

# MCA SYLLABUS

UNDER

## CHOICE BASED CREDIT SYSTEM

FOR THE STUDENTS TO ADMITTED IN THE SESSIONS  
2018-19, 2019-20, 2020-21

**DEPARTMENT OF COMPUTER SCIENCE & IT,  
UNIVERSITY OF JAMMU**

## MCA COURSE STRUCTURE

### Semester-Wise Distribution of Courses and Credits

#### Semester I

| Course No.    | Title  | Credits   | Contact hours per week<br>L-T-P |
|---------------|--|-----------|---------------------------------|
| PSCATC102     | Problem Solving & Programming in C             | 4         | 4-0-0                           |
| PSCATC103     | Computer Organization & Assembly Language      | 4         | 4-0-0                           |
| PSCATC107     | Operating System Principles                    | 4         | 4-0-0                           |
| PSCATC108     | Discrete Mathematics                           | 4         | 4-0-0                           |
| PSCALC190     | Practical ( <i>based on C and Unix/Linux</i> ) | 6         | 0-0-10                          |
| <b>Total:</b> |  | <b>22</b> | <b>16-0-10</b>                  |

#### Semester II

| Course No.    | Title  | Credits   | Contact hours per week<br>L-T-P |
|---------------|--|-----------|---------------------------------|
| PSCATC203     | Data Structures using C-Language                               | 4         | 4-0-0                           |
| PSCATC208     | Database Management System                                     | 4         | 4-0-0                           |
| PSCATC209     | Computer Architecture & Microprocessor                         | 4         | 4-0-0                           |
| PSCATC212     | Computer Networks  | 4         | 4-0-0                           |
| PSCATC213     | Application Programming using Java                             | 4         | 4-0-0                           |
| PSCALC290     | Practical ( <i>based on Data Structures, Oracle and Java</i> ) | 6         | 0-0-10                          |
| <b>Total:</b> |  | <b>26</b> | <b>20-0-10</b>                  |

**Semester III**

| Course No.    | Title  | Credits   | Contact hours per week<br>L-T-P |
|---------------|--|-----------|---------------------------------|
| PSCATC310     | Algorithm Design & Analysis  | 4         | 4-0-0                           |
| PSCATC311     | Computer Graphics  | 4         | 4-0-0                           |
| PSCATC313     | Web Technologies   | 4         | 4-0-0                           |
|               | *Open Course-I   | 4         | 4-0-0                           |
| PSCALC390     | Practical ( <i>based on Computer Graphics and Web Technologies</i> ) | 6         | 0-0-10                          |
| <b>Total:</b> |  | <b>22</b> | <b>16-0-10</b>                  |

\*Students shall register for this Course from other Departments of University. He/she may opt for MOOC course of equivalent credits instead.

**Semester IV**

| Course No.    | Title  | Credits   | Contact hours per week<br>L-T-P |
|---------------|--|-----------|---------------------------------|
| PSCATC420     | Theory of Computation  | 4         | 4-0-0                           |
| PSCATC422     | Numerical & Statistical Computing  | 4         | 4-0-0                           |
| PSCATC423     | Software Engineering   | 4         | 4-0-0                           |
|               | Elective-I ( <i>any one of the following</i> )                                 | 4         | 4-0-0                           |
| PSCATE425     | Python   |           |                                 |
| PSCATE426     | Big Data Analytics with R  |           |                                 |
| PSCATE427     | Machine Learning   |           |                                 |
| PSCATE428     | Internet of Things   |           |                                 |
|               | *Open Course-II  | 4         | 4-0-0                           |
| PSCALC490     | Practical ( <i>based on Numerical &amp; Statistical Methods and Python/R</i> ) | 6         | 0-0-10                          |
| <b>Total:</b> |  | <b>26</b> | <b>20-0-10</b>                  |

\*Students shall register for this Course from other Departments of University. He/she may opt for MOOC course of equivalent credits instead.

## Semester V

| Course No.             | Title  | Credits   | Contact hours per week<br>L-T-P |
|------------------------|--|-----------|---------------------------------|
| PSCATC504              | Artificial Intelligence  | 4         | 4-0-0                           |
| PSCATC511              | Principles of Compiler Design                                  | 4         | 4-0-0                           |
| PSCATC518              | .NET Technology & C#   | 4         | 4-0-0                           |
| PSCATE516<br>PSCATE519 | Elective-II ( <i>any one of the following</i> )                | 4         | 4-0-0                           |
|                        | Mobile Technologies<br>PHP                                     |           |                                 |
| PSCALC590              | Practical ( <i>based on .NET and PHP/Mobile Technologies</i> ) | 6         | 0-0-10                          |
| <b>Total:</b>          |  | <b>22</b> | <b>16-0-10</b>                  |

## Semester VI

### PSCADC601

**PROJECT WORK: 26 credits**

The project in sixth semester shall carry 650 marks distributed as follows:

| Project Component                               |                    | Marks      |
|---|--------------------|------------|
| Mid-Semester Presentation & Internal Evaluation |                    | 250        |
| End-Semester Evaluation                         | Project Evaluation | 250        |
|   | Project Viva-voce  | 150        |
| <b>Total:</b>                                   |                    | <b>650</b> |

### NOTE:

- The students of Computer Science Department shall register for two courses of 4 credits each in 3<sup>rd</sup> and 4<sup>th</sup> semester in the other Departments of University.
- Department shall offer following two open courses of 4 credits in 3<sup>rd</sup> and 4<sup>th</sup> semester for students from other Departments of University.
  - 3<sup>rd</sup> Semester: Problem Solving & Programming in C (PSCATO351)
  - 4<sup>th</sup> Semester: Object Oriented Concepts using C++ (PSCATO451)

**Requirements for earning the MCA degree**

The total credits required for the MCA programme are 144. The credits are distributed over three categories:

| CATEGORIES   | DESCRIPTION                   | CREDITS    |     |
|--|-------------------------------|------------|-----|
| Post-graduate Semester Core Courses (PSCC)           | Core Departmental Courses     | 128        | 136 |
| Post-graduate Semester Elective Courses (PSEC)       | Elective Departmental Courses | 08         |     |
| Post-graduate Semester Open Category Courses (PSOCC) | Other Department Courses      | 08         |     |
| <b>TOTAL CREDITS</b>                                 |                               | <b>144</b> |     |

**Course credits assignment**

**Lectures and Tutorials:** One lecture or tutorial hour per week per semester is assigned one credit.

**Practical/Laboratory:** One and half laboratory hour per week per semester is assigned one credit.

**EXAMINATION:**

There shall be three tests in each semester and the student shall be continuously evaluated during the conduct of each course on the basis of their performance as follows:

| THEORY  | Syllabus to be covered in the examination | Time allotted for the exam. | Weightage (Marks) |            |    |
|---|---|-----------------------------|-------------------|------------|----|
| Minor test I (after one month)  | Upto 25%                                  | 1½ hours                    | 20%               |            |    |
| Minor test II (after two months)  | Upto 50%                                  | 1½ hours                    | 20%               |            |    |
| Major test * (after end of semester)  | Upto 100%                                 | 3 hours                     | 60%               |            |    |
| *(i) 80% weightage in Major Test shall be given to those units which have not been covered in the two Minor Tests.<br>(ii) Certain questions may be framed in such a way which may require knowledge of more than one unit or one question may have multiple parts either subjective and/or objective from one or more units i.e. certain questions may be from across units. |   |                             |                   |            |    |
| <b>Total</b>  |   |                             | <b>100</b>        |            |    |
| <b>PRACTICAL</b>  |   |                             |                   |            |    |
| Daily evaluation of practical records/Viva voce etc. (Internal Evaluation)  | 1   | Viva voce 1                 | 15                | 35         | 75 |
|   | 2   | Viva voce 2                 | 15                |            |    |
|   | 3   | Practical File              | 5                 |            |    |
|   | 4   | Internal exam + Viva voce 3 | 25 + 15           | 40         |    |
| Final Practical performance and viva voce (External Evaluation)   | <b>100% syllabus</b>                      |                             |                   | 75         |    |
| <b>Total</b>  |   |                             |                   | <b>150</b> |    |

## **SCHEME FOR PAPER SETTING (MAJOR EXAMINATION)**

The question paper shall be divided into three sections (A, B & C). No question shall be repeated in the question paper.

### **Section A**

In this section the examiner needs to set 10 objective questions/definitions/fill in the blanks distributed uniformly over the entire syllabus. Each question shall carry 1½ marks and the candidates are required to answer all the questions.

(10 x 1½ = 15 marks)

### **Section B**

There shall be 5 short answer type questions and shall carry 3 marks each. In this section, questions shall be covered from each unit and the candidates are required to answer all the questions.

(3 x 5 = 15 marks)

### **Section C**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

(3 x 10 = 30 marks)

### **ATTENDANCE:**

Each course (theory, practical etc.) shall be treated as an independent unit for the purpose of attendance. A student shall be required to attend a minimum of 75% of the total instruction hours in a course including tutorials and seminars in each semester. A student who fails to secure 75% attendance in a course shall not be eligible to appear in the semester examination in that course and shall be required to repeat that course.

### **CRITERIA FOR PROMOTION OF A STUDENT TO NEXT HIGHER SEMESTER:**

A student will be eligible to proceed from 1<sup>st</sup> semester to 2<sup>nd</sup> semester, from 2<sup>nd</sup> semester to 3<sup>rd</sup> semester, from 3<sup>rd</sup> semester to 4<sup>th</sup> semester, from 4<sup>th</sup> semester to 5<sup>th</sup> semester and from 5<sup>th</sup> to 6<sup>th</sup> semester if he/she has earned 50% credits in Theory/Practical Courses cumulatively in earlier semesters of the programme and has completed the minimum attendance requirements.

### ABSOLUTE GRADE SYSTEM

| MARKS         | Grade | Grade Points | Description of performance |
|---------------|-------|--------------|----------------------------|
| ≥ 90          | O     | 10           | Outstanding                |
| ≥ 75 and < 90 | A+    | 9            | Excellent                  |
| ≥ 65 and < 75 | A     | 8            | Very Good                  |
| ≥ 55 and < 65 | B+    | 7            | Good                       |
| ≥ 50 and < 55 | B     | 6            | Above Average              |
| ≥ 40 and < 50 | C+    | 5            | Average                    |
| ≥ 36 and < 40 | C     | 4            | Pass/Below Average         |
| > 20 and < 36 | D     | 2            | Fail/Poor                  |
| ≤ 20          | E     | 0            | Very Poor                  |

‘D’ and ‘E’ grades refer to unsatisfactory performance. The student shall have to repeat all compulsory courses where the D/E grade is obtained. The weights of ‘D’ and ‘E’ grades shall not be counted in SGPA or CGPA. Other grades would include:

| GRADES | DESCRIPTION             |
|--------|-------------------------|
| I      | Incomplete              |
| W      | Withdrawal              |
| X      | Continued Project       |
| S      | Satisfactory Completion |
| Z      | Non Completion          |

### CONVERSION FROM CGPA TO PERCENTAGE

The conversion of SGPA or CGPA to Percent score will be carried out by multiplication of respective SGPA or CGPA by a factor of 9.

A CGPA of 6.75 shall be considered equivalent to 60% marks.

## MCA-FIRST SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test = 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC102***

***COURSE TITLE: PROBLEM SOLVING & PROGRAMMING IN C***

### Course Objectives & Learning Outcomes:

- The course aims to provide exposure to problem-solving through programming.
- It aims to train the student to the basic concepts of the C-programming language.
- To compare the various programming constructs and choose the right one for the task in hand.
- To choose the right data representation formats based on the requirements of the problem.
- By learning the basic programming constructs they can easily switch over to any other language in future.

### UNIT-I Problem Solving & C Basics

Steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Psuedocode and Flowchart Designing.

History of C, Characteristics of C, Introduction to GCC, compiling, linking and running a C-program, Using MAKE Utility.

C Program Structure, Data Types, Variables and Constants, Printing Out and Inputting Variables, Constants, Type-Casting, Operators and Expressions, Order of Precedence.

10 HOURS

### UNIT-II Control Statements & Arrays

Conditional Statements, Program Loops and Iteration, Library functions. Syntax, semantic, linker, logical and runtime errors.

Single and Multi-dimensional Arrays, Strings, Basic String Handling Functions.

10 HOURS

### UNIT-III Functions & Further Data Types

Functions, Passing Parameters, Recursion, Storage classes. Standard C Preprocessor Directives. Standard Formatted & unformatted I/O Functions;

Defining New Data Types, Structures, Unions, Enumerated Types, Bitwise Operators, Bit Fields.

10 HOURS

### UNIT-IV Pointers & Files

Pointers: Pointers arithmetic, constant void pointers. Dynamic Memory Allocation, Pointers to Pointers, Pointer to array, Array of pointers, Command line input, Pointers to a Function.

Files Character and Line Based I/O, Formatted I/O, Block I/O, File Positioning.

10 HOURS

### UNIT-V File Accessibility & Graphics Programming

File Accessibility and Directories (access, stat, chmod, chown, chdir, chroot), ProcessControl: (Running Linux Commands from C, fork(), the exec family, wait(), exit() ).

Graphics Programming: OpenGL Basics, OpenGL Utility Toolkit (GLUT), Defining window, Display mode, OpenGL Functions, Primitives (Points, Lines, Polygons) and Attributes, Simple graphics programs.

10 HOURS

## MCA-FIRST SEMESTER

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

**COURSE NO: PSCATC102**

**COURSE TITLE: PROBLEM SOLVING & PROGRAMMING IN C**

### **SUGGESTED READINGS:**

1. B. Kernighan and D. Ritchie, "The ANSI C Programming Language", PHI., 2000.
2. Shubhnandan S. Jamwal, "Programming in C", Pearson Publications, 2014.
3. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3rd Edition, 2007.
4. Jeri R. Hanly and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 5th Edition 2007.
5. Yashwant Kanetkar, "Let us C", BPB Publications, 2002.
6. Edward Angel, "OpenGL- A primer", 3rd Edition, Addison-Wesley 2007.
7. Kurt Wall, Mark Watson, and Mark Whitis, "Linux Programming Unleashed", SAMS.
8. Mark Mitchell, Jeffrey Oldham, and Alex Samuel, "Advanced Linux Programming", New Riders Publishing, 2001.
9. Edward Angel, "Interactive Computer Graphics", 5th Edition, Addison-Wesley 2009.

### **NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

#### **SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

#### **SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## MCA-FIRST SEMESTER

|   |                          |
|---|--------------------------|
| Total Marks = 100                                 | Minor Test I = 20 Marks  |
| No. of Credits = 4                                | Minor Test II = 20 Marks |
| Time allotted for Major Test= 3 hours             | Major Test = 60 marks    |
| Examination to be held: December 2018, 2019, 2020 |                          |

**COURSE NO: PSCATC103**

**COURSE TITLE: COMPUTER ORGANIZATION & ASSEMBLY LANGUAGE**

### Course Objectives & Learning Outcomes:

- To describe how data is represented in computer memory.
- To demonstrate how fundamental high-level programming constructs are implemented at the machine-language level.
- To write assembly language program that can input, process and output results.
- To demonstrate the basic computer architecture.
- Students will be to apply mathematical foundations, algorithmic principles, and computer science theory to the modeling and design of computer based systems.

### UNIT-I Binary Systems

Overview of digital computers, Binary Numbers, Number systems, Number based Conversions, Integer & floating point representation using IEEE FORMAT, Rules of Floating point Arithmetic, parity, Error detection and correction methods using Hamming technique, ASCII code representation, Rules of addition/subtraction for r's, (r-1)'s complements, BCD, excess-3 codes.

10 HOURS

### UNIT-II Boolean Algebra & Logic Gates

Basic Theorems and functions, Boolean Expressions, Laws of Boolean Algebra, De-Morgan laws, simplification of Boolean Expressions using SOP, POS, K-map. Logic gates, AND, OR, NOT, NAND, XOR, NOR, XNOR Gates & their design.

10 HOURS

### UNIT-III Combinational Circuits

Introduction, Half & Full adders & subtractors, parallel adders and subtractors. Encoder, decoder, Multiplexer, De-Multiplexer, code converters.

10 HOURS

### UNIT-IV Sequential circuits & Memory organization

Sequential circuits, Basic memory cell, Flip-flops and their types, triggering of flip flops, Registers and their types, bi-directional register.

Memory Hierarchy, Memory and its types, characteristics of memory, memory address map to CPU, cache memory.

I/O devices FD/HD disks, VDU; I/O organization, Modes of I/O transfer like DMA, programmed control, interrupts technique.

10 HOURS

### UNIT-V Microprocessor & Assembly Language

Microcomputer organization, microprocessor organization, Instruction set, addressing modes, stack, subroutines and interrupts, memory organization and I/O interface.

Need and use of Assembly Language, Types of Assemblers (TASM and MASM), assembly Language programming structure, Instruction Sets (operands and opcodes), description of Registers, writing and executing simple assembly programs.

10 HOURS

**MCA-FIRST SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC103***

***COURSE TITLE: COMPUTER ORGANIZATION & ASSEMBLY LANGUAGE***

**SUGGESTED READINGS:**

1. Gear, C. W.: "Computer Organization and Programming", McGraw-Hill.
2. Tannenbaum, A. S.: "Structured Computer Organization", Prentice-Hall of India.
3. Mano, M. M.: "Computer System Architecture", Prentice-Hall, of India.
4. Langholz, G., Grancioni, J. and Kandel, A.: "Elements of Computer Organization", PHI.
5. Hayes: "Computer Architecture and Organization", McGraw-Hill International Edition.
6. Sloan, M. E.: "Computer Hardware and Organization", 2nd Edn, Galgotia publ. Pvt. Ltd.
7. Floyd: "Digital Fundamentals", 3rd edn, Universal bookstall, and pvt. ltd
8. R. K Gaur: "Digital Electronics and microprocessor"-dhanpat Rai pub.
9. Peter Abel: "Assembly language and Programming".

**NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

**SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

**SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

**SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## MCA-FIRST SEMESTER

|   |                          |
|---|--------------------------|
| Total Marks = 100                                 | Minor Test I = 20 Marks  |
| No. of Credits = 4                                | Minor Test II = 20 Marks |
| Time allotted for Major Test= 3 hours             | Major Test = 60 marks    |
| Examination to be held: December 2018, 2019, 2020 |                          |

***COURSE NO: PSCATC107***

***COURSE TITLE: OPERATING SYSTEM PRINCIPLES***

### Course Objectives & Learning Outcomes:

- To learn the fundamentals of Operating Systems.
- To learn the mechanisms of OS to handle processes and threads and their communication.
- To learn the mechanisms involved in memory management in contemporary OS.
- To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
- To brief the students about basic concepts of OS like Unix/Linux and programs using shell programming.

### UNIT-I Introduction to Operating Systems

Evolution of operating systems, operating systems concepts, types of operating systems, different views of the operating system, operating system services, System calls, Types of system calls. Operating system Structure, Layered Approach, Microkernels, Virtual machines.

10 HOURS

### UNIT-II Process Management

Process concept, operation on processes, Inter-process communication, mutual exclusion, Process scheduling, Basic Concepts, Scheduling criteria, Scheduling algorithms, Process Synchronization, Inter process Synchronization, Critical section Problem, Semaphores, Monitors, Message passing. Deadlocks, System Model, Deadlock characterization, Deadlock prevention, Deadlock avoidance.

10 HOURS

### UNIT-III Memory Management

Memory management, swapping, contiguous memory allocation, relocation & protection, Memory management, Paging, Segmentation, Intel Pentium Segmentation, Intel Pentium Paging, Virtual memory, demand paging, performance of demand paging, Page replacement algorithms: FIFO, Optimal, LRU, Counting based page replacement.

10 HOURS

### UNIT-IV File & I/O Management

Files system structure, file system implementation, Directory Implementation. Allocation Methods, contiguous allocation, Linked allocation, Indexed allocation Disk organization, disk space management, disk scheduling, Disk Management, RAID Structure.

10 HOURS

## MCA-FIRST SEMESTER

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

**COURSE NO: PSCATC107**

**COURSE TITLE: OPERATING SYSTEM PRINCIPLES**

### **SUGGESTED READINGS:**

1. Silberschart, Galvin, Gagne, "Operating System Concepts", 9<sup>th</sup> Edition, WSE Wiley, 2016.
2. Andrew. S. Tanenbaum, "Modern operating systems", 4th Edition, Pearson Prentice Hall, 2018
3. Milan Milenkovic, "Operating system-concepts and design", 2nd Edition, McGraw Hill International Edition, 2005
4. A. S. Godbole, "Operating systems", 3rd Edition, Tata McGraw hill, 2017.
5. Deitel H. M., "Operating System", 3rd Edition, Pearson Publications, 2012.
6. Madnick & Donovan, "Operating Systems", Tata McGraw Hill, 2003.
7. Sumitabha Das, "UNIX Concepts and Application", 4th Edition, Tata McGraw Hill, 2017.
8. Richard L. Petersen, "The Complete Reference Linux", 6th Edition, Tata McGraw Hill, 2010.

### **NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

#### **SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

#### **SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## MCA-FIRST SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC108***

***COURSE TITLE: DISCRETE MATHEMATICS***

### Course Objectives & Learning Outcomes:

- Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle, and binomial expansion.
- To analyze algorithms and programs such as finding Fibonacci numbers, Tower of Hanoi problems using recurrence relations and recursion.
- Students will learn core ideas in graph theory.
- Students will be able to model problems in Computer Science using graphs and trees.

### UNIT-I Counting Techniques

Basics of counting pigeon hole principles, permutation and combination, Recurrence Relations & their solution (Homogeneous & non-homogenous), Divide & Conquer Recurrences, Decision trees.

10 HOURS

### UNIT-II Posets, Hasse Diagram, Lattices and Fuzzy

Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, and complemented lattices.

Introduction to fuzzy systems, fuzzy sets, equality of fuzzy sets, normal fuzzy sets, containment, support of a fuzzy set. Alpha-level sets. Basic operation of Fuzzy sets.

10 HOURS

### UNIT-III Graphs

Introduction to Graphs; Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; connectedness; Walks, Paths and Circuits; Components; Connectedness Algorithm, shortest path Algorithms, Eulerian graph; Fleury's algorithms, Hamiltonian graph-Necessary conditions and sufficient conditions; Travelling salesman problem; Bipartite graphs; Directed Graphs, Binary relations, connectedness in directed Graph.

10 HOURS

### UNIT-IV Trees

Properties of trees; Pendant vertices in a tree: Center of a tree; Rooted an binary trees; Spanning Trees–spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph, cutsets and cut-Vertices; Fundamental cutsets; connectivity and separativity.

10 HOURS

### UNIT-V Planar graphs & Coloring

Combinatorial and geometric dual; Kuratowski's graphs; Detection of planarity; Thickness and crossings.

Colorings: Vertex coloring, Chromatic number; Chromatic polynomial, The four colour problem, edge coloring, Coloring algorithms.

10 HOURS

**MCA-FIRST SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2018, 2019, 2020

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC108***

***COURSE TITLE: DISCRETE MATHEMATICS***

**SUGGESTED READINGS:**

1. N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2018.
2. Babu Ram, "Discrete Mathematics", Pearson Publications, 2011.
3. F. Harary, "Graph Theory", Addison-Wesley Publications Comp, 2001
4. J. P Trembly and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", 1st Edition, McGraw Hill.
5. V. Krishnamurthy, "Combinatorics Theory and Applications", Affiliated East-West Press Pvt. Ltd, 2008
6. B. Kolman, R. Busby, "Discrete Mathematical Structures", 6th Edition, Pearson Publications, 2015.

**NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

**SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

**SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

**SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

**MCA-FIRST SEMESTER**

Total Marks = 150

No. of Credits = 6

Examination to be held: December 2018, 2019, 2020

Internal Evaluation = 75 Marks

External Evaluation = 75 Marks

***COURSE NO: PSCALC190***

***PRACTICAL***

Practical will be based on C and Unix/Linux.

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## **MCA-SECOND SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC203***

***COURSE TITLE: DATA STRUCTURES USING C-LANGUAGE***

### **Course Objectives & Learning Outcomes:**

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To understand step by step approach in solving problems with the help of fundamental data structures.
- Student will be able to analyze algorithms and its correctness.
- Student will be able to choose appropriate data structure as applied to specified problem definition.

### **UNIT-I Fundamental Notations**

Primitive and composite data types, self-referential structures, Algorithms, Types of data structures, Operations, Time and space complexity of algorithms, Asymptotic notation.

10 HOURS

### **UNIT-II Linear Data Structures**

Arrays, Linked lists, Stacks, Queues, operations and their complexities, Implementations, Applications.

10 HOURS

### **UNIT-III Non-Linear Data Structures**

Trees, Binary Trees, Traversing binary trees, Threaded binary trees, Binary search trees, heaps, Graphs, Traversing graphs.

10 HOURS

### **UNIT-IV Indexing Structures**

ISAM, m-way trees, B-trees, B+-trees, Hashing techniques for direct access, collision in hashing, collision resolution.

10 HOURS

### **UNIT-V Sorting**

Internal and External sorts, Bubble sort, Insertion sort, Selection sort, Shell sort, Quick sort, Radix sort, Merge sort, Types of merging.

10 HOURS

### **SUGGESTED READINGS:**

1. Vishal Goyal, "A Simplified Approach to Data Structures", Shroff Publishers Pvt. Ltd, 2014.
2. GAV Pai, "Data Structures and Algorithms", Tata McGraw Hills, 2017.
3. Seymour Lipschutz, "Data Structures with C", Schaum Outlines, 2011.
4. Reema Thareja, "Data Structures using C", 2nd Edition, Oxford University Press, 2014.
5. Peter Brass, "Advanced Data Structures", 1st Edition, Cambridge University Press, 2008.

## **MCA-SECOND SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC203***

***COURSE TITLE: DATA STRUCTURES USING C-LANGUAGE***

6. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Universities Press (India) Pvt. Ltd, 2008.
7. Yedidiah Langsam, Moshe J. Augenstein and Aaron M. Tenenbaum, “Data Structures using C and C++”, 2nd Edition, Pearson Prentice Hall, 2007.
8. Adam Drozdek, “Data Structures and Algorithms in C++”, 2nd Edition, Thomson Asia Pvt. Ltd, 2001.
9. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education India, 2001.
10. Jean-Paul Tremblay and Paul G. Sorenson, “Introduction to Data Structures with Application”, 2nd Edition, Tata McGraw-Hill, 2001.

### **NOTE FOR PAPER SETTERS**

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#### **SECTION B:**

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## MCA-SECOND SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC208***

***COURSE TITLE: DATABASE MANAGEMENT SYSTEM***

### Course Objectives & Learning Outcomes:

- To present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve-efficiently, and effectively-information from a DBMS.
- Design ER-models to represent simple database application scenarios and convert them into relational tables
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- To familiarize students with the basic issues of transaction processing and concurrency control.
- Construct simple and moderately advanced database queries using Structured Query Language (SQL).

### UNIT-I Database Management System Concepts

File based system, Need of Database Management System, Components of DBMS, Data independence, Three level architectural of Database, Centralized and client server architecture for DBMS, Introduction to hierarchical and network data models, Conventional file organizations, Inverted files.

10 HOURS

### UNIT-II Relational Data Model

Relational data models, Entity relationship model, Conversion of ER diagrams to Relational Database Design, Joins, Relational algebra and relational calculus concepts, Queries using relational algebra and calculus.

10 HOURS

### UNIT-III Normalisation

Concept of keys, Functional dependencies, Inference rules, Covers, Closure, Equivalence of functional dependencies, Multivalued dependencies, Theory of normalization, Normal forms (1st to 5th).

10 HOURS

### UNIT-IV Concurrency Control

Transaction processing, Deadlocks, Concurrency control, Locking techniques, Timestamp ordering, Recovery management, Recovery techniques, Distributed Database Concepts.

10 HOURS

### UNIT-V SQL

SQL query processing, Table creation and management, Inbuilt functions, Data integrity constraints, Views, Joins, Operators, Privileges, roles and security policies.

10 HOURS

## MCA-SECOND SEMESTER

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC208***

***COURSE TITLE: DATABASE MANAGEMENT SYSTEM***

### **SUGGESTED READINGS:**

1. Bipin C. Desai, "An Introduction to Database Systems", West-publishing company, 2012.
2. Elmasri, Navathe, Somayajulu, Gupt, "Fundamentals of Database Systems", Pearson Education, 1992.
3. Date, C. J., "An Introduction to Database Systems", Addison Wesley Pearson Education, 2014.
4. Narayan S. Umanath, Richard W. Scamell, "Data Modelling and Database Design", Thomson Course Technology India Edition.
5. R. A. Parida, Vinod Sharma, "The power of Oracle 9i", Firewall Media Publications.
6. Deshpande, "SQL/PL for Oracle 8 & 8i".

### **NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

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#### **SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## MCA-SECOND SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC209***

***COURSE TITLE: COMPUTER ARCHITECTURE & MICROPROCESSOR***

### Course Objectives & Learning Outcomes:

- To familiarize students with the components of digital electronics, logical organization and the hardware and corresponding algorithms for computer arithmetics.
- To study memory organization and the functions of each element of a memory hierarchy.
- To understand processor performance at different levels of processing.
- To familiarize students with the design of a Hardware descriptive language.
- To help the students in understanding and analyzing different hardware designs, mathematical models and design integrated applications on different software platforms.

### UNIT-I Digital Electronics

Semi-conductor, p-type, n-type formation, pn junction & its characteristics, Bipolar and MOSFET transistors as current controlled and voltage controlled Switch, Basic design for AND, OR, NOT, NAND, NOR using RTL, DTL, TTL, MOS Technology, Tristate logic.

10 HOURS

### UNIT-II Sequential Circuits & Computer Arithmetic

Sequential circuits: Sequence generator, counters, A/D & D/A converters.

Computer Arithmetic: Flowchart, Hardware design & algorithm for signed magnitude & 2's complement form for addition, subtraction, multiplication & division methods, floating point arithmetic.

10 HOURS

### UNIT-III Memory & Register Organization

Memory: 2D/3D Static RAM, Static and Dynamic Memory, Types of ROM, associative memory and interleaved memory, Random access, Sequential access, direct access, virtual memory, cache memory.

Register transfer logic and micro-operation.

10 HOURS

### UNIT-IV Microprocessor & Control Design

Internal structure of MPU, ALU & Micro-programmed control unit. Instruction format, Bit Slices, I/O interface adapter (Serial and Parallel), Memory read, Memory write, Memory map and I/O map, Interrupts and its types.

10 HOURS

### UNIT-V Parallel Processing and VHDL

Classification of parallel machines, pipeline processing, Vector processing, multiprocessor system architecture-multiport memory, crossbar switch, timeshared common-bus, dual-bus, Bus arbitration.

VHDL: Introduction, Need and importance of VHDL, characteristics, basic components of VHDL.

10 HOURS

## MCA-SECOND SEMESTER

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

**COURSE NO: PSCATC209**

**COURSE TITLE: COMPUTER ARCHITECTURE & MICROPROCESSOR**

### **SUGGESTED READINGS:**

1. Malvino, A. P., Leach, D. P., "Digital Principles and Applications", Tata McGraw-Hill, 2011.
2. Millman and Halkias, "Integrated Electronics", McGraw-Hill.
3. Khambata, J., "Microprocessor and Microcomputer", John Wiley and Applications, PHI.
4. Liu, Y. Gibson, G. A., "Microcomputer Systems: The 8086/808", Family, PHI, 2015
5. AlexandridisNikitas, A., "Microprocessor System Design Concepts", Galgotia Publications.
6. Stone, S., "Introduction to Computer Architecture", Galgotia Publications, 2ndEdn.
7. Mano, M. M., "Computer System Architecture", Prentice-Hall, 2017.
8. Volnei A. Pedroni, "Circuit design with VHDL".

### **NOTE FOR PAPER SETTERS**

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#### **SECTION B:**

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## MCA-SECOND SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC212***

***COURSE TITLE: COMPUTER NETWORKS***

### Course Objectives & Learning Outcomes:

- To study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
- To study the fundamentals of Physical layer, and explain the types of transmission media with real time applications.
- To study data link layer concepts, design issues, and protocols.
- To gain core knowledge of Network layer routing protocols and IP addressing.
- To explore the basic knowledge of cryptography and network security.

### Unit-I Fundamentals of Communication

Fundamentals of Communication, Modulation, Data Encoding, OSI reference model, TCP/IP model, network standardization, Inter-networking. Physical layer, Switching Technique, Transmission media, Co-axial, Twisted Pair and Fiber Optic Cables, Transmission Impairments, Electromagnetic Spectrum, Communication, Radio waves, Microwaves, Satellites, GSM, CDMA.

10 HOURS

### Unit-II Data Transmission and Media access Concepts

Data Link layer, Design issues, Frame, Error detection and correction, Flow Control, Elementary Data link protocols, Character-oriented and Bit-oriented Protocols, Sliding window protocols. Channel allocation methods, TDM, FDM, ALOHA, Carrier sense Multiple access protocols, Collision free protocols, IEEE standard 802 for LANS, Ethernet, Token Bus, Token ring.

10 HOURS

### Unit-III Network Establishment Concepts

Network Layer, Store and Forward Packet Switching, Connectionless and Connection-oriented services, Virtual Circuit, Routing Algorithms, Shortest path, Flooding, Link State, Distant vector, Hierarchical, Broadcast and Multicast Routing. OSPF, BGP, Congestion, Congestion control algorithms.

10 HOURS

### Unit-IV Internet Protocols

TCP/TP Protocol, IP Addresses, Classes of IP Addresses, Subnets, IPv6, Network layer in the Internet, Internet Control Protocols, ARP, RARP, BOOTP, DHCP, Transport Layer, Protocol Stack, TCP and UDP, Transport Services Primitives, Sockets, Socket Programming concept.

10 HOURS

### Unit V Network Application

Application layer, Name service (DNS) Domain Hierarchy, Name servers, Name resolutions, Traditional applications, Telnet, FTP, SMTP, MIME, World wide web-HTTP, HTTP Methods. Network security-Cryptographic Algorithms, DES, AES, RSA, Key exchange methods

10 HOURS

## **MCA-SECOND SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC212***

***COURSE TITLE: COMPUTER NETWORKS***

### **SUGGESTED READINGS:**

1. Andrew S. Tanenbaum, "Computer Networks", 5 e, 2013, Pearson Education Asia.
2. Behrouz A. Forouzan, "Data Communications and Networking", 4e, 2004, Tata McGraw Hills.
3. William Stallings. "Data and Computer Communication", 7e, 2016, Pearson Education Asia.
4. Prakash C. Gupta, "Data Communications and Computer Networks", PHI
5. Michael A. Miller, "Data and Network Communications", 2e, Delmar Thomson Learning.
6. James F. Kurose and Keith W. Ross, "Computer Networking", 3e, Pearson Education.
7. William A. Shay, "Understanding Data Communications and Networks", 2e, Thomson Asia Pvt. Ltd.
8. Peter Norton and Dave Kearns, "Complete Guide to Networking", ie, Techmedia India Ltd.
9. Douglas E. Comer, "Internet networking with TCP/IP Vol I & II", 3e, PHI.

### **NOTE FOR PAPER SETTERS**

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## **MCA-SECOND SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC213***

***COURSE TITLE: APPLICATION PROGRAMMING USING JAVA***

### **Course Objectives & Learning Outcomes:**

- To gain knowledge about Java language.
- To understand the fundamentals of object-oriented programming in Java.
- To understand the basic principles of web application programming.
- Students will be able to design dynamic web application using database connectivity.

### **UNIT –I Java Language Basics**

Features, Object Oriented concepts, Java Virtual Machine Concepts, Primitive Data Type And Variables, Java Keywords, Java Operators, Expressions, Control Statements and Arrays.  
Class and Objects, Static methods, Constructors, Method Overloading.

10 HOURS

### **UNIT –II Inheritance, Packages and Interfaces**

Inheritance, Access Control, Method Overriding, Garbage Collection, Abstract Classes, Polymorphism  
Packages, Interfaces, Exceptions Handling, Types of Exceptions, Writing Exception Subclasses,  
Multithreading, Synchronization in Java.

10 HOURS

### **UNIT –III I/O, Files & Applets Programming**

I/O in Java, Byte Stream Classes, Character Stream Classes, Reading and Writing to Console, Reading and Writing Files, The Transient and Volatile Modifiers, The String and String Buffer Class.

The Applet Class, An Applet Skeleton, Adding images & sound, Passing parameters to an applet.

10 HOURS

### **UNIT –IV AWT & Networking**

AWT Components, Building User Interface with AWT, Handling Events, Event Delegation Model (Events, Listeners, interfaces, Anonymous Classes). Layouts and Layout Manager, Introduction to Swing Components.

Networking: InetAddress class, URL class, TCP sockets, UDP sockets.

10 HOURS

### **UNIT–V Database Connectivity**

JDBC Overview, JDBC implementation, Connection class, Statements, Types of statement objects (Statement, PreparedStatement and CallableStatement), Types of resultset, ResultSetMetadata, Catching Database Results, Handling database Queries, JDBC and AWT.

10 HOURS

## **MCA-SECOND SEMESTER**

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC213***

***COURSE TITLE: APPLICATION PROGRAMMING USING JAVA***

### **SUGGESTED READINGS:**

1. Herbert Schildt–“Java The Complete Reference”, Tata Mcgraw Hill, Tenth edition, 2017.
2. K. Arnold and J. Gosling, “The JAVA programming language”, Third edition, Pearson Education, 2000.
3. Shubhnandan S. Jamwal, “Java 9”, The Team, Shroff Publishers and Distributor Pvt Ltd, 2018.
4. E. Balagurusamy, “ Programming with JAVA”, Tata McGraw Hill, Fifth edition.
5. Dietel & Dietel, “Java How to Program”, Pearson Education, Eleventh edition.
6. Steven Holzner, “Java2 Black Book”, Dreamtech Press.
7. George Reese, “Database Programming with JDBC and Java”, 2nd Edition, O’Reilly.
8. Bruce Eckel, “Thinking in Java”, Prentice Hall.

### **NOTE FOR PAPER SETTERS**

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There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

**MCA-SECOND SEMESTER**

Total Marks = 150

No. of Credits = 6

Examination to be held: May 2019, 2020, 2021

Internal Evaluation = 75 Marks

External Evaluation = 75 Marks

***COURSE NO: PSCALC290***

***PRACTICAL***

Practical will be based on Data Structures, Oracle and Java.

-X-

## **MCA-THIRD SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC310***

***COURSE TITLE: ALGORITHM DESIGN & ANALYSIS***

### **Course Objectives & Learning Outcomes:**

- To design and analysis of various algorithms used in computer science and engineering.
- The students would be able to learn the significance and various aspects of development of algorithms.
- At the end of this course, students would be able to analyze and compare the algorithms on the basis of complexity and design efficient algorithms.

### **UNIT –I Review of Algorithms and Data Structures**

Introduction to algorithm analysis: Introduction to algorithms, Algorithm Specifications, performance analysis, case study on analysis of algorithms. Recursion and Induction: recursive procedures, induction proofs, proving correctness, recurrence equations, recursion. Randomized Algorithms: Basic of Probability Theory, Description of Randomized algorithms, Identifying the repeated Elements, Partiality Testing, Advantages and Disadvantages of using randomized algorithms.

10 HOURS

### **Unit –II Basics of Analysis**

Asymptotic Bounds, Concept of Efficiency of an Algorithm, Well Known Asymptotic Functions & Notations;

Well Known Sorting Algorithms, Comparison of Sorting Algorithms, Best-Case and Worst-Case Analyses, Average-Case Analysis, Amortized Analysis.

10 HOURS

### **Unit–III Design Techniques-I**

Divide-and-Conquer, General Method, Multiplication of two n-bit numbers, Binary Search, Merge Sort, Quick Sort, Strassen's Matrix multiplication, Exponentiation.

Dynamic Programming, General Method, The Problem of Making Change, The Principle of Optimality, Chained Matrix Multiplication.

10 HOURS

### **UNIT–IV Design Techniques-II**

Backtracking, General method, n-queen's problem, Sum of subsets problem.

Greedy Algorithms, General Method, Knapsack problem, Job sequencing with deadlines, Minimum Spanning Trees, Kruskal's Algorithm, Prim's Algorithm, Dijkstra's Single Source Shortest Path Algorithm.

10 HOURS

### **UNIT–V Classification of Problems & Graphs Algorithms**

Non-Deterministic Algorithms, Introduction to NP-Completeness, Establishing NP-Completeness of Problems, NP-Completeness Proofs, NP-Hard Problems.

Graphs Algorithms, Traversing Trees, Depth-First Search, Breadth-First Search, Best-First Search & Minimax Principle, Topological Sort.

10 HOURS

### **MCA-THIRD SEMESTER**

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC310***

***COURSE TITLE: ALGORITHM DESIGN & ANALYSIS***

#### **SUGGESTED READINGS:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, 2009.
2. E. Horowitz, S. Sahni, S. Rajasekaran, "Computer Algorithms", 2nd Edition, Universities Press, 2008.
3. Saara Baase and Allen Van Gelder, "Computer algorithms- Introduction to Design and Analysis", 3rd Edition, Pearson Education, 1999.
4. R. C. T. Lee, S. S. Tseng, R. C. Chang & Y. T. Tsai, "Introduction to the Design and Analysis of Algorithms: A Strategic Approach", 2nd Edition, Tata McGraw-Hill, 2009.
5. M. T. Goodrich and R. Tomassia, "Algorithm Design Foundations, Analysis and Internet examples", 1st Edition, John Wiley and sons, 2006.
6. Aho, Ullman and Hopcroft, "Design and Analysis of algorithms", 3rd Edition, Pearson Education, 2008.

#### **NOTE FOR PAPER SETTERS**

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-x-

## **MCA-THIRD SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC311***

***COURSE TITLE: COMPUTER GRAPHICS***

### **Course Objectives & Learning Outcomes:**

- To introduce the components of a graphics system and make students familiar with building approach of graphics system components and algorithms related with them.
- To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.
- To make students able to implement the application of computer graphics concepts in the development of computer games, information visualization, and business applications.

### **UNIT-I Introduction to Computer Graphics**

Concept of Computer Graphics and its applications; Graphics input and output devices. Video display devices: Refreshing display devices, Random scan display device, Raster scan devices, Flat Panel Devices, color CRT, Direct View Storages Devices. Input Devices, Hard Copy Devices.

10 HOURS

### **UNIT-II Graphic Primitives**

Concept of Graphic Primitives, points, lines etc., Line (DDA and Bresenham line algorithm), Circle (Polar, Bresenham and Mid-point circle algorithm), Ellipse (Polar and Midpoint ellipse algorithm), Area filling techniques (Boundary fill, Flood fill, scan line area fill algorithm), character generation; Aliasing, half toning, Sampling, Filtering Techniques.

10 HOURS

### **UNIT-III Geometric Transformations**

2-dimensional Graphics: 2D Cartesian and Homogeneous co-ordinate system, Geometric transformations (translation, Scaling, Rotation, Reflection, Shearing), Composite transformations.

3-dimensional Graphics: 3D Cartesian and Homogeneous co-ordinate system, Geometric transformations (translation, Scaling, Rotation, Reflection), Composite transformations.

10 HOURS

### **UNIT-IV Viewing & Clipping Transformations**

Introduction; objectives of viewing transformation; Concept of projections: parallel projection, orthographic and oblique projections, isometric projections, perspective projections (concept of vanishing points, single point, perspective transformation, 2-point and 3-point perspective transformation and general perspective transformation with COP at the origin.

Clipping Operations: Point and Line clipping, Cohen- Sutherland and Cyrus-Beck Line Clipping algorithms.

10 HOURS

### **UNIT-V Three-Dimensional Object Representation**

Polygon surfaces, Polygon tables, plain equation, polygon meshes, Bezier curves & Surfaces, properties of Bezier curves, Hermite Interpolation.

Hidden line and surface elimination algorithms: z-buffer, scan-line, sub-division, Painter's algorithm. Illumination Models: Diffuse reflection, Specular reflection, refracted light, texture surface patterns, Halftoning, Dithering. Surface Rendering Methods: Constant Intensity method, Gouraud Shading, Phong Shading.

10 HOURS

**MCA-THIRD SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC311***

***COURSE TITLE: COMPUTER GRAPHICS***

**SUGGESTED READINGS:**

1. Hearn, D. Baker, and P. M., "Computer Graphics", 2nd Edition Prentice-Hall, 2013.
2. A. P Godse, "Computer Graphics", 4th edition, Technical publications Pune, 2015.
3. Newman, W. Sproul, R. F., "Principles of Interactive Computer Graphics", 2nd Edition, McGraw Hill, 2001.
4. Rogers, D. F, "Procedural Elements for Computer Graphics", 2nd Edition McGraw-Hill, 2003.
5. S. Harrington, " Computer Graphics: A Programming Approach", 2nd Edition, Tata McGraw- Hill, 1987.
6. Rogers, D. F., "Mathematical Elements of Computer Graphics", 2nd Edition, McGraw Hill Education, 2017.
7. R. A. Plastock and G. Kalley, "Computer Graphics", McGraw Hill, 2017.

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## **MCA-THIRD SEMESTER**

Total Marks = 100  
No. of Credits = 4  
Time allotted for Major Test= 3 hours  
Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks  
Minor Test II = 20 Marks  
Major Test = 60 marks

***COURSE NO: PSCATC313***

***COURSE TITLE: WEB TECHNOLOGIES***

### **Course Objectives & Learning Outcomes:**

- Students are able to develop a dynamic webpage by the use of java script and DHTML.
- Students will be able to write a well formed / valid XML document.
- Students will be able to write a server side java application called Servlet/JSP to catch form data sent from client, process it and store it on database.
- Students will be able to connect web applications to a DBMS and perform operations on DBMS table.

### **UNIT-I HTML**

Text Formatting Tags, META Tag, Adding Lists, Table, Embedding objects, Paragraphs, Formatting, Links, Head, Images, Tables, Lists, Blocks, Layout, Forms, Colors, Color values, Frame and Form, Form Controls, CSS, Defining Styles, Elements of Style, Linking a Style Sheet to an HTML Document, In-line Styles, External Style Sheets, Internal Style Sheets, Introduction to XML.

10 HOURS

### **UNIT-II JavaScript**

Variables, String manipulation, Mathematical Functions, Statements, Operators, Arrays, and Functions, Data and Objects, Regular Expressions, Built-in Objects, Events, Opening a New Window, Messages and Confirmations, The Status Bar, Writing to a Different Frame, Rollover, Buttons, Moving Images.

10 HOURS

### **UNIT-III Servlets**

Servlet Life Cycle, Servlet Request and Response Disadvantages of Servlets, Reading Headers  
JSP: Scripting Elements, JSP Expression, JSP Declaration, Predefined variables/objects, using user defined functions, working with Databases Using JSP, Inserting, Updating, and Deleting Database Records.

10 HOURS

### **UNIT-IV ASP.NET**

ASP. NET Standard Controls: Label, Textboxes, buttons, hyperlink, checkboxes, Regular expressions.  
Server pages: Creating Server pages, page Life Cycle, HTTP Request Object, HTTP Response Object, Postback, Tracing & Debugging ASP. NET page.

10 HOURS

### **UNIT-V Server Control**

State Management and Types of State Management, HTTP Cookies, HTTP Session, HTTP Application, Query String Method, State Management using Postback URL, View State.  
Validation Controls, Data Bind Control and Types of Data Bind Control, Repeater, Data List, Grid View, Form View, Detail View.

10 HOURS

### **MCA-THIRD SEMESTER**

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC313***

***COURSE TITLE: WEB TECHNOLOGIES***

#### **SUGGESTED READINGS:**

1. H. M. Deitel, P. J. Dietel and A. B. Goldberg, "Internet and Worldwide Web", 4th edition, Pearson Education.
2. Chris bates, "Web Programming", 2nd Edition, Wiley Dreamtech India.
3. Ramesh Bangia,, "Multimedia and Web Technology", 2nd Edition, Firewall Media.
4. James Jaworski, "Mastering Javascript and Jscript", 2nd Edition, BPB.
5. Phil Hana, "JSP: The complete Reference", Osborne/McGraw-Hill, 2001.
6. Jeff Rule, "Dynamic HTML", 1st Edition, Dreamtech Press.
7. Jose Annunziato and Stephanie Fesler Kaminaris, "Java Server pages in 24 Hours", 1st Edition, Techmedia.
8. <https://www.w3schools.com/>
9. <https://www.javatpoint.com/>

#### **NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

##### **SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

##### **SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

##### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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**MCA-THIRD SEMESTER**

Total Marks = 150

No. of Credits = 6

Examination to be held: December 2019, 2020, 2021

Internal Evaluation = 75 Marks

External Evaluation = 75 Marks

***COURSE NO: PSCALC390***

***PRACTICAL***

Practical will be based on Computer Graphics and Web Technologies.

-X-

**OPEN COURSE SYLLABUS**

**In 3<sup>rd</sup> Semester:**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCAT0351***

***COURSE TITLE: PROBLEM SOLVING & PROGRAMMING IN C***

**Course Objectives & Learning Outcomes:**

- The course aims to provide exposure to problem-solving through programming.
- It aims to train the student to the basic concepts of the C-programming language.
- To compare the various programming constructs and choose the right one for the task in hand.
- Choose the right data representation formats based on the requirements of the problem.
- By learning the basic programming constructs they can easily switch over to any other language in future.

**UNIT-I Problem Solving& C Basics**

Steps for problem solving, Computer as a tool for problem solving. Program Design tools: Algorithm, Psuedocode and Flowchart Designing.

History of C, Characteristics of C, Introduction to GCC, compiling, linking and running a C-program, Using MAKE Utility.

C Program Structure, Data Types, Variables and Constants, Printing Out and Inputting Variables, Constants, Type-Casting, Operators and Expressions, Order of Precedence.

10 HOURS

**UNIT-II Control Statements & Arrays**

Conditional Statements, Program Loops and Iteration, Library functions. Syntax, semantic, linker, logical and runtime errors.

Single and Multi-dimensional Arrays, Strings, Basic String Handling Functions.

10 HOURS

**UNIT-III Functions & Further Data Types**

Functions, Passing Parameters, Recursion, Storage classes. Standard C Preprocessor Directives. Standard Formatted & unformatted I/O Functions;

Defining New Data Types, Structures, Unions, Enumerated Types, Bitwise Operators, Bit Fields.

10 HOURS

**UNIT-IV Pointers & Files**

Pointers: Pointers arithmetic, constant void pointers. Dynamic Memory Allocation, Pointers to Pointers, Pointer to array, Array of pointers, Commandline input, Pointers to a Function.

Files Character and Line Based I/O, Formatted I/O, Block I/O, File Positioning.

10 HOURS

**UNIT-V File Accessibility & Graphics Programming**

File Accessibility and Directories (access, stat, chmod, chown, chdir, chroot), ProcessControl: (Running Linux Commands from C, fork(), the exec family, wait(), exit() )

Graphics Programming: OpenGL Basics, OpenGL Utility Toolkit (GLUT), Defining window, Display mode, OpenGL Functions, Primitives (Points, Lines, Polygons) and Attributes, Simple graphics programs.

10 HOURS

**OPEN COURSE SYLLABUS**  
**In 3<sup>rd</sup> Semester:**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2019, 2020, 2021

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCAT0351***

***COURSE TITLE: PROBLEM SOLVING & PROGRAMMING IN C***

**SUGGESTED READINGS:**

1. B. Kernighan and D. Ritchie, "The ANSI C Programming Language", PHI., 2000.
2. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3<sup>rd</sup> Edition, 2007.
3. Jeri R. Hanly and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 5th Edition 2007.
4. Yashwant Kanetkar, "Let us C", BPB Publications, 2002.
5. Edward Angel, "OpenGL- A primer", 3<sup>rd</sup> Edition, Addison-Wesley 2007.
6. Kurt Wall, Mark Watson, and Mark Whitis, "Linux Programming Unleashed", SAMS.
7. Mark Mitchell, Jeffrey Oldham, and Alex Samuel, "Advanced Linux Programming", New Riders Publishing, 2001.
8. Edward Angel, "Interactive ComputerGraphics", 5<sup>th</sup> Edition, Addison-Wesley 2009.

**NOTE FOR PAPER SETTERS**

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**SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC420***

***COURSE TITLE: THEORY OF COMPUTATION***

### **Course Objectives & Learning Outcomes:**

- To apply mathematical foundations, algorithmic principles and computer science theory to the modeling and design of computational systems.
- To demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.
- To understand the limitations of computers and know about unsolvable problems.

### **UNIT–I Regular Languages and Expressions**

Sets, Relations and Functions, Symbols, Alphabet, Strings, Backus-Naur Form, Languages, Grammar, Classification of Grammars, Regular Set, Regular expressions, Algebra of Regular expressions, Regular grammar, Regular languages, Closure properties of Regular languages, Applications of regular expressions.

10 HOURS

### **UNIT–II Finite Automata**

Deterministic Finite Automata (DFA) Non-Deterministic Finite Automata (NFA),  $\epsilon$ -NFA, Equivalence Finite Automata, Equivalence of Regular Expression and Finite Automata, Pumping Lemma for Regular Languages, Applications of finite automata, Mealy and Moore Machines.

10 HOURS

### **UNIT–III Context Free Grammar (CFG)**

Production rules and derivation, Types of Productions, Reduction of Grammar, Chomsky Normal Form, Griebach Normal Form, Pushdown Automata (PDA), Equivalence between CFG and PDA, Context Free Language, Closure properties for context free languages, Pumping Lemma for Context free languages, Applications of Context Free Grammar.

10 HOURS

### **UNIT–IV Turing Machines**

Description, Transition diagram, Roles of Turing machine, Church-Turing Thesis, Modular Construction of complex Turing machines, Extensions of Turing machines, Non-Deterministic Turing Machines. Universal Turing Machine, Turing acceptable and Turing decidable languages.

10 HOURS

### **UNIT–V Function Theory**

Recursive Function Theory and Unsolvable Problems Partial, total and constant functions, Primitive recursive functions; Unbounded minimalisation and  $\mu$ -recursion.

Decidable and Undecidable Problems, The Halting Problem, Reduction to Another Undecidable Problem, Undecidability of Post Correspondence Problem.

10 HOURS

## **MCA-FOURTH SEMESTER**

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC420***

***COURSE TITLE: THEORY OF COMPUTATION***

### **SUGGESTED READINGS:**

1. H. R. Lewis and C. H. Papadimitriou, "Elements of the Theory of Computation", Prentice Hall of India, 2<sup>nd</sup> Edition.
2. J. E. Hopcroft, R. Motwani and J. D Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education Asia, 3<sup>rd</sup> Edition, 2008.
3. Michael Sipser, "Introduction to the Theory of Computation, Thompson", Second Edition, 2006.
4. Jeffrey Shallit, "A Second Course in Formal Languages and Automata Theory", Cambridge University Press, 2008.
5. K. L. P. Mishra and N. Chandrasekaran, "Theory of Computer Science", Prentice Hall, 3<sup>rd</sup> Edition, 2006.
6. Rogers H., "Theory of Recursive Functions and effective computing", Mcgraw-Hill, 1987.
7. J. C. Martin, "Introduction to Languages and Theory of Computation", Tata Mcgraw Hill, 3<sup>rd</sup> Edition, 2007.

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC422***

***COURSE TITLE: NUMERICAL AND STATISTICAL COMPUTING***

### **Course Objectives & Learning Outcomes**

- To demonstrate understanding of numerical and statistical methods in support of the analysis, design and application for problem solving in the field of information technology.
- To compute solution of algebraic and transcendental equation by numerical methods like Bisection method and Newton Raphson method.
- To apply method of interpolation and extrapolation for prediction.
- To recognize elements and variable in statistics and summarize qualitative and quantitative data.

### **UNIT-I Solutions of Equations**

Iterative Methods: Zeros of a single transcendental equation; Newton-Raphson Methods, Rate of Convergence of NR method; Polynomial Evaluation; Birge vieta Methods.

Solutions of Simultaneous Linear equations–Gauss elimination method and pivoting, III conditioned equations and refinement of solutions; Gauss–Seidal interactive Method, Gauss-Jacobi method.

10 HOURS

### **UNIT-II Numerical differentiation and Integration**

Numerical differentiation and Integration, Solutions of Differential Equations; Modified Euler's Method, Runge-Kuta method (2<sup>nd</sup> and 4<sup>th</sup>); Automatic error monitoring, Numerical Integration Newton's cotes of Integration. Trapezoidal rule, Simpson's 1/3rd and 3/8th rule.

10 HOURS

### **UNIT-III Basics of Statistics and Interpolation**

Basic Statistics: Measures of central tendencies:-Mean, Median, Mode; Measures of dispersion: Range variance and standard deviation; Frequency distribution and cumulative frequency distributions; Linear correlation coefficient; Linear regression; Non-linear regression.

Interpolation: - Newton's Forward, Backward & Langrange's interpolation.

10 HOURS

### **UNIT-IV Probability**

Discrete Probability Distributions: Binomial (Derivation, mean and variance and fitting of Binomial distribution), Poisson (Poisson as a limiting case of Binomial distribution, mean and variance and fitting of Poisson distribution).

Normal distribution, mean and variance of normal distribution. Student's T- test.

10 HOURS

### **UNIT-V Statistical and Sampling Theory**

Concept of Population, Sample; Importance of Sampling and its advantages, Sampling distributions (mean, standard deviation and probability distribution).

Statistical decisions, hypothesis testing, type-1 and type-2 errors, level of significance, one tailed and two tailed tests. Comparison sample means (analysis of variance, ANOVA-one way);

Chi-square testing (test of independence, testing of goodness of fit, population variance).

10 HOURS

### **MCA-FOURTH SEMESTER**

**Contd.**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC422***

***COURSE TITLE: NUMERICAL AND STATISTICAL COMPUTING***

#### **SUGGESTED READINGS:**

1. Stoer, Bullrich, "Computer Oriented Numerical Methods, Springer Verlag", 2nd Edition, 1980.
2. S. D. Conte & Carl De Boor, "Elementary Numerical Analysis, Macgraw hill", 3rd Edition, 1980.
3. Krishnamurthy, "E. V., Sen, S. K.: Computer Based Numerical Algorithm", East West Press, 2nd Edition, 1984.
4. Rajaraman, V., "Computer Oriented Numerical Methods, Prentice Hall India", 3rd Edition, 1993.
5. Draper, N. A., Smith, H, "Applied Regresion Analysis", John-Wiley and Sons, 3rd Edition, 1998.
6. Anderson, T. W, "An Introduction to Multivariate Statistical Analysis", John-Wiley and Sons, 3rd Edition, 2009.
7. Morrison, D. F., "Multivariate Statistical Methods", McGraw-Hill, 2nd Edition, 1978.

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##### **SECTION B:**

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##### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC423***

***COURSE TITLE: SOFTWARE ENGINEERING***

### **Course Objectives & Learning Outcomes:**

- To gain knowledge of basic SW engineering methods and their appropriate application.
- To understand software testing approaches such as unit testing and integration testing.
- To produce efficient, reliable, robust and cost-effective software solutions.
- Students will be able to perform independent research and analysis.
- Students will be able to analyze, design, verify, validate, implement, apply, and maintain software systems.

### **UNIT-I Introduction**

Evolution of Software Engineering, Software Engineering: A layered technology, process frame work and software engineering paradigms, Software process technology, Software Requirements Analysis, Analysis Principles, Modeling the system architecture, Software prototyping and specification.

10 HOURS

### **UNIT-II Software Design**

Design Process, Concepts, Principles, Architectural Design, Data Design, Mapping requirements into Software Architecture, Effective modular design, Procedural Design, Interface design, HCI design.

10 HOURS

### **UNIT-III Software Quality Planning and Project Management**

Evaluation of individual projects: Technical assessment, cost-benefit analysis (Evaluation Techniques), and Risk evaluation, Concept of Software Project Management and its importance, software cost estimation techniques, different types of project metrics, Models for cost estimation (COCOMO, Putnam's, function point), Introduction to project scheduling, project schedules, project and activities, scheduling activities, Schedule development methods (Critical Path Method, Critical Chain Scheduling, PERT).

10 HOURS

### **UNIT-IV Software Quality Assurance**

Introduction, Quality Planning, Quality Assurance, Quality Control, Tools and Techniques of Quality Control, Pareto analysis, Six Sigma, Cost of Quality, software quality metrics (McCal's Quality Model, Boehm's Quality Model, Dromey's Quality Model), Capability maturity models.

10 HOURS

### **UNIT-V Software Testing and Maintenance**

Testing Issues, Testing Object-Oriented Systems, Testing Techniques: White Box Testing, Black-Box Testing, Testing Strategies: Unit Testing, Integration and Validation testing, System Testing, Introduction to maintenance, characteristics, maintenance task, Reverse Engineering, Re-engineering, Clean room Software engineering.

10 HOURS

## **MCA-FOURTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC423***

***COURSE TITLE: SOFTWARE ENGINEERING***

### **SUGGESTED READINGS:**

1. Roger, S. Pressman, "Software Engineering: A practitioner's Approach", McGraw Hill, 5<sup>th</sup> Edition.
2. Walker Royce, "Software Project Management", Pearson Education, 2004.
3. Pankaj Jatlore, "An Integrated Approach to Software Engineering", Narosa Publication, 3<sup>rd</sup> Edition.
4. Shari Lawrence, PF Legger, "Software Engineering Theory and Practice", Pearson Education, 2<sup>nd</sup> Edition.
5. R. E. Fairley, "Software Engineering Concepts", McGraw Hill.
6. Ian Sommerville, "Software Engineering", Pearson Education.
7. Robert S. Arnold, "Software Re-engineering", IEEE Comp. Society, 2003.
8. Lorenz and Kidd, "Object Oriented Software Metrics", Prentice Hall.
9. Booch, "Object-Oriented Analysis and Design with Applications", Addison-Wesley, 3<sup>rd</sup> Edition, 2007.

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

-X-

## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE425***

***COURSE TITLE: PYTHON***

### **Course Objectives & Learning Outcomes:**

- To understand the basic and advanced features of core language built-ins.
- To implement various packages of python library.
- To communicate using sockets, write client and server side scripts.
- To design and implement basic applications with database connectivity.
- Students will gain basic and advanced programming concepts of Python.

### **UNIT-I Introduction**

Installing and working with python, Data Types: Identifiers and keywords, integral types, floating-point types, strings, Sequence types: Tuples, Named tuples, lists, Set Types: Sets, Frozen sets, Mapping types: dictionaries, iterating and copying collections. Control structures: conditional branching, looping, Exception handling: catching and raising exceptions, custom exceptions, custom functions: names and docstring, argument and parameter unpacking.

10 HOURS

### **UNIT-II Modules and Packages**

Modules and packages, Overview of python standard library, Classes in python, inheritance, odds and ends, iterators, generators, generator expression.

10 HOURS

### **UNIT-III File Handling and Database programming**

Writing and Reading Binary Data, Writing and Parsing Text Files, Writing and Parsing XML Files, Random Access Binary Files, DBM data bases, SQL databases.

10 HOURS

### **UNIT-IV Networking and Web programming**

Sockets introduction, Creating a socket, using a socket, disconnecting, non-blocking sockets, CGI, Server client program using CGI, mod\_python, FastCGI and SCGI, mod\_wsgi, WSGI, MVC, Templates, Data persistence, Frameworks-Django, Turbogears, Zope, etc.

10 HOURS

### **UNIT-V Python Django Framework**

Introduction to Django Web Framework, features of Django, Installing Django, MVC model, HTTP concepts, Views, URL Mapping, Creating Template Objects, Form validation and Error Messages, Form Display, Django Models, Model Fields, Model Inheritance, CRUD on DB, Session and Caching, Dynamic Webpages, Toggle Hidden Content.

10 HOURS

## **MCA-FOURTH SEMESTER**

*Contd.*

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE425***

***COURSE TITLE: PYTHON***

### **SUGGESTED READINGS:**

1. Mark Summerfield, "Programming in python 3: A Complete Introduction to Python Programming".
2. Mark Lutz, "Learning Python", O Reily, 4th Edition, 2009.
3. Brian K. Jones, "Python Cookbook".
4. Alex Martelli, "Python in a nutshell".
5. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", 2009.
6. Python online documentation: [www.python.org/doc](http://www.python.org/doc).

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#### **SECTION B:**

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#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE426***

***COURSE TITLE: BIG DATA ANALYTICS USING R***

### **Course Objectives& Learning Outcomes**

- To know the fundamental concepts of big data and analytics.
- To explore tools and practices for working with big data.
- To know about the research that requires the integration of large amounts of data.
- To work with big data tools and its analysis techniques.
- To analyze data by utilizing clustering and classification algorithms.

### **UNIT-I Introduction to Big Data**

Evolution of Big data–Best Practices for Big data Analytics–Big data characteristics–Validating–The Promotion of the Value of Big Data–Big Data Use Cases- Characteristics of Big Data Applications– Perception and Quantification of Value -Understanding Big Data Storage–A General Overview of High-Performance Architecture–HDFS–MapReduce and YARN–Map Reduce Programming Model.

10 HOURS

### **UNIT-II Clustering and Classification**

Advanced Analytical Theory and Methods: Overview of Clustering–K-means–Use Cases–Overview of the Method–Determining the Number of Clusters–Diagnostics–Reasons to Choose and Cautions.-Classification: Decision Trees–Overview of a Decision Tree–The General Algorithm–Decision Tree Algorithms–Evaluating a Decision Tree–Decision Trees in R–Naïve Bayes–Bayes' Theorem–Naïve Bayes Classifier.

10 HOURS

### **UNIT-III Association and Recommendation System**

Advanced Analytical Theory and Methods: Association Rules–Overview–Apriori Algorithm–Evaluation of Candidate Rules–Applications of Association Rules–Finding Association& finding similarity– Recommendation System: Collaborative Recommendation- Content Based Recommendation–Knowledge Based Recommendation- Hybrid Recommendation Approaches.

10 HOURS

### **UNIT-IV Stream Theory**

Introduction to Streams Concepts–Stream Data Model and Architecture–Stream Computing, Sampling Data in a Stream–Filtering Streams–Counting Distinct Elements in a Stream–Estimating moments–Counting oneness in a Window–Decaying Window–Real time Analytics Platform(RTAP) applications–Case Studies– Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics.

10 HOURS

### **UNIT-V NOSQL Data Management for Big Data and Visualization**

NoSQL Databases: Schema-less Models|: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores–Tabular Stores–Object Data Stores–Graph Databases Hive–Sharding – Hbase–Analyzing big data with twitter–Big data for E-Commerce Big data for blogs–Review of Basic Data Analytic Methods using R.

10 HOURS

## **MCA-FOURTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE426***

***COURSE TITLE: BIG DATA ANALYTICS USING R***

**Tools and Platforms: Hadoop**

### **SUGGESTED READINGS:**

1. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
2. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/El sevier Publishers, 2013.
3. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.
4. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.
5. Dietmar Jannach and Markus Zanker, “Recommender Systems: An Introduction”, Cambridge University Press, 2010.
6. Kim H. Pries and Robert Dunnigan, “Big Data Analytics: A Practical Guide for Managers” CRC Press, 2015.
7. Jimmy Lin and Chris Dyer, “Data-Intensive Text Processing with Map Reduce”, Synthesis Lectures on Human Language Technologies, Vol. 3, No. 1, Pages 1-177, Morgan Claypool publishers, 2010.

### **NOTE FOR PAPER SETTERS**

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There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

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## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE427***

***COURSE TITLE: MACHINE LEARNING***

### **Course Objectives & Learning Outcomes:**

- To introduce students to state-of-the-art methods and modern programming tools for data analysis.
- To understand complexity of Machine Learning algorithms and their limitations.
- To understand modern notions in data analysis oriented computing.
- Student will be able of performing experiments in Machine Learning using real-world data.
- Student will be able to identify algorithmic aspects in machine learning and data mining tasks, evaluate correctness and efficiency of the used methods, and their applicability in each current situation.

### **Unit-I Machine Learning Basics**

Introduction to Machine Learning, Types of machine Learning: supervised, unsupervised, semi supervised and reinforcement learning, Steps in the design of learning system, Training and testing, Cross Validation, Performance prediction parameters, Applications of machine learning.

10 HOURS

### **Unit-II Supervised Learning**

Labelled data, Classification and its algorithms: Nearest Neighbour, Naive-Bayes classifier, Decision trees, Linear regression, Logistic regression, Support vector machines, Principal component analysis.

10 HOURS

### **Unit-III Unsupervised Learning**

Unlabelled data, Clustering and its types, Partition clustering, Hierarchical Clustering, Fuzzy clustering, Density based clustering, Model based clustering, K-means clustering, Applications of Clustering.

10 HOURS

### **Unit-IV Artificial Neural Networks & Fuzzy Logic**

Basic structure of ANNs, Activation functions, Learning Rules, Types of ANN: feed forward and feedback, applications of neural networks.

Fuzzy Logic: Introduction, Membership function, Operations on fuzzy Sets, Applications of fuzzy logic.

10 HOURS

### **Unit-V Reinforcement and Semi-supervised Learning**

Introduction, Q learning, Temporal Difference Learning, Learning from Examples, Reward Hypothesis.

Genetic algorithm: Introduction, Steps involved in genetic algorithm, Applications of genetic algorithm.

Introduction to Deep learning concepts.

**Tools and Platforms:** Introduction to WEKA and PYTHON.

10 HOURS

## **MCA-FOURTH SEMESTER**

*Contd.*

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE427***

***COURSE TITLE: MACHINE LEARNING***

### **SUGGESTED READINGS:**

1. Machine Learning, "A Probabilistic Perspective", MIT Press, 2012 by Kevin Murphy.
2. Christopher M. Bishop , "Pattern Recognition and Machine Learning", Springer, 2006.
3. Shai Shalev-Shwartz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms".
4. Haykin, S. "Neural Networks and Learning Machines. Prentice Hall." New York (2008).
5. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", John Wiley & Sons, 2010.
6. Montgomery, D. C., and G. C. Runger, "Applied Statistics and Probability for Engineers", John Wiley & Sons, Sixth Edition, 2013.
7. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.
8. NPTEL lectures on Introduction to Machine Learning.

### **NOTE FOR PAPER SETTERS**

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#### **SECTION C:**

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-X-

## **MCA-FOURTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE428***

***COURSE TITLE: INTERNET OF THINGS***

### **Course Objectives & Learning Outcomes**

- To understand the basics of Internet of Things (IoT) and its application sectors.
- Understand M2M and Internet of Things.
- Understand and become proficient in Internet of Things platforms.
- Understand and apply Internet of Things T protocols appropriately.
- Design and develop Internet of Things based applications.

### **UNIT-I Introduction and Concepts of IOT**

Introduction to IOT, definition and characteristics of IOT, Architecture of Internet of Things, Physical and logical design of IOT, IOT enabling technologies, IOT levels and deployment templates, Domain specific IOTs, home automation, cities, environment, Domain specific IOTs, Energy, retail, agriculture, industry, health and lifestyle

10 HOURS

### **UNIT-II IOT and M2M Communication**

M2M, difference between IOT and M2M, ETSI M2M Architecture, system architecture, ETSI M2M SCL resource structure, Security in ETSI M2M framework, SDN and NFV for IOT, IOT system management, need for IOT system management, SNMP, Network operator requirements, NETCONF-YANG, IOT system management with NETCONF-YANG, IoT Design methodology-case study on IOT system for Weather Monitoring.

10 HOURS

### **UNIT-III IOT Platforms**

Introduction to Hardware used for IoT: Microcontrollers, Microprocessors, SoC, Sensors 2 C, I 3 1 8. Introduction to Arduino, Pi, Spark, Intel Galileo etc.

10 HOURS

### **UNIT-IV IOT Technical Standards and Protocols**

RF Protocols: RFID, NFC; IEEE 802. 15. 4: ZigBee, Z-WAVE, THREAD; Bluetooth Low Energy (BLE), IPv6 for Low Power and Lossy Networks (6LoWPAN) and Routing Protocol for Low power and lossy networks (RPL), CoAP, XMPP, Web Socket, AMQP, MQTT, WebRTC, PuSH, Architectural Considerations in Smart Object Networking.

10 HOURS

### **UNIT-V Developing Internet of Things**

IoT platforms design methodology, IoT Physical devices and endpoints, IoT Systems: Logical design using Python, IoT physical servers and cloud offerings (Cloud computing for IoT).

10 HOURS

## **MCA-FOURTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE428***

***COURSE TITLE: INTERNET OF THINGS***

### **SUGGESTED READINGS:**

1. Arshdeep Bahga, Vijay Madiseti, “Internet of Things, A Hands-on Approach”, University Press, First Edition 2015.
2. Oliver Hersent, David Boswarthick, Omar Elloumy, “The Internet of Things”, First Edition, 2015.
3. Michael Miller, “The Internet of Things, How Smart TVs, Smart Cars, Smart Homes, and Smart Cities are changing the World”, Pearson, First edition, 2015.
4. <https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects>.

### **NOTE FOR PAPER SETTERS**

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**MCA-FOURTH SEMESTER**

Total Marks = 150

No. of Credits = 6

Examination to be held: May 2020, 2021, 2022

Internal Evaluation = 75 Marks

External Evaluation = 75 Marks

***COURSE NO: PSCALC490***

***PRACTICAL***

Practical will be based on Numerical & Statistical Methods and Python/R.

-x-

## **OPEN COURSE SYLLABUS**

### **In 4<sup>th</sup> Semester:**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCAT0451***

***COURSE TITLE: OBJECT ORIENTED CONCEPTS USING C++***

### **Course Objectives & Learning Outcomes:**

- To learn advanced features of the C++ programming language as a continuation of the previous course.
- To learn the characteristics of an object-oriented programming language: data abstraction and information hiding, inheritance, and dynamic binding of the messages to the methods.
- Students will be able to use the characteristics of an object-oriented programming language in a program.
- Students will be able to use the basic object-oriented design principles in computer problem solving.

### **Unit–I The Object Oriented Methodology and C++ basics**

Paradigms of Programming Languages, Evolution of OO Methodology, Basic Concepts of OO Approach, Comparison of Object Oriented and Procedure Oriented Approaches, Benefits of OOPs, Introduction to Common OO Language, Applications of OOPs, Object-based programming languages.

Abstraction, Encapsulation, Inheritance, Polymorphism, Difference between C and C++. Basic program construction, working with variables and const qualifiers.

10 HOURS

### **Unit–II Programming Constructs**

Input output statements: cin, cout, comments, escape sequence, manipulators, type conversion, operators, and library functions.

Control statements, Structures, Enumeration, Functions, passing arguments to functions, reference arguments, overloaded functions, inline functions, default arguments, variables and storage class and returning by reference, Arrays and Strings.

10 HOURS

### **Unit–III Classes & Operator Overloading**

Objects and Classes, defining class, c++ objects as physical objects, c++ objects and data types, object as function argument, constructors, as function argument, overloaded constructors, copy constructors, returning objects from functions, this pointer, structures and classes, static class data, static functions, friend functions, const and classes, array of objects.

Overloading unary and binary operator, Data conversions (built-in & user defined data types).

10 HOURS

### **Unit–IV Inheritance & Virtual Functions**

Inheritance concept, derived class and base class, derived class constructors, overloading member functions, class hierarchies, public, private & protected inheritance, levels of inheritance, multiple inheritance, Virtual Inheritance, new and delete operator.

Early & late binding, Virtual functions.

10 HOURS

**OPEN COURSE SYLLABUS**

**In 4<sup>th</sup> Semester:**

*Contd.*

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: May 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCAT0451***

***COURSE TITLE: OBJECT ORIENTED CONCEPTS USING C++***

**Unit–V Files I/O & Generic Programming**

File Input/Output & Exception Handling: Using istream/ostream member functions, Understanding implementation of Files, Writing and Reading Objects. Understanding of working and implementation of Exception Handling.

Understanding Generic Functions with implementation of searching sorting algorithm. Understanding Class Templates using Implementation of Generic stack, linked lists, Understanding Components of Standard Template Library, Working of STL Elements.

10 HOURS

**SUGGESTED READINGS:**

1. Bjarne Stroustrup, “The C++ Programming Language”, 3<sup>rd</sup> edition, Addison Wesley.
2. Herbert Schildt, “C++ The Complete Reference”, McGraw Hill.
3. Robert Lafore, “Object Oriented Programming in C++”, Galgotia publ.
4. E. Balagursamy, “Object Oriented Programming using C ++”, Tata McGraw Hill.
5. D. Ravichandran, “Programming with C++”, Tata McGraw Hill.
6. Scott Meyers, “Effective C++: 50 Specific Ways to Improve Your Programs and Designs”, Addison Wesley.
7. S. B. Lippman and J. Lajoie, “C++ Primer”, 3<sup>rd</sup> edition, Addison Wesley.
8. Bruce Eckel, “Thinking in C++”, President, Mindview Inc., Prentice Hall, 2<sup>nd</sup> edition.

**NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

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**SECTION B:**

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**SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## **MCA-FIFTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC504***

***COURSE TITLE: ARTIFICIAL INTELLIGENCE***

### **Course Objectives & Learning Outcomes**

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
- To use different machine learning techniques to design AI machine and enveloping applications for real world problems.

### **UNIT-I Introduction**

Introduction to AI: History of AI, Basic Elements of AI, Introduction to Turing Machine, Turing Test and Rational Agent Approaches; State Space Representation of Problems, Game Playing, Min-Max Search, Alpha Beta Cutoff Procedures.

Introduction to Expert system, Expert System Life Cycle, Study of existing expert systems like MYCIN and DENDRAL.

10 HOURS

### **UNIT-II Searching Techniques**

Heuristic Search techniques-Hill Climbing, Best first search: OR graph, A\* algorithm, Problem Reduction: AND-OR graph,

The AO\* Algorithm. Constraint satisfaction: Introduction and algorithm.

10 HOURS

### **UNIT-III Knowledge Representation**

Knowledge Representation Structures: Propositional Logic, First Order Predicate Logic, CNF, DNF, Prenex Normal Form, Resolution, Unification, Inference Mechanisms Semantic Nets, Frames, Scripts, conceptual dependences, Procedural & Declarative knowledge, Reasoning, Uncertainty.

10 HOURS

### **UNIT-IV Multi Agent Systems and Genetic Algorithms**

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

10 HOURS

### **UNIT-V Understanding Natural Languages**

Understanding Natural Languages: Parsing techniques, context free and transformational grammars, transition nets, augmented transition nets, Fillmore's grammar; grammar-free analyzers, sentence generation.

10 HOURS

**MCA-FIFTH SEMESTER**

*Contd.*

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC504***

***COURSE TITLE: ARTIFICIAL INTELLIGENCE***

**SUGGESTED READINGS:**

1. Kevin Knight, Elaine Rich, B. Nair, "Artificial Intelligence", McGraw Hill Education.
2. Charniak, E., "Introduction of Artificial Intelligence", Narosa Publishing House.
3. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2<sup>nd</sup> Edition.
4. George F. Luger, "Artificial Intelligence", Pearson Education.
5. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI.
6. Barrat, James, "Our final invention: Artificial intelligence and the end of the human era", Macmillan, 2013.

**NOTE FOR PAPER SETTERS**

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## MCA-FIFTH SEMESTER

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC511***

***COURSE TITLE: PRINCIPLES OF COMPILER DESIGN***

### Course Objectives & Learning Outcomes:

- To introduce principal structure of compiler, basic theories and methods used for different parts of compiler.
- To impart knowledge of fundamentals of language translator, structure of a typical compiler, parsing methods etc.
- To design various phases of compiler such as Lexical analyzer, parser etc.
- To distinguish different optimization techniques in the design of compiler.
- Students will be able to design and develop a comprehensive Compiler for a given language.

### UNIT-I Compiler Structure & Lexical Analysis

Compiler Structure: Compilers and Translators, Analysis- Synthesis Model of Compilation, Various Phases of Compiler, Pass Structure, Bootstrapping & Compiler Construction Tools.

Lexical Analysis: Interface with input, parser and symbol table, token, lexeme and patterns, difficulties in lexical analysis, Error Reporting, Regular definition, Transition diagrams, LEX.

Capabilities of Lexical Analyzer.

10 HOURS

### UNIT-II Finite Automata

Finite Automata: Nondeterministic Finite Automata, Deterministic Finite Automata, Subset Construction, Thompson's construction, DFA State Minimization.

The Syntactic Specification of Programming Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of CFG.

10 HOURS

### UNIT-III Parsing

Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive Descent Parsers, Predictive Parsers, Non-recursive Predictive Parsers, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers.

YACC, Syntax Directed Definitions, Type checking.

10 HOURS

### UNIT-IV Memory Management & Intermediate Code Generation

Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management.

Error Detection and Recovery: Lexical phase errors, Syntactic phase errors, Semantic errors.

Intermediate Code Generation: Different Intermediate forms: three address code, Quadruples & Triples.

10 HOURS

## **MCA-FIFTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC511***

***COURSE TITLE: PRINCIPLES OF COMPILER DESIGN***

### **UNIT-V Code Optimization & Generation**

Sources of optimization, Local optimization, Loop optimization, Peephole optimization

Issues in the design of Code Generator, Basic Blocks and Flow Graphs, Transformations on Basic Blocks, DAG, Code Generation Algorithm, Register Allocation and Assignment.

10 HOURS

### **SUGGESTED READINGS:**

1. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa Publ. House.
2. A. V. Aho, R. Sethi and J. D Ullman, "Compiler: principle, Techniques and Tools", Addison Wesley.
3. Tremblay and Sorenson: "The theory and Practice of Compiler Writing", McGraw Hill, 1985.
4. London: "Compiler Construction", Thomson Learning.
5. H. I. Holub, "Compiler Design in C", Prentice Hall.
6. Appel, Andrew W., "Modern compiler implementation in C", Cambridge university press, 2004.
7. Louden, Kenneth C, "Compiler construction", Cengage Learning, 1997.

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## **MCA-FIFTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC518***

***COURSE TITLE: .NET Technology & C#***

### **Course Objectives & Learning Outcomes:**

- To develop correct, well-documented programs using the C# programming language; learn to develop object-oriented programs using C# classes and objects; learn to use Windows Forms and WPF to create GUI-based programs.
- To demonstrate how to design, code, compile, and execute business-oriented programs using the C# programming language commands.
- Students will be able to build web applications and validate form data using server-side validation controls
- Students will be able to create dynamic Web applications that interact with a database using server-side programming.

### **UNIT-I .NET Framework & C#**

The. NET Framework: Introduction, Benefits, Components; C# program structure, Creating console application.

C# Language: Introduction, data types, value types, reference types, identifiers, variables, constants, literals, C# operators, expressions, control structures.

10 HOURS

### **UNIT-II C# Fundamentals and Object Oriented Concepts**

Methods, Arrays, Strings, Structures, Enumerations, Generics, Classes and Objects, class and method modifiers, Inheritance, Polymorphism and Interfaces, Properties and Indexers, delegates and Events.

10 HOURS

### **UNIT-III Assemblies, Exceptions, Multithreading and Windows Applications**

Namespaces, assemblies, Microsoft Intermediate Language (MSIL), Metadata, Attributes, Reflection, Exceptions, Multithreading, Building windows Application, working with C# controls, Event Handling, Graphics Device Interface (GDI).

10 HOURS

### **UNIT-IV File Handling and LINQ**

Streams, Types of Stream, Standard I/O Streams – Console, Handling text in files, Dealing with Binary files, Binary Reader and Binary Writer, Serialization / Deserialization, Lambda Expressions, Anonymous Methods, Basic LINQ operations.

10 HOURS

### **UNIT-V ADO.NET and Database Connectivity**

Introduction to ADO. NET, Major Components of ADO. NET, Establishing Database Connections, Connection objects, Command objects, Datasets, Data readers, Querying Databases, Data Grid Views, Data Validation.

10 HOURS

## **MCA-FIFTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATC518***

***COURSE TITLE: .NET Technology & C#***

### **SUGGESTED READINGS:**

1. E Balagurusamy, "Programming in C#", Tata McGraw Hill, 3<sup>rd</sup> edition, 2010.
2. Mark Michaelis, "Essential C# 4. 0", Pearson Education, 3<sup>rd</sup> edition.
3. Ivor Horton, "Beginning Visual C++ 2008", wrox, 2008.
4. Herbert Schildt, "C# 4. 0-The Complete Reference", McGraw Hill Education, 2010.
5. Joseph Albahari& Ben Albahari, "C# 5. 0 in a Nutshell", O'Reilly, 2012.
6. Tim Patrick, "Microsoft ADO. NET 4 step by step", O'Reilly, 2010.
7. Hejlsberg, Anders, Scott Wiltamuth, and Peter Golde, "C# language specification", Addison-Wesley Longman Publishing Co., Inc., 2003.

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## **MCA-FIFTH SEMESTER**

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE516***

***COURSE TITLE: MOBILE TECHNOLOGIES***

### **Course Objectives & Learning Outcomes:**

- To make the student understand the concept of mobile computing paradigm, its novel applications and limitations.
- To understand the typical mobile networking Infrastructure through a popular GSM protocol
- To understand the ad hoc networks and related concepts.
- Students will be able to develop new mobile application.

### **UNIT-I Basic of Mobile Technology & Smart Client**

Mobile Devices -Definition, m-commerce, m-business, component of wireless environment, wireless communication, mobile device classification, Wireless Network -WPANS, WLAN, WWANS (1 G, 2G, 2.5G, 3G).

Introduction to Mobile Communications and Computing, Mobile Computing, novel applications, limitations and architecture;

Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, security in MANETs.

10 HOURS

### **UNIT-II Cellular Concept and Its Initial Implementations**

The cellular concept, Multiple access technologies for cellular systems, Cellular system operation and planning (General principles, System Architecture, Location updating and call setup), Handoff and power control

Initial implementations of the cellular concept: The AMPS system, TACS system, NMT system, NTT system, Concluding remarks.

10 HOURS

### **UNIT-III Digital Cellular Mobile Systems**

Introduction, GSM: The European TDMA digital cellular standard, GSM standardization and service aspects GSM reference architecture and function partitioning, GSM radio aspects, Security aspects, GSM protocol model, Typical call flow sequences in GSM, Evolutionary directions for GSM, Introduction to GPRS, Architecture and Services.

10 Hours

### **Unit-IV Mobile Data Communications and Protocols**

Introduction, Circuit switched data on analog cellular networks, Circuit switched data on digital cellular networks, high speed Circuit switched data in GSM, Packet switched data services on cellular networks, Packet data in analog cellular networks, CDPD (cellular digital packet data), Packet data in digital cellular, Evolution of cellular mobile data capabilities: The EDGE concept, Data over lower power wireless or cordless telecommunication networks, Data services over DECT (Digital enhanced cordless telecommunications), Data services in PACS (Personal Access communications System).

Protocols and Platforms for Mobile Computing: WAP, Bluetooth. XML. J2ME. JavaCard. PaImOS, Windows CE. SymbianOS. Unix for Mobile Devices. Android.

10 HOURS

## **MCA-FIFTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE516***

***COURSE TITLE: MOBILE TECHNOLOGIES***

### **UNIT-V Android Basic & Its components**

Introduction to Android -History of android, The Open Handset Alliance, Android SDK installation, Android SDK & their codenames, Advantages of android, The Android O/S Architecture, Over view of IDE for Android application, AVD, launching and starting AVD (android virtual device) Managing Application Resources -What are resources, resource value types, storing different resource values types (string, string arrays, Boolean, colors, integer, animation, & menus)

Android Application Components- Activities & its life cycle, Services & its life cycle, Broadcast receiver, Content provider, Intents, shutting down component, Android Manifest File in detail, Use of Intent Filter.

10 HOURS

### **SUGGESTED READINGS:**

1. Raj Kamal, "Mobile Computing", Oxford University Press-New Delhi, 2<sup>nd</sup> Edition.
2. Jochen Schiller, "Mobile Communications", Addison-Wesley, 2<sup>nd</sup> Edition, 2004.
3. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002.
4. Reza Behravanfar, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML".
5. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden, Schwiebert, Loren, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill Professional, 2005.
6. Hansmann, Merk, Nicklous, Stober, "Principles of Mobile Computing", Springer, 2<sup>nd</sup> Edition, 2003.
7. Martyn Mallick, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2003.
8. shane conder, Lauren darcey, "Android wireless application development", 2<sup>nd</sup> Edition, Addison – Welsey.
9. Rick rogers, John Lombardo, "Android Application Development", O'Reilly.
10. Reto Meier, "Professional Android 2 application development", Wrox.

### **NOTE FOR PAPER SETTERS**

The question paper shall be divided into three sections namely A, B and C with total weightage of 15, 15 and 30 marks respectively with detail as under:

#### **SECTION A:**

There shall be 10 objective questions distributed uniformly over the entire syllabus. Each question carries 1½ marks and the candidates are required to answer all the questions.

#### **SECTION B:**

There shall be 5 short answer type questions and each shall carry 3 marks. In this section, questions shall be set from each unit and the candidates shall be required to answer all the questions.

#### **SECTION C:**

There shall be 3 long answer type questions each set from Unit –III, IV and V with internal choice. Each question shall carry 10 marks.

## MCA-FIFTH SEMESTER

Total Marks = 100  
No. of Credits = 4  
Time allotted for Major Test= 3 hours  
Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks  
Minor Test II = 20 Marks  
Major Test = 60 marks

***COURSE NO: PSCATE519***

***COURSE TITLE: PHP***

### **Course Objectives & Learning Outcomes:**

- To understand the concepts of PHP and its advantages over other languages.
- To provide students with the skills and knowledge necessary to create dynamic database-driven websites using both PHP.
- To familiarize with PHP built-in functions and creating custom functions.
- To understand how to create sessions, modify and destroy cookies.
- Students will be able to test, debug and develop simple web application using server side PHP programming and Database Connectivity using MySQL.

### **UNIT-I PHP Basics**

Introduction: XAMPP & WAMPP, Configure php. ini, PHP Syntax, data types, variables, Strings, Constants, Operators, Echo / Print, conditional statements, loops, user defined functions  
Arrays, Date and Time, include/ include\_once, require/require\_once;PHP Form ;\$\_GET, \$\_POST, \$\_REQUEST, \$\_DELETE, File Upload.

10 HOURS

### **UNIT-II Session and Cookies**

Session: introduction, Start a PHP session, session variables, modify and destroy session. Logins and passwords: Create a session, use a login to limit access to one or more pages.  
Cookies: Start a PHP Cookies, Cookie variables, modify and destroy Cookie.  
Error handling in PHP: -Displaying errors, warnings, types of errors, error levels in PHP, logging Errors and ignoring errors.

10 HOURS

### **UNIT-III Working with Files and Directories**

File system basics, understanding file permissions, setting file permissions, PHP permissions, accessing files, writing to files, deleting files, moving the file pointer, reading files, examining file details, working with directories, viewing directory content.

10 HOURS

### **UNIT-IV PHP MVC**

Codeigniter: Models, views, controllers, installation, working with Simple Database Pgm file.  
Laravel: Introduction, Installation, Directory Structure, URL Routing, Controller View, Passing Data in View, Print Variable, Build Master Layout, Include a File, Form Handling, Connecting Database, Validation Preserving the Data, File Uploading, Simple Crud Operation(CREATE, READ, UPDATE, DELETE, SEARCH).

10 HOURS

## **MCA-FIFTH SEMESTER**

***Contd.***

Total Marks = 100

No. of Credits = 4

Time allotted for Major Test= 3 hours

Examination to be held: December 2020, 2021, 2022

Minor Test I = 20 Marks

Minor Test II = 20 Marks

Major Test = 60 marks

***COURSE NO: PSCATE519***

***COURSE TITLE: PHP***

### **UNIT-V Patterns and Sending Emails**

Strings & Patterns: quoting, matching, extracting, searching, replacing, formatting, PCRE, NOWDOC, encodings.

Configuring PHP for email, Sending email with mail(), using headers, reviewing SMTP, using PHPMailer.

Security: sanitizing data to prevent SQL Injection, buffer overflow, etc.

10 HOURS

### **SUGGESTED READINGS:**

1. Ratschiller, Tobias, and Till Gerken, “Web application development with PHP 4. 0”, New Riders, 2000.
2. Ware, Brent, “ Open source development with LAMP: using Linux, Apache, MySQL and PHP”, Addison-Wesley Longman Publishing Co., Inc., 2002.
3. Welling, Luke, and Laura Thomson, “PHP and MySQL Web development”, Sams Publishing, 2003.
4. Sklar, David, and Adam Trachtenberg, “PHP cookbook”, O'Reilly Media, Inc., 2006.
5. Popel, Dennis, “Learning PHP Data Objects”, Packt Publishing Ltd, 2007.
6. Lerdorf, Rasmus, Kevin Tatroe, and Peter MacIntyre., “Programming Php”, O'Reilly Media, Inc., 2006.

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#### **SECTION C:**

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**MCA-FIFTH SEMESTER**

Total Marks = 150

No. of Credits = 6

Examination to be held : December 2020, 2021, 2022

Internal Evaluation = 75 Marks

External Evaluation = 75 Marks

***COURSE NO: PSCALC590***

***PRACTICAL***

Practical will be based .NET and PHP/Mobile Technologies.

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**MCA- SIXTH SEMESTER**

***COURSE NO: PSCADC601***

***PROJECT WORK***

No. of Credits = 26

Examination to be held: May 2021, 2022, 2023

The scheme of evaluation regarding Project work shall be as follows:

The project in sixth semester shall carry 650 marks distributed as follows:

| Project Component                               |                    | Marks |
|---|--------------------|-------|
| Mid-Semester Presentation & Internal Evaluation |                    | 250   |
| End-Semester Evaluation                         | Project Evaluation | 250   |
|   | Project Viva-voce  | 150   |
| Total:  |                    | 650   |

The student is required to take up project work of four to six months duration. The student will submit a synopsis at the beginning of the semester for approval from the department. The student will have to present the progress of the work through Mid-Semester Presentation after two months duration. The date of Mid-Semester Presentation will be communicated by the department and will be displayed on the departmental notice board. All the students are required to keep in touch with the respective supervisor allotted by the department. The evaluation of Mid-Semester presentation shall be internal, to be done at the departmental level.

End semester evaluation will be carried by Board of Examiners consisting of Head of the Department, one/two Senior Professors of concerned subject nominated by the Vice-Chancellor and one or more outside expert(s) to be appointed by the Vice-Chancellor out of the panel to be provided by the Head of the Department who shall evaluate/asses final practical performance/dissertation of the students. Majority of the examiners shall form the quorum for the purpose. Each student shall carry out the project in the Department/Other Institution/Organization as approved by the Department under the supervision of a teacher assigned by the Department.

In case a student has failed to submit his project report by the date fixed by the department or his work is found unsatisfactory, he may be asked to take more time to work in such manner as may be decided by the Head. The “I grade” shall be awarded for incomplete Project/ Dissertation work. The result of such students shall be announced separately by the university.

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