The Matplotlib Module, Multiple plots, Polar plots, Pie Charts, Plotting mathematical functions.

**Textbooks:**

1. David Beazley & Brain K. Jones, Python Cookbook, 3rd edition, O' Reilly,2013.
2. Yashavant Kanetkar & Aditya Kanetkar, Let Us Python, 2nd edition, BPB,2020.

## MCA-2nd Year

SEMESTER – III

(Paper-18)

MCA 303 ELECTIVE I

(b)Computer Graphic and Multimedia

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

### UNIT I:

Introduction to computer graphics and graphics systems. Raster and vector graphics systems, video display devices, physical and logical input devices, simple colour models.

### UNIT II:

Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm.

### UNIT III:

2D Transformation: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines.

### UNIT IV:

Viewing pipeline, Window to Viewport co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse.

### UNIT V:

Hidden Surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Printer's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods, fractal - geometry. Rendering of a polygonal surface; Flat, Gouraud, and Phong shading; Texture mapping, bump texture, environment map; Introduction to ray tracing; Image synthesis, sampling techniques, and anti-aliasing.

### UNIT VI:

Multimedia, concepts, design, hardware, standards – MPEG, JPEG, MIDI, multimedia design methodology, development and testing.

### Textbooks:

1. Donald Hearn and Pauline Baker Computer Graphics, Prentice Hall, New Delhi,2012
2. Fundamentals of Computer Graphics &Multimedia,Mukherjee,PHI

**MCA-2nd Year****SEMESTER III****(Paper-19).****Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45****Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT-I:**

FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING: Introduction; Object-Oriented Paradigm; Basic Concepts of Object-Oriented Programming, Objects and Classes, Data abstraction and encapsulation, Inheritance, Polymorphism etc.; JAVA EVOLUTION: Java History; Java Features (Compiled and interpreted, Platform-independent and portable. Object-oriented, Robust and secure, Distributed, Simple, small and familiar, Multithreaded and interactive, High performance, Dynamic and extensible); How Java Differs from C and C++(Java and C, Java and C++); Java and Internet, Java and World Wide Web, Web Browsers (Hot Java, Netscape Navigator, Internet Explorer); Hardware and Software Requirements; Java Support Systems, Java Environment (Java development kit, Java standard library). JAVA CLASSES: Types of Classes, Scope rules, Access modifiers, Instantiating Objects of a class, Calling methods, Packages & Interfaces, The String class, Java control statements, Operators, Arrays & Vectors. PROGRAMMING IN JAVA: Java Applications, Applets & Servlets

**UNIT -II:**

JAVA APPLETS: Life Cycle of Applet, Creating Applets, Adding Applet to HTML File; Running the Applet, Passing Parameters to an Applet, Drawing Images on the applet.

JAVA SWING: Introduction to Swing, Swing features, Swing Components, Working with Swing, Swing basic Containers, Buttons, User Interface Components (Buttons, Text Fields, Text Areas, Check Boxes, Radio Buttons, Applet etc.), Layouts & Layout Managers, Using Dialogs, Option Pane class, Input Dialog Boxes, Timers & sliders, Progress Bars, Tables. EVENT HANDLING: Event delegation Approach, Action Listener, Adjustment Listener, Mouse Listener and Mouse Motion Listener, Window Listener, Key Listener, Change Listener, Caret Listener. MANAGING ERRORS AND EXCEPTIONS: - Introduction; Types of Errors (Compile-time error, Run-time error); Exceptions; Syntax of Exception Handling Code; Multiple Catch Statements; Using finally Statement; Creating User defined Exceptions

JAVA I/O HANDLING: I/O File Handling (Input Stream & Output Streams, File Input Stream & File Output Stream, Data I/P and O/P Streams, Buffered I/P and O/P Streams, File Class, Reader and Writer Streams, Random Access File).

**UNIT-III:**

MULTITHREADING: Overview of Multithreading, The Thread control methods, Thread life cycle, newly created threads, Main thread, creating a Thread (Implementing Runnable Interface, Extending the Thread Class), Thread Synchronization, Writing Applets with Threads. Sockets.

(Connection Interface, Statement Interface, Prepared Statement Interface, Result Set Interface, Result Set Meta Data SOCKET PROGRAMMING: Introduction, TCP/IP Protocol, UDP Protocol, Ports, Using TCP/IP Sockets. Using UDP JAVA DATABASE CONNECTIVITY (JDBC): JDBC/ODBC bridge, Driver Manager Class, Java.SQLPackage Interface), SQL Exception class. 1. Herbert Schildt."The Complete Reference". Ninth Edition Book: Herbert Schildt.

**TEXTBOOK:** 1. Bruce Eckel, Thinning in Java, Pearson Education, 2006.

## MCA-2nd Year

### SEMESTER - III

#### (Paper-20)

#### MCA 305 Data Communication and Computer Networks

Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Introduction: Data Communications, Networks, The Internet, Protocols and Standards, Network Models, Layered Tasks, The OSI Model, Layers in the OSI Model, TCP/IP Protocol Suite, Data and Signals-, Analog and Digital, Periodic Analog Signals, Digital Signals, Digital Transmission, Digital-to-Digital Conversion, Analog to-Digital Conversion, Analog Transmission, Digital-to-analog Conversion, Analog-to-analog Conversion Internetworking concept-Application level-Network level Interconnection - Internet Architecture-Inter Connection through IP Routers, Internet Addresses - Mapping Internet addresses to Physical addresses (ARP)Determining an Internet address at startup (RARP).

#### UNIT II

Internet Protocol: Datagram Delivery-Routing IP datagrams, error and control messages (ICMP)-classless and subnet addresses extensions-User Datagram Protocol (UDP).

#### UNIT III:

Routing Protocols: Routing cores-peers-routing algorithms-Autonomous Systems - Exterior Gateway Protocol- Internet Multicasting-Multicast Routing Protocols - Internet Group Management Protocol (IGMP).

#### UNIT IV:

TCPAP TCP/IP over ATM: ATM hardware - ATM cell transport-Adaptation Layer-IP address binding in ATM network-Logical IP subnet - ATMARP. Socket Interface: Unix I/O-networks I/O-creating sockets Connecting sockets-obtaining information about hosts, networks, protocols, services.

#### UNIT V:

Application Protocols: Domain Name System - File transfer & access (FTP, TFTP, NFS) -electronic mail (SMTPMIME)- Network management (SNMP)-Internet security.

#### TEXTBOOK:

1. Douglas E. Comer, "Internetworking with TCP/IP Principles, Protocols and Architectures", Prentice Hall of India Private Limited, (4 Edition), 2002.2. W. Stallings, Data and Computer Communication, McMillan. 3. A.S. Tanenbaum, Computer Networks, PHI. Scanned.

## **MCA-2nd Year**

**SEMESTER-III**

**(Paper-21)**

**MCA 306 ELECTIVE I**

**a) Python Programming LAB**

**Full Marks: 25 (MSE) +25 (ESE) 50, Time: 3 hrs. Pass Marks: 34**

## **MCA-2nd Year**

**SEMESTER-III**

**(Paper-22)**

**MCA 306 ELECTIVE I**

**b) Computer programming and Multimedia LAB**

**Full Marks: 25 (MSE) +25 (ESE) 50, Time: 3 hrs. Pass Marks: 34**

## MCA-2nd Year

SEMESTER III  
(Paper-23)

MCA 307 Lab on Java Programming

Full Marks: 25 (MSE)+25 (ESE) 50, Time: 3 hours, Pass Marks: 45

**Introduction, Compiling & executing a java program.**

**Topics:**

1. introduction compiling and executing java program.
2. Program with data types & variables.
3. Program with decision control structures: if, nested if etc.
4. Program with loop control structures: do, while, for etc.
5. Program with classes and objects.
6. Implementing data abstraction & data hiding.
7. Implementing inheritance.
8. Implementing and polymorphism.
9. Implementing packages.
10. Implementing generics.
11. Program with modern features of java.
12. Implementing interfaces and inner classes
13. Implementing wrapper classes
14. Implementing generics.
15. Implementing cloning.
16. Implementing Reflections
17. Working with files.



## MCA-2nd Year

### SEMESTER IV

(Paper-24)

### MCA 401 ELECTIVE I

#### a) Software Engineering

**Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

**Instructions to question setter and examinee**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

THE PRODUCT: The evolving role of software -Software.

THE PROCESS: Software Engineering: A Layered Technology-The software process-Software process models-Linear sequential model-Prototyping model-RAD model - Evolutionary software process models Component based development - Formal methods model-Fourth generation techniques.

#### UNIT II:

SOFTWARE PROJECT PLANNING: Observation on estimating- Software scope-resources Software project estimation - Decomposition techniques - Empirical estimation models-Make buy decision.

PROJECT SCHEDULING AND TRACKING: Basic Concepts -Relationship between people and effort Scheduling-Earned value analysis.

#### UNIT III:

SYSTEM ENGINEERING: Computer based systems-The system engineering hierarchy - Business process engineering: overview - Product engineering: overview - Requirement Engineering-System modeling. ANALYSIS CONCEPTS AND PRINCIPLES: Requirement Analysis-Requirement elicitation for software Analysis principles- Software Prototyping-Specification.

ANALYSIS MODLEING: The elements of the Analysis Model-Data Modeling - Functional modeling and information flow- Behavioral modeling - The mechanics of structured analysis-Data Dictionary.

#### UNIT IV:

DESIGN CONCEPTS AND PRINCIPLES: Software design and software engineering - The design process Design principles - Design Concepts-Effective modular design - Design heuristics for effective Design Model - Design Documentation. modularity

ARCHITECTURAL DESIGN: software Architecture - Data design - Architectural Styles-Mappingdesign.

requirements into software architecture-Transform Mapping-Transactional Mapping-Refining architectural

USER INTERFACE DESIGN: The Golden Rules-User interface design-Task analysis and modeling - Interface design activities - Implementation tools- Design evaluation.

#### UNIT V:

SOFTWARE TESTING TECHNIQUES: Software testing fundamentals-Test case design-white box testing basis path testing-Control structure testing-Black box testing-Testing for specialized environments, architectures and applications

**SOFTWARE TESTING STRATEGIES:** A strategic approach to software engineering - Strategic issues-unit testing-Integration Testing-Validation Testing-System testing - The Art of debugging.

## MCA-2nd Year

### SEMESTER IV

#### (Paper-24)

#### MCA 401 ELECTIVE I

#### (b) Internet of Things

**Full Marks: 30(MSE) +70 (ESE)-100 Time: 3 hrs. Pass Marks: 45**

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### Unit I:

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

#### Unit II:

Introduction to sensors, Transducers, Classification, Roles of sensors in IOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IOT sensors, Role of actuators, types of actuators.

#### Unit III:

Protocol Standardization for IoT :M2M and WSN Protocols, RFID Protocols & NFC protocols, Issues with IoT Standardization ,Unified Data Standards ,Protocols – IEEE 802.15.4, Zigbee, IPv6 technologies for the IoT, IPv6 over low-power WPAN (6LoWPAN) Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACnet , Current, M2M etc.

#### Unit IV:

IOT Analytics Role of Analytics in IOT, Data visualization Techniques, Introduction to R Programming, Statistical Methods.

#### Unit V:

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

#### Unit VI:

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

#### Unit VII:

IoT Physical Devices & Endpoints: Basic Building Block of IoT Device, Exemplary Device, Arduino Interfaces, Hardware requirement for Arduino, Connecting remotely over the network using VNC, GPIO Basics, Controlling GPIO Outputs Using a Web Interface, – Programming, APIs / Packages, Introduction to Raspberry Pi Interfaces, Beagle bone InterfacesLinuxonRaspberryPi,RaspberryPiInterfaces-

Serial,SPI,I2C;ProgrammingRaspberryPi; with Python- Controlling LED with Raspberry Pi, Interfacing LED & Light Sensor(LDR) and Switch with Raspberry Pi; Other IoT Devices- pc Duino, Beagle Bone Black, Cubie board  
Unit VIII Internet of things Challenges: Vulnerabilities of IoT, Security, Privacy & Trust for IoT, Security requirements, Threat analysis, Use cases and misuse cases.

**Unit IX :**

IoT Applications: Introduction, Home Automation- Smart Lighting & Appliances, Intrusion Detection, Smoke/Gas Detectors; Cities- Smart Parking, Smart Lighting & Roads, Structural Health Monitoring, Surveillance, Emergency Response; Environment- Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection; Energy- Smart Grids, Renewable energy Systems,Prognostics;Logistics; Retail- Inventory Management, Smart Payments, Smart Vending Machines; Logistics- Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring, Remote Vehicle Diagnostics; Agriculture- Smart Irrigation, Green House Control; Industry- Machine Diagnosis & Prognosis, Indoor Air Quality Monitoring; Health & Lifestyle- Health & Fitness Monitoring, Wearable Electronics; Smart Metering, e-Health Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Plant Automation, Real life examples of IOT in Manufacturing Sector

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

**Unit XI :**

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

**Reference Books:**

ArshdeepBahga& Vijay Madiseti- Internet of Things: A hands-on Approach, 2015, Universitiespress

## MCA-2nd Year

### SEMESTER – IV

(Paper-25)

#### MCA 402 Network Security & Cryptography

Full Marks: 30 (MSE) +70 (ESE)-100 Times: 3 hrs. Pass Marks: 45

#### Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

#### UNIT I:

Symmetric Ciphers-Classical Encryption Techniques - Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography - Block Ciphers and the Data Encryption Standard-Simplified Data Encryption Standard, Block Cipher Principles, The Data Encryption Standard, Strength of Data Encryption Standard, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

#### UNIT II:

Advanced Encryption Standard-Evaluation Criteria for Advanced Encryption Standard, the Advanced Encryption Standard Cipher-Substitute Byte Transformation Contemporary Symmetric Ciphers-Triple Data Encryption Standard, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers-Confidentiality using Symmetric Encryption - Key Distribution.

#### UNIT III:

Public Key Cryptography and RSA - Principles - RSA Algorithm, Key Management and other Public Key Cryptosystems - Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Manage Authentication and Hash Functions- Authentication Requirements, Authentication Functions, Manage Authentication Codes.

#### UNIT IV:

Digital Signatures and Authentication Protocols-Digital Signatures, Authentication Protocols, Digital Signature Standard.

#### UNIT V:

Network Security Practice- Authentication Applications - Kerberos, X.509 Authentication Service Electronic Mail Security - PGP, Secured MIME, IP Security- Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload.

## **MCA-2nd Year**

**SEMESTER-IV  
(Paper-26)**

**MCA 403 Comprehensive Viva**

**Full Marks: 50 (MSE) +50 (ESE)-100 Time: 3 hrs. Pass Marks: 45**

**Instructions to question setter and examinee**

## **MCA-2nd Year**

**SEMESTER-VI  
(Paper-27)**

**MCA 404 Final Project**

**Full Marks: 200,Times: 3 hrs. Pass Marks: 60**

**Final Project**

**EL X01 SOFT COMPUTING****Full Marks: 30 (MSE)+70 (ESE)-100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

Introduction: Soft Computing Constituents Soft Computing Vs Hard Computing -Applications Artificial Neural Network (ANN): Fundamental Concept - Basic Terminologies - Neural Network. Architecture-Learning Process Fundamental Models of ANN: McCulloch-Pitts Model Hebb Network-Linear Separability.

**UNIT II:**

Supervised Learning Networks: Perceptron Network Adaline and Madeline Networks - Back Propagation Network - Radial Basis Function Network.

**UNIT III:**

Unsupervised Learning Networks: Korhonen Self Organizing Network - Counter Propagation Network -ART Network - Hopfield Network - Special Networks: Boltzmann Machine - Support Vector Machine.

**UNIT IV:**

Fuzzy Sets: Fundamental Concept - Basic Terminologies - Operations on Fuzzy Set - Properties of Fuzzy Sets Fuzzy Sets Vs Crisp Sets - Fuzzy Relations: Basic Concepts - Fuzzy Composition –Fuzzy Equivalence and Tolerance Relation- Membership Functions- Fuzzification - Defuzzification.

**UNIT V:**

Genetic Algorithm: Fundamental Concept - Basic Terminologies-Traditional Vs Genetic Algorithm Elements of GA - Encoding - Fitness Function - Genetic Operators: Reproduction Cross Over Inversion and Deletion - Mutation-Simple and General GA- The Schema Theorem - Classification of Genetic Algorithm-Applications of GA.

**TEXTBOOKS:**

S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Wiley India, 2007.

**EL X02 MOBILE COMPUTING****Full Marks: 30 (MSE) +70 (ESE) = 100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

Introduction, issues in mobile computing, overview of wireless telephony: cellular concept.

GSM: air-interface, channel structure, location management: HLR-VLR, hierarchical, handoffs, channel allocation in cellular systems, CDMA, GPRS.

**UNIT II:**

Wireless Networking, Wireless LAN Overview: MAC issues, IEEE 802:11; Blue Tooth, Wireless multiple access protocols, TCP over wireless, Wireless applications, data broadcasting, Mobile IP, WAP: Architecture, protocol stack, application environment, applications.

**UNIT III:**

Data management issues, data replication for mobile computers, adaptive clustering for mobile... wireless networks, File system, Disconnected operations.

**UNIT IV:**

Mobile Agents computing, security and fault tolerance, transaction processing in mobile computing environment.

**UNIT V:**

Adhoc networks, localization, MAC issues, Routing protocols, global state routing (GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, applications.

**TEXTBOOKS:**

1. J. Schiller, Mobile Communications, Addison Wesley.



**EL X03 SOFTWARE PROJECT MANAGEMENT****Full Marks: 30 (MSE)+70 (ESE) 100 Time: 3 hrs. Pass Marks: 451**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT-1:**

Introduction and Software Project Planning, Fundamentals of Software Project Management (SPM), Need identification, Vision and Scope ,document, Project Management Cycle, SPM Objectives, Management Spectrum SPM Framework, Software Project Planning, Planning Objectives, Project Plan, Types of project plan, Structure da Software Project Management Plan, Software project estimation, Estimation methods, Estimation models, Decision process.

**UNIT-II:**

Organization and Scheduling Project Elements, Work Breakdown Structure (WBS); Types of WBS, Project Functions, Activities and Tasks, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project schedule, Scheduling Objectives, Building the project schedule, Scheduling terminology and techniques, Network Diagrams: PERT, CPM, Bar Charts: Milestone Charts, Gantt Charts. Project Monitoring and Control Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned

**UNIT-III:**

Value Indicators: Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV). Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking, Software Reviews, Types of Review: Inspections, Desk checks, Walkthroughs, Code Reviews, Pair Programming. UNIT. IV.

**UNIT-IV:**

Software Quality Assurance and Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & validation, Testing Automation & Testing Tools, Concept f Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, The SEI Capability Maturity Model CMM), SQA Activities, Formal SQA Approaches: Proof of correctness, Statistical quality assurance, Cleanroom process.

**UNIT-V:**

Project Management and Project Management Tools Software Configuration Management Software Configuration Items and tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control, Risk Management: Risks and risk types, Risk Breakdown Structure (RBS), Risk Management Process: Risk identification, Risk analysis, Risk planning, Risk monitoring, Cost Benefit Analysis, Software Project Management Tools: CASE Tools, Planning and Scheduling Tools, MS-Project.

**EL X04 ENTERPRISE RESOURCE PLANNING****Full Marks: 30 (MSE)+70 (ESE)-100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

grated Management Information Seamless Integration-Supply Chain Management- Integrated Data del-Benefits Of ERP-Business Engineering And ERP- Definition of Business Engineering principles of business engineering- Business engineering with information technology.

**UNIT II:**

The Business model - ERP implementation-an Overview-Role of Consultant, Vendors and users, Customization- Precautions- ERP Post implementation options- ERP Implementation Technology -Guidelines for ERP Implementation.

**UNIT III:**

ERP domain- MPG/PRO - IFS/Avalon- Industrial and financial systems- Baan IV SAP - Market Dynamics and dynamic strategy.

**UNIT IV:**

Description- Multi-client server solution-Open technology- User Interface-Application Integration.

**UNIT V:**

Basic architectural Concepts- The system control interfaces- Services-Presentation Interface-Database Interface.

**TEXTBOOK:**

1. Vinod Kumar Garg and N.K. Venkita Krishnan, 'Enterprise Resource Planning- Concepts and Practice" PHI, 1998.

**EL X05 DATA MINING AND DATA WAREHOUSING****Full Marks: 30 (MSE) +70 (ESE)- 100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 questions out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**Evolution of database technology-Introduction to data warehousing and data mining  
Differences between operational databases and data warehouses.**UNIT II:**

Data warehouse architecture &amp; design, Hardware &amp; Operational design, Tuning and testing.

**UNIT III:**

Data mining: Data preprocessing, data mining primitives, languages &amp; system architectures, concept description: characterization and comparison, Mining association rules, classification and prediction.

**UNIT IV:**

Cluster analysis, Applications and trends in

**UNIT V:**

Introduction to Microsoft's OLE DB for Data mining, D.B. Miner.

**TEXTBOOKS:**

1. Sam Anahory and Dennis Murray, "Data Warehousing in the real world", Addison Wesley 1997. 2. Jiawei Han et, al., "Data Mining: Concepts and Techniques", Morgan Kaufmaan series, 2000.

**REFERENCE BOOKS:**

1. Usama M. Fayyad, Gregory Piatetsky - Shapiro, Padhraí Smyth and Ramasamy Uthurusamy, "Advances in Knowledge Discovery and Data Mining", The M.I.T Press, 1996.

**EL X06 E-COMMERCE****Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**Electronic Commerce Environment and Opportunities: Background-The Electronic Commerce Environment  
electronic Marketplace Technologies-Modes of Electronic Commerce: Overview - Electronic Data Interchange

Migration to Open EDI- Electronic Commerce with WWW/Internet-Commerce Net Advocacy- We Commerce going forward

**UNIT II:**

Approaches to safe Electronic Commerce: Overview - Secure Transport Protocols-Secure Transactions - Secure Electronic Payment Protocol(SEPP)-Secure Electronic Transaction (SET)- Certificates for Authentication Security on Web Servers and Enterprise Networks- Electronic cash and Electronic payment schemes: Internet Monetary payment and security requirements - payment and purchase order process - Online Electronic cash v

**UNIT III:**

Internet/Intranet Security issues and solutions: The need for Computer Security - Specific Intruder Approaches - Security strategies- Security Tools-Encryption - Enterprise Networking and Access to the Internet-Antivirus Programs-Security Teams.

**UNIT IV:**

MasterCard/ Visa secure Electronic Transaction: Introduction -Business Requirements - Concepts-Payment processing-E-mail and secure e-mail technologies for electronic commerce: Introduction - The Meanof Distribution-A model for message handling - How does e-mail work? MIME: Multipurpose Internet Mail Extensions S/MIME: Secure Multipurpose Internet Mail Extensions - MOSS: Message Object Security Services

**UNIT V:**

internet and Web site establishment: Introduction-Technologies for web servers - Internet tools relevant to Commerce-Internet Applications for Commerce - Internet charges - Internet Access and Architecture -- Searching the Internet

**TEXTBOOKS:**

1. Daniel Minoli& Emma Minoli, "Web Commerce Technology Handbook", Tata McGraw Hill, 1999. 2K. Raini&nNao. "E-Commerce", Tata McGraw Hill, 1999.

**EL X07 CLOUD COMPUTING****Full Marks: 30 (MSE)+70 (ESE) 100****Time: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

LOUD ARCHITECTURE AND MODEL Technologies for Network-Based System - System Models for Distributed and Cloud Computing -

NIST Cloud Computing Reference Architecture.

Cloud Models: - Characteristics-Cloud Services - Cloud models (IaaS, PaaS, SaaS) -Public vs

Private Cloud-Cloud Solutions - Cloud ecosystem - Service management - Computing on demand.

**UNIT II:****VIRTUALIZATION**

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management- Virtualization for Data-center Automation.

**UNIT III:****CLOUD INFRASTRUCTURE**

Architectural Design of Compute and Storage Clouds-Layered Cloud Architecture Development Design Challenges Inter Cloud Resource Management - Resource Provisioning and Platform Deployment Global Exchange of Cloud Resources.

**UNIT IV:****PROGRAMMING MODEL**

Parallel and Distributed Programming Paradigms - MapReduce, Twister and Iterative MapReduce Hadoop Library from Apache - Mapping Applications Programming Support - Google App Engine, Amazon AWS- Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, Cloud Sim

**UNIT V:****SECURITY IN THE CLOUD**

Security Overview - Cloud Security Challenges and Risks-Software-as-a-Service Security - Security Governance - Risk Management - Security Monitoring - Security Architecture Design - Data Security Application Security - Virtual Machine Security - Identity Management and Access Control -Autonomic Security.

**TEXTBOOKS:**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

**EL X08 SYSTEM PROGRAMMING****Full Marks: 30 (MSE) +70 (ESE) 100****Time: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Basic Assembler Functions - A simple SIC Assembler p Assembler Algorithm and Data Structure

Machine-Dependent Assembler Features: Instruction Formats and Addressing Modes - Program Relocation-

Machine-Independent Assembler Features: Literals-Symbol-Defining Statements Expressions - Program

Blocks-Control Sections and Program Linking-Assemble Basic Loader Functions: Design of an Absolute

Loader- A Simple Bootstrap Loader- Machine Dependent Loader Features: Relocation-Program Linking-

Algorithm and Data Structures for a Linking Loader-Machine-Independent Loader Features: Automatic

Library Search - Loader Options - Loader

**UNIT II:**

Design Options: Linkage Editors-Dynamic Linking-Bootstrap Loaders: Implementation Example's

DOS Linker-SunOS Linkers-Cray MPP Linker

**UNIT III:**

Basic Compiler Functions: Grammars, Lexical Analysis, Syntactic Analysis, Code Generation Machine-

Dependent Compiler Features: Intermediate Form of the Program, Machine-Dependent Code Optimization -

Machine-Independent Compiler Features: Structured Variables, Machine-Independent Code Optimization,

Storage Allocation, Block-Structured Languages -Compiler Design Options: Division into Passes, Interpreters,

P-Code Compilers, Compiler-Compilers-Implementation Examples: SunOS C Compiler- Java Compiler and

Environment - the YACC Compiler-Compiler.

**UNIT IV:**

Basic Macro Processor Functions: Macro Definition and Expansion-Macro Processor Algorithm and Data

Structures - Machine-Independent Macro Processor Features: Concatenation of Macro Parameters -

Generation of Unique Labels - Conditional Macro Expansion- Keyword Macro Parameters - Macro Processor

Design Options: Recursive Macro Expansion-General Purpose Macro Processors-Macro Processing within

Language Translators - Implementation : MASM Macro Processor-ANSI C Macro Language The ELENA Macro

Processor

**TEXTBOOKS:**

Leland L. Beck, Manjula.D. "System Software - An Introduction to Systems Programming". Third Edition, Pearson Education, Inc., 2007

**EL X09 DIGITAL IMAGE PROCESSING AND MULTI-MEDIA****Full Marks: 30 (MSE) +70 (ESE)-100 Time: 3 hrs. Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

sampling and quantization, some basic relationships between pixel, image geometry in 2D. image enhancement in the spatial domain.

**UNIT II:**

Introduction to spatial and frequency methods: Basic gray level transformations, histogram equalization, local enhancement, image subtraction, image averaging, basic spatial, filtering, smoothing spatial filters, sharpening spatial filters. Introduction to the Fourier transformation: Discrete fouriertransformation, fast Fourier transformation, filtering in the frequency domain, correspondence between filtering in the spatial and frequency domain smoothing frequency-domain filters, sharpening frequency domain filters, homomorphic filtering, dilation and erosion, opening and closing, hit-or miss transformation.

**UNIT III:**

Some basic morphological algorithms: Line detection, edge detection, gradient operator, edge linking and boundary detection, thresholding, region-oriented segmentation, representation schemes like chain codes, polygonal approximations, boundary segments, skeleton of a region, recognition and interpretation patterns and pattern classes, decision-theoretic methods, introduction to neural network.

**UNIT IV:**

Introduction to Image Compression: JPEG, MPEG, Wavelets, operating system issues in multimedia, real time OS issues, interrupt latency etc., network management issues Like QOS guarantee, resource reservation, traffic specification etc. security issues like digital watermarking, partial encryption schemes for video stream encryption. Latest developments in field of multimedia like VOIP, video on demand and video conferencing.

**TEXTBOOK**

1. Rafael C. Gonzalez and Richard E. Woods. Digital Image Processing. Prentice-Hall of India, 2002

**REFERENCE BOOKS**

1. William K. Pratt, Digital Image Processing: PIKS Inside (3rd ed.), John Wiley &amp; Sons, 2001Inc.,

2. Bernd Jahne, Digital Image Processing. (5th revised and extended edition). Springer, 2002 3. S. Annadurai and R. Shanmugalakshmi. Fundamentals of Digital Image Processing. Pearson Education 2007

**EL X10 NEURAL NETWORKS****Full Marks: 30 (MSE) +70 (ESE) 100****Time: 3 hrs.****Pass Marks: 45**

Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

Neurocomputing and Neuroscience Historical notes, human Brain, neuron Mode I. Knowledge representation, AI and NN. Learning process: Supervised and unsupervised learning, Error correction learning competitive learning, adaptation, statistical nature of the learning process.

**UNIT II:**

Data processing

Scaling, normalization, Transformation (FT/FFT), principal component analysis, regression, covariance matrix, eigen values &amp; eigen vectors. Basic Models of Artificial neurons, activation Functions, aggregation function, single neuron computation, multilayer perceptron, least mean square algorithm, gradient descent rule, nonlinearly separable problems and benchmark problems in NN.

**UNIT III:**

Multilayered network architecture, back propagation algorithm, heuristics for making BP algorithm performs better. Accelerated learning BP (like recursive least square, quick prop, RPROP algorithm), approximation properties of RBF networks and comparison with multilayer perceptron.

**UNIT IV:**

Recurrent network and temporal feed-forward network, implementation with BP, self-organizing map and SOM algorithm, properties of feature map I computer simulation. Principal component and Independent component analysis, application to image and signal processing.

**UNIT V:**

Complex valued NN and complex valued BP, analyticity of activation function, application in 2D information processing. Complexity analysis of network models. Soft computing. Neuro-Fuzzy genetic algorithm Integration.

**TEXTBOOKS:**

1. J.A. Anderson, An Introduction to Neural Networks, MIT



**EL X11 COMPILER DESIGNING****Full Marks: 30(MSE) +70 (ESE) 100****Time: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

Lexical and Syntactic Analysis: Review of regular languages, design of a lexical analyzer generator, context free grammars, syntactic analysis - design of top down and bottom up parsers.

Syntax directed translation: Top down and bottom up approaches, data types, mixed mode expression; subscripted variables, sequencing statement, subroutines and functions: Parameters called by address, by name and by value, subroutines with side effects. Code generation, machine dependent and machine independent optimization techniques.

**TEXTBOOKS**

1. A. V. Aho, R. Sethi and J. D. Ullman, Compilers: Principles, Techniques, and Tools (US edition), Addison Wesley, 1986.

**EL X12 DISTRIBUTED SYSTEM****Full Marks: 30 (MSE) +70 (ESE) 100****Time: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Distributed Computing Systems: Definition - System Models- Advantages of Distributed Systems - Design Challenges-Distributed Computing Environment - Networking and Internetworking Types of Networks- Network Principles - Internet Protocols.

**UNIT II:**

Message Passing: Fundamental Concept-Features - Issues-Synchronization - Buffering - Message Encoding and Decoding - Process Addressing-Failure Handling-Remote Procedure Calls: RPC Model - Transparency - Implementation - Stub Generation-RPC Messages - Marshaling-Communication Protocols- Client-Server Binding- Lightweight RPC.

**UNIT III:**

Distributed shared Memory - Basic Concept -General Architecture - Advantages - Design Issues- Structuring Approaches - Consistency Models - Replacement Strategy - Thrashing-Synchronization Mechanisms: Clock Synchronization - Event ordering - Mutual Exclusion-Deadlock-Election Algorithms.

**UNIT IV:**

Resource Management: Basic Concept - Features-Task Assignment Approach-Load- Balancing Approach - Load-Sharing Approach - Process Management: Basic Concept - Process Migration Threads.

**UNIT V:**

Distributed File Systems: Uses-Services - Features-File Models-Accessing Models - Sharing Semantics-Caching Schemes-File Replication-Fault Tolerance- Atomic Transactions - Design Principles.

**TEXTBOOKS:**

Pradeep K. Sinha, "Distributed Operating Systems", Prentice Hall India, 2008, New Delhi.

**EL X13 PARALLEL SYSTEM****Full Marks: 30 (MSE) +70 (ESE)=100****Time: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

Processes and processors. Shared memory. Fork. Join constructs. Basic parallel programming techniques- loop splitting, spin locks, contention barriers and row conditions. Variations in splitting, self and indirect scheduling. Data dependency-forward and backward block scheduling. Linear recurrence relations. Backward dependency.

**UNIT II:**

Performance tuning overhead with number of processes, effective use of cache. Parallel programming examples: Average, mean squared deviation, curve fitting, numerical integration, travelling salesmanproblem, Gaussian elimination. Discrete event time simulation. Parallel Programming constructs in HPF, FORTRAN 95. Parallel programming under Unix.

**TEXTBOOKS:**

1.Parallel Computing, Quinn, TMH 2. Introduction to Parallel Processing Sashi Kumar, PHI

**EL X 14 REAL TIME SYSTEMS****Full Marks: 30 (MSE) +70 (ESE) = 100****Times: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT-I:** Introduction Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing

etc., Release Times, Deadlines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

**UNIT-II:** Real Time Scheduling

Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems,

**UNIT-III:** Resources Sharing

Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects.

**UNIT-IV:** Real Time Communication

Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols

**UNIT-V:** Real Time Operating Systems and Databases

Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristics of Temporal data. Temporal Consistency, Concurrency Control, Overview of Commercial Real Time databases

**TEXTBOOK**

1. Real Time Systems by Jane W. S. Liu, Pearson Education Publication.

**EL XI5 MODELING AND SIMULATION****Full Marks: 30 (MSE) +70 (ESE)=100****Times: 3 hrs.****Pass Marks: 45**

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly

**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).

**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).

**UNIT I:**

System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.

**UNIT II:**

System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte Carlo simulation, Distributed Lag models, Cobweb model.

**UNIT-III:**

Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation.

**UNIT-IV:**

System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.

**UNIT-V:**

Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression-based languages, object-oriented simulation, general purpose vs. application oriented simulation packages, CSMP-III, MODSIM-III.

**TEXTBOOKS**

1. Geoffrey Gordon," System Simulation", PHI 2. Jerry Banks, John S. C Barry L. Nelson David M. Nicol, "Discrete Event System Simulation",

**EL X16 EMBEDDED SYSTEM****Full Marks: 30 (MSE) +70 (ESE) 100 Time: 3 hrs. Pass Marks: 451**

Instructions to question setter and examinee

This paper will be of 70 marks and divided into three groups:

**Group A:** This group Consist of 10 multiple choice question of 2 marks each (10 x 2=20 marks) from the entire syllabus uniformly**Group B:** This group Consist of 6 question out of which 4 are to answered, each carrying 5 Marks (4x 5 = 20).**Group C:** This group Consist of 4 questions, out of which 2 are to be answered each, carrying 15 marks (2 x 15= 30).**UNIT I:**

Introduction to Embedded Systems: Overview of embedded systems, features, requirements and applications of embedded systems, recent trends in the embedded system design, common architectures for the ES design, embedded software design issues, communication software, introduction to development and testing tools.

**UNIT II:**

Embedded System Architecture: Basics of 8-bit RISC microcontroller (PIC), block diagram, addressing modes, instruction set, timers, counters, stack operation, programming using PIC controller, basics of 32-bit microprocessor (ARM), processor and memory organization, data operations, flow of control, pipelining in ARM, ARM bus (AMBA).

**UNIT III:**

Embedded Software: Programming in embedded environment, Programming for microcontrollers such as Intel 8051 and PIC. Overview of Java 2 micro edition (J2ME), concept of a MIDLET, applications of J2ME in mobile communication.

**UNIT IV:**

Interfacing and Communication Links: Serial interfacing, real time clock, SPI/ micro wire bus, 12C bus, CAN bus, PC parallel port, IRDA data link, PCI bus architecture. Operating Systems for Embedded Systems: OS Fundamentals, processes and threads, context switching, scheduling issues, inter task communication, introduction to memory management, evaluating OS performance, real time operating systems, popular RTOS and their applications.

**UNIT V:**

Applications of Embedded Systems: Industrial and control applications, networking and telecom applications, DSP and multimedia applications, applications in the area of consumer appliances, concept of smart home.

**TEXTBOOKS**

1. Daniel W. Lewis, Fundamentals of Embedded Software, where C and assembly meet, Pearson Education 2001.

**REFERENCES BOOKS**

1. John B. Peatman, Design with PIC Microcontrollers, Pearson Education, 1997.

2. Robert B. Reese, Microprocessors: From assembly language to C using PIC18Fxx2, Shroff Publishers and Distributors Pvt Ltd. 2005.