

Mount Carmel College Autonomous

Affiliated to Bengaluru City University

58, Palace Road, Bengaluru- 560 052

Regulations, Scheme & Syllabus

For

Master of Computer Applications (MCA)

Choice Based Credit System (CBCS)

Mount Carmel College Autonomous, Bengaluru offers various under graduate and post graduate programmes in Science, Humanities, Commerce and Management disciplines and Application areas. The post graduate **MCA programme** established in the year 2000 affiliated to Bangalore University then, and now affiliated to **Bengaluru Central University (BCU)**, approved by **All India Council for Technical Education (AICTE)** span through **two academic years** with four semesters of four months duration each under **Choice Based Credit System(CBCS)**. Students undertaking the MCA programme at Mount Carmel College are trained to explore and acquire an in-depth understanding of Computer Applications. This programme is designed to foster a culture wherein students' talent is amplified with knowledge, technical training and guidance. Through rigorous evaluation patterns, students are encouraged to deploy their skills and venture into IT sector. The curricular and co- curricular activities are designed to ensure that the students receive a holistic education.

The first semester offers four core courses - three courses are coupled with lab modules and one allied course. The bridge course is also offered to tutor and encourage students from non-technical background. The second and third semesters open avenues for specialization by offering electives. In the fourth semester students are entitled to take up research publication, industry internship project and community development programme.

Program Specific Outcomes (PSOs)

PSO1: Ability to design, develop and test software by applying knowledge of computing techniques, computer applications and project management design principles to meet the automation needs of industry and society.

PSO2: Ability to critically analyze and apply theoretical foundations of computer science in developing optimized solutions to the real world problems.

PSO3: Ability to apply domain knowledge to engage in research activities and also to practice professional ethics, exhibit leadership and social responsibility.

Programme Outcomes (PO)

PO1: Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

PO2: Problem Analysis: Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

PO3: Design/Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PO4: Conduct Investigations of complex computing problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern Tool usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PO6: Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

PO7: Life-long learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8: Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9: Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

PO11: Individual and Team work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

PO12: Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Regulation and Scheme

1. Eligibility: Candidate should have passed **BCA/Bachelor Degree in Computer Science/ Engineering** or equivalent Degree.

OR

Candidate should have passed **B.Sc. /B.Com. /B.A. with Mathematics at 10+2 Level** or at Graduation Level (with additional bridge courses as per the norms of the concerned University).

Candidate should also have obtained at least **50% marks (45% marks** in case of candidates belonging to reserved category) in the qualifying Examination.

2. Duration of the Course: 2 years (4 semesters)

3. Medium of Instruction: English

4. Intake: 45

5. Mode of Admission:

Candidate must appear for Post Graduate Common Entrance Test – **PGCET** as per the schedule notified by Karnataka Examination Authority

OR

Candidate must appear for Karnataka Management Aptitude Test – **KMAT** conducted by Karnataka Post Graduate Private Colleges' Association.

6. Evaluation Procedure for core/elective courses:**a) Continuous Internal Assessment for Theory (CIA): 30 Marks**

| | |
|--|-----------|
| Two Tests - CIA I (Descriptive) CIA II (MCQ) Tests are conducted for 50 marks and scaled down to 10 marks each | 20 |
| Assignments / Projects / Presentations | 10 |
| Total | 30 |

b) End Semester Examination for Theory (ESE): 70 Marks

Question Paper Pattern: The **End Semester Examination (ESE)** shall be conducted at the end of the semester for 70 marks. The question paper shall be set by the examiner (from the list of external examiners approved by BOS) in the **following pattern:**

Section – A: 6 questions of **5** marks each out of which **4** questions to be answered. (Questions 1 – 6).

Section – B: 7 questions of **10** marks each out of which **4** questions and **1 compulsory question 13** to be answered. (Questions 7 – 13)

NOTE: (Compulsory question: A case study or an application oriented question that will cover the concepts taught in the respective paper. The question should aid the students to apply their knowledge acquired during the semester.)

c) Continuous Internal Assessment for Practical (CIA): 15 Marks

| | |
|--|-----------|
| One Test - CIA I | 10 |
| Assignments / Projects / Presentations | 05 |
| Total | 15 |

d) End Semester Examination for Practical (ESE): 35 Marks

Practical Question Pattern: The examiner is requested to give **choice of 3 program questions** from the list of both Part A and Part B programs, out of which the candidate will be required to attempt **compulsorily one program from Part A and one program from Part B.**

e) Pass Criteria: No minimum marks for CIA. To be declared PASS in a semester the candidate must secure:

- **40% in each paper** – both in theory & practical in the ESE **and**
- **Minimum of 40% (ESE + CIA)** for each paper
- Along with a semester average of 50%

7. Evaluation Procedure for Allied courses:

- a) Continuous Internal Assessment (CIA): 15 Marks**
- b) End Semester Examination (ESE): 35 Marks**

Course Matrix

I SEMESTER

| Sem | Course Code | Course Title | No. Of Hours (per week) | | | Total Credits | Marks | | |
|----------|--------------|--------------------------------------|----------------------------|----------|-----------|------------------|------------|------------|----------------|
| | | | L | T | P | | CIA | ESE | Total (100) |
| I | 1MCACC01 | Advanced Database Management Systems | 4 | - | 4 | 6 | 30+15 | 70+35 | 150 |
| | 1MCACC02 | Advanced Operating System | 4 | - | 4 | 6 | 30+15 | 70+35 | 150 |
| | 1MCACC03 | Advanced Web Programming | 3 | - | 4 | 5 | 30+15 | 70+35 | 150 |
| | 1MCACCO4 | Advanced Software Engineering | 3 | 2 | - | 6 | 30+15 | 70+35 | 150 |
| | 1MCAAC01 | Discrete Mathematics | 3 | - | - | 3 | 15 | 35 | 50 |
| | Total | | 17 | 2 | 12 | 24 | 180 | 435 | 650 |
| | 1MCABC01 | Bridge Course (Non Credit) | 3 | - | - | - | 15 | 35 | 50 |

Note: Bridge course is a **non-credit course** offered only in first semester, for non-computer science background students.

L – Lecture

T – Tutorial

P – Practical

CIA – Continuous Internal Assessment

ESE – End Semester Examination

II SEMESTER

| Sem | Course Code | Course Title | No. Of Hours (per week) | | | Total Credits | Marks | | |
|-----------|---|---------------------------|----------------------------|----------|-----------|------------------|-------------|-------------|----------------|
| | | | L | T | P | | CIA (30) | ESE (70) | Total (100) |
| II | 2MCACC01 | Advanced Java Programming | 4 | - | 4 | 6 | 30+15 | 70+35 | 150 |
| | 2MCACC02 | Data and File Structures | 4 | - | 4 | 6 | 30+15 | 70+35 | 150 |
| | 2MCACC03 | Artificial Intelligence | 4 | - | - | 4 | 30 | 70 | 100 |
| | 2MCAAC02 | Research Methodology | 2 | - | - | 2 | 15 | 35 | 50 |
| | 2MCAEC11/ 2MCAEC12/ 2MCAEC13/ 2MCAEC14 | Elective – I | 3 | 2 | - | 4 | 30+15 | 70+35 | 150 |
| | 2MCAP01 | Python Programming Lab | - | - | 4 | 2 | 15 | 35 | 50 |
| | Total | | 17 | 2 | 12 | 24 | 180 | 420 | 600 |

L – Lecture

T – Tutorial

P – Practical

CIA – Continuous Internal Assessment

ESE – End Semester Examination

| Elective I | |
|-------------------|---------------------------------------|
| 2MCAEC11 | Cyber Security |
| 2MCAEC12 | Data Warehousing and Knowledge Mining |
| 2MCAEC13 | Optimization Techniques |
| 2MCAEC14 | Theory of Computation |

III SEMESTER

| Sem | Course Code | Course Title | No. Of Hours (per week) | | | Total Credits | Marks | | |
|--------------|---|--|----------------------------|----------|-----------|------------------|------------|------------|------------|
| | | | L | T | P | | CIA | ESE | Total |
| III | 3MCACC01 | Machine Learning | 4 | - | 4 | 6 | 30+15 | 70+30 | 150 |
| | 3MCACC02 | Advanced Algorithms | 4 | - | - | 4 | 30+15 | 70+30 | 150 |
| | 3MCACC03 | Data Communication and Computer Networks | 3 | 2 | - | 4 | 30+15 | 70+30 | 150 |
| | 3MCAEC21/ 3MCAEC22/ 3MCAEC23/ 3MCAEC24 | Elective II | 3 | - | 4 | 5 | 30+15 | 70+35 | 150 |
| | 3MCAEC31/ 3MCAEC32/ 3MCAEC33/ 3MCAEC34 | Elective III | 3 | - | 4 | 5 | 30+15 | 70+35 | 150 |
| | 3MCAECP32/ 3MCAECP33/ 3MCAECP34 | | | | | | | | |
| | 3MCAOE | Open Elective | 2 | - | - | 2 | 15 | 35 | 50 |
| Total | | | 19 | 2 | 12 | 26 | 210 | 490 | 800 |

L – Lecture

T – Tutorial

P – Practical

CIA – Continuous Internal Assessment

ESE – End Semester Examination

| Elective – II | | Elective - II Lab | |
|----------------|-----------------------------------|--------------------|---------------------------------------|
| 3MCAEC21 | Digital Image Processing | 3MCAECP21 | Digital Image Processing Lab |
| 3MCAEC22 | Internet of Things | 3MCAECP22 | Internet of Things Lab |
| 3MCAEC23 | System Modeling and Simulation | 3MCAECP23 | System Modeling and Simulation Lab |
| 3MCAEC24 | UI Design | 3MCAECP24 | UI Design Lab |
| Elective – III | | Elective - III Lab | |
| 3MCAEC31 | Big Data Analytics | 3MCAECP31 | Big Data Analytics Lab |
| 3MCAEC32 | Mobile Application Development | 3MCAECP32 | Mobile Application Development Lab |
| 3MCAEC33 | NoSQL | 3MCAECP33 | NoSQL Lab |
| 3MCAEC34 | Enterprise Resource Planning | 3MCAECP34 | Open Technologies Lab |

Open Elective

3D Animation using Maya

IV SEMESTER

| Sem | Paper Code | Paper Title | No. Of Hours (per week) | | | Total Credits | Marks | | |
|-----|---|----------------------------------|----------------------------|----------|----------|------------------|------------|------------|------------|
| | | | L | T | P | | CIA | ESE | Total |
| IV | 4MCACC01 | Cloud Computing | 3 | 2 | - | 4 | 30+15 | 70+35 | 100 |
| | 4MCACC02 | Internship Project | - | - | - | 12 | 60 | 140 | 200 |
| | 4MCAEC41/ 4MCAEC42/ 4MCAEC43/ 4MCAEC44 | Elective IV | 3 | - | - | 3 | 30+15 | 70+35 | 100 |
| | 4MCACDP | Community Development Project | | | | 1 | - | 50 | 50 |
| | | Total | 6 | 2 | - | 20 | 120 | 330 | 450 |

L – Lecture

T – Tutorial

P – Practical

CIA – Continuous Internal Assessment

ESE – End Semester Examination

| Elective – IV | |
|---------------|---------------------------|
| 4MCAEC41 | Software Defined Networks |
| 4MCAEC42 | Storage Area Networks |
| 4MCAEC43 | Block Chain Technology |
| 4MCAEC44 | Digital Marketing |

Detailed Syllabus

1MCACC01: ADVANCED DATABASE MANAGEMENT SYSTEMS

Total No. of Hours: 52

Hours per week :L:T:P(4:0:0)

Course Objective: To provide strong foundation of database concepts and develop skills for the design, storage and retrieval in relational databases, XML and No SQL databases.

Course Outcomes:

CO1: Understand the underlying principles of Relational Database Management System.

CO2: Analyze and understand Database storage

CO3: Understand Query processing on XML Data model

CO4: To implement and maintain an efficient database system using emerging tools

| | | |
|-------------------|---|---------------|
| MODULE I | <p>Introduction to Relational Databases: Database system applications, Purpose of database systems, Database Systems versus File Systems, Database Languages, Database Users and Administrators, History of Database Systems. Data Models: Entity-Relationship Model, Relational Model. Database System Architecture: Database System Architectures, Distributed Databases, Parallel Databases.</p> | 10 hrs |
| MODULE II | <p>Relational Databases Language: Data definition in SQL, Queries in SQL, Insert, Delete and Update Statements in SQL, Views in SQL, Specifying General Constraints as Assertions, specifying indexes, Embedded SQL, TSQL. Relational Database Design: First Normal Form, Functional Dependencies, Decomposition, Desirable Properties of Decomposition, Third Normal Form, Fourth Normal Form, Boyce-Codd Normal Form, Fifth Normal Form.</p> | 10 hrs |
| MODULE III | <p>Database Storage: File organization, Organization of records in files, Data Dictionary storage. Indexing and Hashing: Basic Concepts, Ordered Indices, B⁺-Tree Index Files, Static Hashing, Dynamic Hashing. Transaction Processing And Concurrency Control : Definition of Transaction and ACID properties; Concurrency Control Techniques: Lock based Concurrency control -Optimistic Concurrency Control – Time-stamp based Concurrency Control, Deadlock Handling.</p> | 12 hrs |
| MODULE IV | <p>Object-Based Databases: Object-Oriented Databases – Need for complex Data Types, Object-Oriented Data Model, Object-Oriented Languages. Difference between Object-Oriented and Object-Relational Databases. XML Data Model: Structured, Semi-structured, and Unstructured Data, XML Hierarchical Tree Data Model, XML Documents, DTD, and XML Schema, Storing and Extracting XML Documents from Databases - XML Languages, Extracting XML Documents from Relational Databases.</p> | 10 hrs |
| MODULE V | <p>NoSQL: Definition and introduction, Document databases – MongoDB, Storing data and accessing data from MongoDB, Querying MongoDB, Document store internals, MongoDB reliability and durability, Horizontal scaling, CRUD operations in MongoDB, Creating and using indexes in MongoDB.</p> | 10 hrs |

TEXT BOOKS

- [1] Ramez Elmasri, Shamkant B Navathe, “*Fundamentals of Database Systems*”, Addison Wesley, Pearson Education, Seventh Edition. Edition.
(Chapter 1,2,3,5,6,7,8,12,13,14,15,16(16.4,16.5,16.6,16.7,16.8),17(17.1,17.2,17.3),20
21(21.1,21.2),24(24.1,24.3,24.4)

REFERENCE BOOKS

- [2] Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “*Database System Concepts*”, Tata McGraw Hill, Sixth Edition.
[3] Jeffry A Hoffer, Mary B Prescott, Heikki Topi, “*Modern Database management System*”, Pearson Education, Ninth Edition
[4] Kristina Chodorow, MongoDB, “*The definitive Guide*”, O’Reilly, 2nd Edition, 2013

ADVANCED DBMS LAB

Total No. of Hours: 52

Hours per week:L:T:P(0:0:4)

| Sl.No | Exercises |
|-------|---|
| 1 | <p>Create a database and implement the following:</p> <p>a) Data Definition Language Commands, Data Manipulation Language Commands, Data Control Language and Transfer Control Language Commands</p> <p>b) Integrity Constraints</p> <p>c) Demonstrate SQL Built-in functions(Date, Time, Numeric, String & Conversion)</p> <p>d) Retrieving data from multiple tables using joins.</p> <p>e) Sub-Queries.</p> |
| 2 | <p>a) Creation of Views, Synonyms, Sequence and Indexes.</p> <p>b) Implement variables and type declarations using TSQL block.</p> <p>c) Demonstrate Exception Handling</p> |
| 3 | <p>a) Illustration of procedures and functions.</p> <p>b) Creation of database triggers and cursors.</p> |
| 4 | <p>a) Create database using XML attributes and elements.</p> <p>b) Implement queries based on FLOWER expressions and joins using XQuery.</p> <p>c) Implement queries based on Nested queries and sorting of results using XQuery.</p> <p>d) Implement queries based on functions and types using XQuery.</p> |
| 5 | Implement JSON Datatypes |
| 6 | <p>a) Perform CRUD Operations to design Schemas</p> <p>b) Stack, merge, Strsplit functions and implementation</p> <p>c) Learn about Data Management using MongoDB</p> |
| 7 | <p>a) MongoDB integration with Java.</p> <p>b) Implementation of Unstructured data like images and videos in MongoDB using Java.</p> |

Scheme of Evaluation

Three Programs from the lab list will be given by the examiner out of which students will be executing any two.

| | |
|----------------------------------|-----------------|
| Writing TWO Programs | 10 Marks |
| Execution of TWO programs | 20 Marks |
| Viva-Voce | 5 Marks |
| Total | 35 Marks |

1MCACC02: ADVANCED OPERATING SYSTEM

Total No. of Hours: 52

Hours per week:L:T:P(4:0:0)

Course Objective: To understand Operating System with UNIX and to map those concepts to the real world entities.

Course Outcomes:

- CO1:** Apply the fundamental concepts of the operating systems for a given problem and discuss its performance issues
- CO2:** Apply graph theory concepts to model OS problem and give valid conclusions.
- CO3:** Analyze the given problem and solve using OS management techniques.
- CO4:** Design algorithms for the given problem & compare its performance with existing ones
- CO5:** Demonstrate the working of basic commands of UNIX environment including file processing.
- CO6:** Demonstrate the usage of different shell commands, variable and AWK filtering to the given problem

| | | |
|-------------------|---|---------------|
| MODULE I | <p>Introduction to Operating Systems: System Structure What operating systems do; Computer System Organization; Computer System Architecture; Operating System Operations; Computing Environments; Operating System Services; System Calls; Types of System Calls; System Programs; Operating System Structure; Virtual Machines; System boot.</p> <p>Overview of Process Concept; Process Scheduling; Operations on Processes; Inter-Process Communication; Multi-Threaded Programming: Overview: Multithreading Models</p> | 12 hrs |
| MODULE II | <p>Process Management Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling, Process Synchronization</p> <p>Synchronization: The Critical Section Problem: Peterson's Solution; Semaphores, Classical Problems of Synchronization.</p> | 8 hrs |
| MODULE III | <p>Deadlocks: System model; Deadlock Characterization, Methods for handling deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from deadlock. Memory Management Memory Management Strategies: Background, Swapping; Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management; Background; Demand Paging; Page Replacement; Allocation of Frames; Thrashing</p> | 12 hrs |
| MODULE IV | <p>The File System: The File, What's in a File name? The Parent-Child Relationship, The HOME Variable: The Home Directory, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames, The Unix File System. The vi Editor: vi Basics, Input Mode, ex Mode and Command Mode.</p> <p>Basic File Attributes: ls options, File Ownership, File Permissions, chmod, Directory Permissions, Changing the File Ownership More File</p> | 12 hrs |

| | | |
|-----------------|---|---------------|
| | Attributes: File Systems and Inodes, Hard Links, Symbolic Links, The Directory, umask, Modification and Access Times, find. The Shell: The Shell's Interpretive Cycle, Shell Offerings, Pattern Matching-The Wild- cards, Escaping and Quoting, Redirection: The Three Standard Files, Two Special Files:/dev/null and /dev/tty, pipes, tee: Creating a Tee, Command Substitution. | |
| MODULE V | The Process: Process Basics, ps: Process Status, System Processes, Mechanism of Process Creation, Internal and External Commands, Running Jobs in Background, Killing Processes with Signals, Job Control, at and batch, cron. Essential Shell Programming: Shell Variables, Environment Variable Shell Scripts, read, Using Command Line Arguments, exit and exit status of command, The Logical Operators, The if Conditional, using test and the Evaluate Expression, The case conditional, expr, while: looping, for looping with a list, set and shift, trap, Debugging Shell Scripts | 08 hrs |

TEXT BOOKS

- [1] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “*Operating Systems Principles*”, 8th Edition, Wiley – India. (Chapter 1.1, 1.2, 1.3; 2.1, 2.3, 2.4,2.5,2.7,2.8,2.11; 3.1, 3.2,3.3,3.4; 4.1,4.2; 5.1,5.2,5.3,5.5; 6.2,6.3,6.5,6.6; 7.1-7; 8.1-6; 9.1,9.2,9.4-6)
- [2] Sumitabha Das, “*UNIX Concepts and Applications*”, 4th Edition, Tata McGraw Hill, 2006. (Chapter 2,6,6,9,16)

REFERENCE BOOKS

- [3] Sumitabha Das, “*UNIX Concepts and Applications*”, 4th Edition, Tata McGraw Hill, 2006.
- [4] Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, “*Operating Systems Principles*”, 8th Edition, Wiley – India.
- [5] Kenneth Rosen ,”*UNIX-The Complete Reference*”,2nd Edition, McGraw-Hill Osborne, 2000.
- [6] Steve Montsugu:” *Using UNIX*”, 2nd Edition, Prentice Hall India, 1999.
- [7] M G Venkateshmurthy ,”*UNIX and Shell Programming*”, Pearson Education Asia, 2005 Behrouz A Forouzan and Richard F Gilberg
- [8] D M Dhamdhere,” *Operating Systems – A Concept Based Approach*”, 2nd Edition, Tata McGraw – Hill, 2002.
- [9] P C P Bhatt, “*Operating Systems*”, 2nd Edition, PHI, 2006.

1MCACP02: UNIX PROGRAMMING LAB**Total No. of Hours: 52****Hours per week:L:T:P(0:0:4)**

| Ex. No | Part – A |
|---------------------------|--|
| <i>Note: Shell Script</i> | |
| 1 | Illustrate general purpose utilities |
| 2 | Illustrate various file manipulation commands |
| 3 | Demonstrate directory manipulation commands |
| 4 | Illustrate various file permissions |
| 5 | Demonstrate <i>grep</i> command |
| 6 | Demonstrate various string manipulation commands |
| 7 | Demonstrate various admin commands for file and disk management |
| 8 | Illustrate various admin commands used in networks |
| Part – B | |
| 9 | Unix commands using system calls: <i>cat. ls. Mv</i> |
| 10 | Demonstrate the following file/directory manipulation a) File type b) Number of links c) Time of last access d) Read, write, and execute permission |
| 11 | Illustrate the creation of a child process using fork system call |
| 12 | Demonstrate copying a file into another using system calls |
| 13 | Illustrate how to execute two commands concurrently with a command pipe |
| 14 | Illustrate communication between two unrelated processes using named pipe(FIFO file) |
| 15 | Demonstrate inter process communication using shared memory system calls |
| 16 | Demonstrate file locking using semaphores |
| 17 | Demonstrate the creation of zombie process |
| 18 | Illustrate suspending and resuming processes using signals |
| 19 | Demonstrate the following: a) Creating message queue. b) Writing to a message queue. c) Reading from a message queue |
| 20 | Illustrate connection-oriented communication between server and client process using Internet domain socket |

Scheme of Evaluation

Three Programs from the lab list will be given by the examiner out of which students will be executing any two.

| | |
|----------------------------------|-----------------|
| Writing TWO Programs | 10 Marks |
| Execution of TWO programs | 20 Marks |
| Viva-Voce | 5 Marks |
| Total | 35 Marks |

1MCACC03: ADVANCED WEB PROGRAMMING**Total No. of Hours: 40****Hours per week: L:T:P(3:0:0)**

Course Objective: To understand web development using core technologies for designing and implementation

Course Outcomes:

CO1: Apply the concept and usages of web based programming techniques

CO2: Develop interactive web pages using various web technologies such as Bootstrap, JavaScript and dynamic HTML

CO3: Demonstrate applications of AJAX and JQuery in web designing

CO4: Illustrate the use of PHP for server side applications

CO5: Design and implement user interactive dynamic web based applications

| | | |
|-------------------|--|--------------|
| MODULE I | <p>Web Design principles: Basic Principles involved in developing a web site, Planning Process, Five Golden Rules of web designing.</p> <p>HTML and CSS: Introducing Bootstrap, Working with Layouts – working with containers, Inserting rows and columns to layout, using responsive utility classes, Working with Content – Headings, Paragraphs, Lists, Coding Tables, Forms, Typography, Components – Button, Labels, Checkbox and Radio buttons, Coding Forms, Inline Forms, using Cards for Layout, Adding Breadcrumbs, using Pagination component.</p> | 8 hrs |
| MODULE II | <p>JavaScript: Working with Data types and Variables, Conditional and Looping statements, Arrays.</p> <p>jQuery: Adding jQuery to a page, DOM, Page Elements – Selectors, Filters, Setting and Removing Attributes, Events – Mouse, Document, Form and Keyboard events, jQuery Event concepts, jQuery Effects, Form Validation.</p> <p>Ajax: The Basics, Ajax the Query way – load, get and post, JSON – Accessing JSON data.</p> | 8 hrs |
| MODULE III | <p>AngularJS: Introduction to Angular JS, Directives, Expressions, Controllers, Filters, Services, Events, Forms, Validations.</p> <p>Node.js: Introduction to node.js, Event-driven programming, Node.js Modules, Node.js File Module, Node.js Events</p> <p>Ruby: Background and introduction: Basics – Variables, Operators, Control Statements, Defining classes and methods, Strings, Numbers, Date and Time, Arrays, Hashes, Files and Directories.</p> | 9 hrs |
| MODULE IV | <p>PHP: Introduction – Variables, Constants, Operators and Conditionals, Arrays, Strings, Numbers, Functions, Date and Time, Validating Form Data. Objects –</p> <p>Classes and Objects, Inheritance, Introspection, Dynamic PDF files creation</p> | 8 hrs |

| | | |
|---------------------|--|--------------|
| MODULE V | MySQL: Naming Database Elements, Choosing Column Types and Properties, Accessing MySQL. Using PHP with MySQL: Connecting to MySQL, Executing and Retrieving Query Results, Updating Records with PHP , Paginating Query Results, Making Sortable Displays, Using Cookies and Sessions | 6 hrs |
|---------------------|--|--------------|

TEXT BOOKS

- [1] Matt Lambert, “Learning Bootstrap 4”, Second Edition, Packt Publishing, 2016.(Chapter 1,4,5,6)
- [2] David Sawyer McFarland, “Javascript& jQuery – The Missing Manual”, O Reilly,2011. .(Chapter 1,2,5,6,13)
- [3] Larry Ullman, “PHP and MySQL for Dynamic Web sites”, Fifth Edition, Peachpit Press. .(Chapter 3,4,5,6,7)
- [4] Carlson, Leonard Richardson, “Ruby Cookbook”, O“Reilly Media, 2006.(Chapter 3,4,6,7,8,9)
- [5] Kevin Tatroe, Peter Macintyre and Rasmus Lerdorf, “Programming PHP: Creating Dynamic Web Pages”, O“Reilly, Third Edition. .(Chapter 3,4,5)

REFERENCE BOOKS

- [6]Bruce A. Tate, Curt Hibbs, “Ruby on Rails: Up and Running”, O“Reilly Media, 2006
- [7]Amos Q Haviv “MEAN Web Development” , PACKT Publication,2014
- [8]Jon Duckett, “*Beginning HTML, XHTML, CSS, and JavaScript*”, Wiley Publishing,2010

1MCACP03: ADVANCED WEB PROGRAMMING LAB

Total No. of Hours: 52

Hours per week:L:T:P(0:0:4)

| Ex.No | Part – A |
|-------|---|
| 1 | Bootstrap: Typography |
| 2 | Bootstrap: Tables and Images |
| 3 | Bootstrap: Jumbotron, Alerts |
| 4 | Bootstrap: Buttons, Button Groups, Badges, Progress Bar |
| 5 | Bootstrap: Navbar, Forms and Inputs |
| 6 | Bootstrap: Pagination and Grid System |
| 7 | Javascript: Arrays and operations on arrays |
| 8 | jQuery: Selectors and Filters |
| 9 | jQuery: Events and Effects |
| 10 | jQuery: Form Validation |
| 11 | Illustration of Arrays, String, Numbers in Ruby. |
| 12 | Illustration of Hashes, Date and Time in Ruby. |
| 13 | Illustration of File handling in Ruby. |
| 14 | Demonstration of Exception Handling in Ruby. |
| | Part – B |
| | Domain based Project |

Scheme of Evaluation:

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|---------------|---------------------------------|-----------|
| PART A | Writing ONE programs | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

1MCACC04: ADVANCED SOFTWARE ENGINEERING**Total No. of Hours: 52****Hours per week:L:T:P(3:2:0)****Course Objective:** Equip with knowledge and skills of software development process**Course Outcomes:****CO1:** Understand different software engineering process models and the principle of requirement engineering**CO2:** Understand design engineering and analyze various architectural styles and patterns.**CO3:** Understand component level design and familiarize with quality management and SQA plan**CO4:** Understand and analyze various testing strategies

| | | |
|-------------------|---|---------------|
| MODULE I | <p>Introduction to Software Engineering: Software- Characteristics of software Categories of software, Legacy software-software Myths.</p> <p>Generic View of Process: Software Engineering-A layered technology- process framework-Capability Maturity Model Integration (CMMI)-Product and Process</p> <p>Process Models: The waterfall Model- Incremental Model- Evolutionary Process Model- Specialized process models, Component based Development, The formal Methods Model –Agile process model.</p> <p>Requirements Engineering: Requirement engineering Tasks-Initiating the requirement engineering process- Eliciting requirements- Developing use cases,-building the requirements model - Negotiating requirements- validating requirements.</p> | 10 hrs |
| MODULE II | <p>Design Engineering: The design within the context of Software Engineering-The design process and Design quality- Design concepts – Design Model</p> <p>Architectural Design: Software architecture – Architectural style and Patterns – Architectural Design –Architectural mapping using Data flow, Transform Mapping, Refining Architectural Design</p> | 8 hrs |
| MODULE III | <p>Component Level Design: What` is a component – Designing class based components – Designing conventional components</p> <p>User Interface Design: The golden rules – User Interface Analysis and Design - Interface Analysis User - Interface design steps</p> <p>Quality Management: Software Quality, McCall's Quality Factors, ISO 9126 Quality Factors – Quality concepts – Software Quality Assurance – Software Reviews – Formal Technical reviews – Formal approaches to SQA – Software reliability – The ISO 9000 Quality Standards – SQA plan.</p> | 10 hrs |
| MODULE IV | <p>Testing Strategies: A Strategic approach to software testing – strategic issues – Test strategies for conventional software – Test strategies for Object Oriented software - Validation testing – System testing – The art of Debugging</p> <p>Testing Tactics: Software testing fundamentals - White-box testing - Basic path testing - Control structure testing - Black-box testing – Testing for specialized environments, Architectures, and Applications</p> | 12 hrs |

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| MODULE V | Metrics for Process and Projects: Metrics in the process and project domains - software measurement- Metrics for software quality Estimation: Software project estimation - Decomposition techniques – Empirical estimation models Risk Management: Software risks - Risk identification – Risk projection - Risk Refinement - Risk Mitigation, Monitoring, and Management The RMMM plan. Software Project Management- Introduction, Project management life cycle, Project Evaluation and Programme Management, An overview of Project Planning – Case Study | 12 hrs |
|---------------------|---|---------------|

TEXT BOOKS

- [1] Pressman S Roger, “*Software Engineering A Practitioner’s Approach*”, McGraw Hill, Seventh edition, 2010(Chapters 1, 2, 3, 5, 8, 9, 10, 11, 14, 15, 16, 17, 18, 25, 26, 28)
- [2] Somerville Ian, “*Software Engineering*”, Pearson Education Asia, Ninth edition, 2010 (Chapters 24,26)

REFERENCE BOOKS

- [3] Pankaj Jalote, “*An Integrated Approach to Software Engineering*”, Narosa Publishing House, 2011

ADVANCED SOFTWARE ENGINEERING – TUTORIAL SESSION**Total No. of Hours: 52****Hours per week:L:T:P(0:2:0)**

Choosing a case study draw the following diagrams using Star UML/Rational Rose:

| Ex.No. | Exercise |
|---------------|---|
| 1 | Use case diagram |
| 2 | Class Diagram |
| 3 | Interaction Diagram |
| 4 | State Diagram |
| 5 | Activity Diagram |
| 6 | Consider a working system (e.g. ATM system) and study its specifications and report the various bugs. |
| 7 | Using Selenium IDE, Write a test suite containing minimum 4 test cases |
| 8 | Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects) |
| 9 | Write and test a program to get the number of list items in a list / combo box |
| 10 | Write and test a program to login a specific web page |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

1MCAAC01: DISCRETE MATHEMATICS**Total No. of Hours: 40****Hours per week:L:T:P(3:0:0)**

Course Objective: To equip with mathematical skills for automating, simulating and modeling computer hardware and software systems

Course Outcomes:

CO1: Apply the fundamentals of set theory for the given problem.

CO2: Understand the concept of logical reasoning

CO3: Implement various algorithms using principles of mathematical induction

CO4: Model the given problem by applying the concepts of graph theory.

CO5: Identify and list the different applications of discrete mathematical concepts in computer science.

| | | |
|-------------------|---|---------------|
| MODULE I | Mathematical Logic: Methods of proof-Rules of inference-Valid arguments-Rules of inference for quantified statements. Principle of Mathematical Induction and Recursive Definitions. Basic counting principles-the product rule and the sum rule-Examples to illustrate sum and product rule. The inclusion exclusion principle and examples, Pigeonhole Principle and examples. | 13 hrs |
| MODULE II | Review of set theory concepts-Relations-Representation of Relations- Types of Relations-Relations and Partition-Diagrammatic Representation of partial order relations and posets-Maximal, minimal elements and Lattices-Recurrence relations- Generating function. | 13 hrs |
| MODULE III | Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Representing Graphs and Graph Isomorphism’s – Connectivity – Euler and Hamilton Paths – Shortest Path Problems – Planar Graphs - Graph Coloring-Chromatic Polynomials. Trees and their basic properties-Rooted trees-Sorting-Prefix codes and Weighted trees. | 13 hrs |

TEXT BOOKS

- [1] Ralph P. Grimaldi, B.V. Ramana, “Discrete and Combinational Mathematics”, 5th Edition, Pearson Education.(Chapter 1,5,6,7)
- [2] Swapan Kumar Sarkar, “A Text Book of Discrete Mathematics”, S.Chand.(Chapter 1,2,5,7,8)
- [3] D.S.Malik and M.K.Sen,“Discrete Mathematical Structures”, Thomson.(Chapter 2,3,7,9,11)
- [4] Kenneth H Rosen, “Discrete Mathematics & its Applications”, 6th Edition, McGraw-Hil (Chapter 1,4,5,7,8)
- [5]

REFERENCE BOOKS

- [6] C.L. Liu, “Elements of Discrete mathematics”, Tata McGraw Hill, Second Edition.J. L. Mott,, A
- [7] Kandel and T. P. Baker, “Discrete Mathematics for computer scientists and mathematicians”, Prentice hall of India,Second Edition.
- [8] J. P. Trembly and R. P. Manohar, “Discrete Mathematical Structures with applications to computer science”, McGraw Hill.
- [9] F. Harary, “Graph Theory”, Addition Wesley.

MCABC01: PROGRAMMING AND PROBLEM SOLVING USING C

BRIDGE COURSE

Total No. of Hours: 40

Hours per week:L:T:P(3:0:0)

Course Objective: To acquire problem solving techniques and implement in computer Programming.

Course Outcomes:

CO1: Understand the basic concepts of programming, C compiler and problem solving through C by writing algorithms.

CO2: Familiarize with variables, operators, expressions, input and output statements.

CO3: Learn decision making statement and looping structure.

CO4: Implement programs using Arrays, Pointers Structures, Unions and Functions.

CO5: Implement file concepts and Strings in programs and executing through command prompt.

| | | |
|-------------------|---|---------------|
| MODULE I | <p>Introduction to Programming and Problem Solving: The Problem solving aspect – Top-down design – Implementation of algorithm – program verification – the efficiency of algorithms – The analysis of algorithms.</p> <p>Introduction to C: Compilers and Interpreters –Structure of a C Program – Programming rules – Program execution</p> | 06 hrs |
| MODULE II | <p>The C Declaration: The C character set – Delimiters – C keywords – Identifiers –Constants - Variables – Rules for defining variables – Data types – Declaring variables – Initializing variables – Type conversion</p> <p>Operators and Expressions: Arithmetic, Relational, Logical and Bitwise operators – Priority of operators – comma and conditional operators.</p> <p>Input and Output in C: Formatted Functions – Unformatted functions, Commonly used Library functions.</p> | 06 hrs |
| MODULE III | <p>Decision Statement: the <i>if</i> statement – <i>if...else</i> – Nested if-else statement – break – continue – goto – switch – Nested switch statement.</p> <p>Loop control statement: for loop – Nested for loop – While loop – do-while loop.</p> <p>Arrays: Array definition – initialization of array,Characteristics of array ,1D and 2D array – Multidimensional array.</p> <p>Strings and Standard functions: Declaration and initialization of string string standard functions – applications of strings.</p> | 08 hrs |
| MODULE IV | <p>Functions: Definition of functions – declaration and prototype – return statement – call by value and call by reference – function arguments – Recursion.</p> <p>Pointers: Features of pointers – pointer declaration – arithmetic operations with pointers – pointers and arrays – Pointers to pointers –</p> | 12 hrs |

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|-----------------|--|---------------|
| | Pointers to Strings. Storage class: Automatic variables – External variables – Static variables – Register variables. Structure and Union: Features of structures – declaration and initialization of structures – Nested structure – Array of structures – Pointers to structure – Structure and functions – Bit fields – Union – calling BIOS and DOS service. | |
| MODULE V | Files: Streams and File types – Steps for file operations – File I/O – Structures Read and Write – Other file functions – Errors in reading and Writing files. Command line argument. | 08 hrs |

TEXT BOOKS

- [1] E. Balaguruswamy ,”Object oriented programming with C++”,4th Edition Tata McGraw Hill.

REFERENCE BOOKS

- [2] Herbert Schildt,” C++ The Complete Reference”, 4th Edition, Tata McGraw Hill, 2014.
[3] E Balaguruswamy,”Programming in ANSI C”, 7th Edition, McGraw Hill.
[4] Herbert Schild ,”C The Complete Reference” ,4th Edition, McGraw Hill.

2MCACC01: ADVANCED JAVA PROGRAMMING

Total No. of Hours: 52

Hours per week:L:T:P(4:0:0)

Course Objective: To understand the concept of Servlet, JSP and its services, to create packages and interfaces and build database connection. Also develop EJB application.

Course Outcomes:

- CO1:** Learn the concept of Servlet and its life cycle.
- CO2:** Understand JSP tags and its services.
- CO3:** Learn the methods of building database connection.
- CO4:** Design and develop JSP applications using JSP tags.
- CO5:** Develop Enterprise Java Bean Applications.

| | | |
|-------------------|---|---------------|
| MODULE I | Servlet - Servlet Structure, Servlet packaging, HTML building utilities Lifecycle, Single Thread Model interface, Handling Client Request: Form Data Handling Client Request: HTTP Request Headers. Generating server Response HTTP Status codes, Generating server Response: HTTP Response Headers Handling Cookies, Session Tracking. | 8 hrs |
| MODULE II | Introduction to JSP - Overview of JSP: JSP Technology, Need of JSP, Benefits of JSP, Advantages of JSP, Basic syntax, Invoking java code with JSP scripting elements, creating Template Text, Invoking java code from JSP, Limiting java code in JSP, using JSP expressions, comparing servlets and JSP, writing scriptlets. For example Using Script lets to make parts of JSP conditional, using declarations, declaration example. | 10 hrs |
| MODULE III | Controlling the Structure of generated servlets and Java Beans - Controlling the Structure of generated servlets: The JSP page directive, import attribute session attribute, isElignore attribute, buffer and auto flush attributes, info attribute, error Page and isErrorPage attributes, isThreadSafe Attribute, extends attribute, language attribute, Including files and applets in JSP Pages, using java beans components in JSP documents JAR files, manifest file, Working with Java Beans. Introspection, Customizers, Bean properties: Simple properties, Design Pattern events, creating bound properties, Bean Methods, Bean info class Persistence. | 12 hrs |
| MODULE IV | Annotations and JDBC - Annotations: Built-in Annotations with examples, Custom Annotation. Talking to Database, Immediate Solutions, Essential JDBC program, using prepared Statement Object, Interactive SQL tool. JDBC in Action Result sets, Batch updates, Mapping, Basic JDBC data types, Advanced JDBC data types, immediate solutions. | 10 hrs |

| | | |
|---------------------|--|---------------|
| MODULE V | EJB and Server Side Component Models -Introduction to EJB: The Problem domain, Breakup responsibilities, Code Smart not hard, the Enterprise java bean specification, Components Types. Server Side Component Types: Session Beans, Message Driven Beans, Entity Beans, The Java Persistence Model. Container services: Dependency Injection, Concurrency, Instance pooling n caching, Transactions, security, Timers, Naming and object stores, Interoperability, Life Cycle Callbacks, Interceptors, platform integration. Developing your first EJB, Models: The Stateless Session Bean, the Stateful Session Bean, the Singleton Session Bean, and Message-Driven Beans. EJB and PERSISTENCE. Persistence Entity manager Mapping Persistence objects, Entity Relationships. | 12 hrs |
|---------------------|--|---------------|

TEXT BOOKS

- [1] Marty Hall, Larry Brown, “*Core Servlets and Java Server Pages*”, Volume 1: CoreTechnologies. Second Edition.(Chapter 3,4,5,6,7,8,9,10,11,12,13,14)
- [2] “*Java 6 Programming*”, Black Book, Dreamtech Press, 2012.(Chapter 17,18,19,20,21,22,27,28,29,30)

REFERENCE BOOKS

- [3] Marty Hall, Larry Brown, “*Core Servlets and Java Server Pages*”, Volume 1: CoreTechnologies. Second Edition.
- [4] Andrew LeeRubinger, Bill Burke, “*Developing Enterprise Java Components*”, EnterpriseJavaBeans 3.1.O’reilly.
- [5] Michael Sikora, “*EJB 3 Developer Guide, A practical guide for developers and architects to the Enterprise Java Beans Standard*”, Shroff Publishers & Distributors PVT LTD. July 2008.
- [6] Herbert Schildt, “*Java The Complete Reference*”, 8th Edition. Comprehensive coverage of the Java Language. Tata McGraw-Hill Edition – 2011.

ADVANCED JAVA PROGRAMMING LAB

Total No. of Hours: 52

Hours per week: (0:0:4)

| Ex. No | Part – A |
|----------|---|
| 1 | Write a JAVA Servlet Program to implement a dynamic HTML using Servlet (user name and Password should be accepted using HTML and displayed using a Servlet). |
| 2 | Write a JAVA Servlet Program to Auto Web Page Refresh (Consider a webpage which is displaying Date and time or stock market status. For all such type of pages, you would need to refresh your web page regularly; Java Servlet makes this job easy by providing refresh automatically after a given interval). |
| 3 | Write a JAVA Servlet Program to implement and demonstrate GET and POST methods (Using HTTP Servlet Class). |
| 4 | Write a JAVA Servlet Program using cookies to remember user preferences. |
| 5 | Write a JAVA Servlet program to track Http Session by accepting user name and password using HTML and display the profile page on successful login. |
| 6 | Write a JSP Program which uses jsp:include and jsp:forward action to display a Webpage. |
| Part – B | |
| 7 | Write a JSP Program which uses tag to run a applet |
| 8 | Write a JSP Program to get student information through a HTML and create a JAVA Bean class, populate Bean and display the same information through another JSP |
| 9 | Write a JSP program to implement all the attributes of page directive tag. |
| 10 | Write a JAVA Program to insert data into Student DATA BASE and retrieve info based on particular queries (For example update, delete, search etc...). |
| 11 | Demonstrate an EJB application that demonstrates Session Bean (with appropriate business logic). |
| 12 | Demonstrate an EJB application that demonstrates MDB (with appropriate business logic). |
| 13 | Demonstrate an EJB application that demonstrates persistence (with appropriate business logic). |

Scheme of Evaluation

Three Programs from the lab list will be given by the examiner out of which students will be executing any two.

| | |
|----------------------------------|-----------------|
| Writing TWO Programs | 10 Marks |
| Execution of TWO programs | 20 Marks |
| Viva-Voce | 5 Marks |
| Total | 35 Marks |

2MCACC02: DATA AND FILE STRUCTURES

Total No. of Hours: 52

Hours per week: L:T:P(4:0:0)

Course Objective: To know higher order concepts in data and structuring file using C language.

Course Outcome:

CO1: Determine preferred data structures (Arrays, linked lists, stack, queues, trees, graphs) for a given problem

CO2: Design algorithms for various operations (creation, insertion, deletion and traversal) on data structures

CO3: Explain the applications of data structures

CO4: Understand and apply searching techniques (linear, binary, and hashing)

CO5: Understand & Apply sorting techniques (Insertion sort, Selection sort, Quick sort, Merge Sort, Exchange sort)

CO6: Implement the data structures using a programming language

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction to Abstract Data Types: Data management concepts, Data types – primitive and non-primitive, Abstract data type. Performance analysis and measurement (Best, Average and Worst case analysis and time space tradeoff). Definition and Classification of Data Structures –Operations on Data Structures. | 07 hrs |
| MODULE II | Arrays: Definition, representation of arrays (row-major, column-major), Types of arrays (1D, 2D, multi-dimensional), operations on arrays (insertion, deletion, traversal). Strings - String operations - Character manipulation, String length, Concatenation, Sub string and Pattern Matching. Linked Lists: Definition, Types of Linked List (Singly Linked List, Doubly Linked List, Circularly Linked List), Operations on Linked List (Insertion, Deletion, and Search). Applications of Linked lists. Array and Linked list comparison. | 10 hrs |
| MODULE III | Stack: Definition, Primitive Operations (Push, Pop), Stack- implementation using Linked List. Applications of stacks (Function calls, recursion, infix to postfix expression, evaluation of postfix expression). Queues: Definition, Primitive Operations (Insertion, Deletion), Queue - Implementation Using Linked List, Double Ended Queue, priority queues, Garbage Collection. Applications of queues. | 10 hrs |
| MODULE IV | Trees: Definition of Trees, Binary Tree -Definition with example, Linear and Linked List Representation of Binary Tree, Expression trees. Binary search trees - concept, Operations -Creation, Insertion, Traversals. Height Balanced Trees – AVL trees, Multi way trees, B-trees, operations on B-tree. Graphs: Concepts, representation of graphs, applications of graphs, BFS & DFS traversal, Shortest path algorithm. | 13 hrs |

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|---------------------|--|---------------|
| MODULE V | Searching & Sorting: Linear search, Binary search, and hashed list searches. General sort concepts, external & internal sorting (insertion sort, selection sort, quick sort, merge sort, Exchange sort) Hashing & File Structures: Hashing: The symbol table, Hashing functions, Collision-Resolution techniques. File Structure: Physical Storage Media File Organization, Organization of records into Blocks, Sequential Files, Indexing and Hashing, Primary indices, Secondary indices, index Files, Indexing and Hashing Comparisons. | 12 hrs |
|---------------------|--|---------------|

TEXT BOOKS

- [1] Richard F Gillberg, "Data Structures: A Pseudocode with approach with C " Cengage Learning Second Edition(Chapter 1,2,3,4,6,7,8,9,10,11,12,13)

REFERENCE BOOKS

- [2] Michael J. Folk, Bill Zoellick, Greg Riccardi, "File Structures An Object Oriented Approach with C++", Addison-Wesley, Third edition.
- [3] Horowitz and Sahani, "Fundamentals of data Structures", Galgotia Publication Pvt. Ltd., New Delhi, Second Edition
- [4] Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Addison-Wesley, 2011.
- [5] Ellis Horowitz, Sartaj Sahani, Susan Anderson-Freed, "Fundamentals of Data Structures", Universities Press, Second Edition.
- [6] Robert L. Kruse, Bruce P. Leung, Clovis L. Tondo, "Data Structures and program Design in C", Prentice Hall India, Second Edition.

DATA AND FILE STRUCTURES LAB

Total No. of Hours: 52

Hours per week: (0:0:4)

| Ex. No | Part – A |
|-----------------|--|
| 1 | Implement various operations on singly linked list (Creation, Insertion, Traversal, Deletion) |
| 2 | Implement various operations on Circular linked list (Creation, Insertion, Traversal, Deletion) |
| 3 | Implement stack operations using pointers (push, pop, process) |
| 4 | Implement various operations on queue using pointers (Insertion, Deletion, Process the Queue) |
| 5 | Create a double-ended queue (Deque) with the following operations: (a) insert in the Beginning (b) insert in the end (c) delete from beginning (d) delete from end |
| 6 | Implement sort algorithms (Any two – on rotation) (Insertion sort, Merge sort, Quick sort, Heap sort, Radix sort) |
| 7 | Implement search algorithms - Linear & Binary search |
| 8 | Implement conversion of infix expression to its postfix form |
| 9 | Implement evaluation of postfix expression |
| Part – B | |
| 10 | Implement various operations on Binary trees (Creation, Insertion, Deletion, Process) |
| 11 | Implement Binary tree traversals (Pre-order, In-order, Post-order) |
| 12 | Given a graph G display the adjacency matrix |
| 13 | Implement traversal algorithms Breadth-First- Search/ Depth-First- Search traversal on a graph G |
| 14 | Implement B Tree for a given set of integers and perform operations insert(),search() and display() on the B Tree |
| 15 | Program to store and retrieve student data from file using hashing. Use any collision resolution techniques |

Scheme of Evaluation

Three Programs from the lab list will be given by the examiner out of which students will be executing any two.

| | |
|----------------------------------|-----------------|
| Writing TWO Programs | 10 Marks |
| Execution of TWO programs | 20 Marks |
| Viva-Voce | 5 Marks |
| Total | 35 Marks |

2MCACC03: ARTIFICIAL INTELLIGENCE

Total No. of Hours: 52

Hours per week:L:T:P(4:0:0)

Course Objective: To familiarize students with Artificial Intelligence techniques for building well-engineered and efficient intelligent systems.

Course Outcome:

CO1: Understand the basic principles and applications of Artificial Intelligence

CO2: Solve various problems by applying a suitable search method

CO3: Represent knowledge using various different techniques

CO4: Apply knowledge representation and list the key aspects of planning

| | | |
|-------------------|--|---------------|
| MODULE I | Introduction: What is Artificial Intelligence, what is an AI technique, criteria for success, Problems, problem spaces and search, Production system, Problem characteristics, Hill-climbing, Best-First search, AO algorithm, constraint satisfaction. | 08 hrs |
| MODULE II | Knowledge Representation: Knowledge Representation Issues, Approaches to knowledge Representation, Representing simple facts in logic, computable functions and predicates, Procedural vs declarative knowledge, forward vs Backward Reasoning matching, control knowledge. | 10 hrs |
| MODULE III | Natural language Processing: Natural language Processing, Introduction, overview of linguistics, Grammars and language, Basic Parsing techniques, Semantic analysis and representation, structure, Natural Language generation, Natural Language systems | 10 hrs |
| MODULE IV | Expert systems: Expert systems, Rule-Based system architecture Non-production system Architecture, dealing with uncertainty, knowledge acquisition and validation, knowledge system Building tools. | 12 hrs |
| MODULE V | Pattern Recognition: Pattern Recognition, Recognition and classification process, learning classification Patterns, Recognizing and understanding speech. | 12 hrs |

TEXT BOOKS

- [1] E. Rich and K. Knight, “*Artificial Intelligence*”, Second Edition(Chapter 1,2,3,5,6,7)
- [2] Dan. W. Patterson, “*Introduction to Artificial Intelligence and expert system*”. PHI(Chapter 2,4)

REFERENCE BOOKS

- [3] S. Russell and P. Norvig, “*Artificial Intelligence: A Modern Approach*”, Second Edition Pearson Education
- [4] Eugene Charniak and Drew McDermott, “*Introduction to Artificial Intelligence*”, Second Edition
- [5] Nils J. Nilson, “*Principles of Artificial Intelligence*”, Narosa Publication

2MCAP01: PYTHON PROGRAMMING LAB

Total No. of Hours: 52

Hours per week: (0:0:4)

| Ex. No. | Part – A |
|--|---------------------------------------|
| Programs to demonstrate | |
| 1 | Array, String, List |
| 2 | Tuple, Set, Dictionary |
| 3 | Class and Object & Regular Expression |
| 4 | NumPy: Arrays, Random, Date Time |
| 5 | NumPy: Math, Statistics |
| 6 | Pandas: Data Series |
| 7 | Pandas: Data Frame |
| 8 | Classifier: KNN |
| 9 | Classifier: SVM |
| 10 | Classifier: ANN |
| 11 | Regression |
| 11 | Clustering: k-Means |
| 12 | Clustering: Hierarchical |
| 13 | Clustering: Fuzzy k-Means |
| 14 | Visualization using Matplotlib |
| Part – B | |
| Mini project: Implement a machine learning algorithm for a specific domain. | |

Scheme of Evaluation

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|-----------------|---------------------------------|--------------|
| PART A | Writing ONE programs | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

2MCAAC02: RESEARCH METHODOLOGY**Total No. of Hours: 26****Hours per week:L:T:P(2:0:0)**

Course Objective: To understand the principles, procedures and techniques in planning and carrying out research projects.

Course Outcomes:

CO1: Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.

CO2: Carry out literature survey, to define the problem statement and suggest suitable solution for the given problem.

CO3: Analyze the problem and conduct experimental design with the samplings.

CO4: Perform the data collection from various sources segregate the primary and secondary data

CO5: To understand concepts/section of Copy Right Act /Patent Act /Cyber Law/ Trademark

| | | |
|-------------------|---|--------------|
| MODULE I | Introduction to Research: Meaning , definition, objectives and characteristics of research. Types of research- basic research (fundamental research), applied research, action research, descriptive research, analytical research, evaluation research, historical research, exploratory research, industrial research, development research. | 4 hrs |
| MODULE II | Research Process : Research design, important experimental designs, sample design. Census and sample method; theoretical basis for sampling, methods of sampling, size of sample, merits and limitations of sampling, sampling and non-sampling errors, reliability of sampling. Data and methods of data collection: types of data- primary and secondary data. Primary data collection methods- direct personal investigation, direct oral investigation schedules and questionnaires, interviews and type of interviews. Pre-testing and pilot study. | 6 hrs |
| MODULE III | Measurement and scaling technique: Measurement in research; measurement scales- nominal scale, ordinal scale, interval scale, and ratio scale. Sources of error in measurement. Scaling- meaning, classification basis, important scaling techniques- rating scale, ranking scale, arbitrary scale, sum mated scale | 4 hrs |
| MODULE IV | Intellectual Property Rights: Patenting - definition of patent. Patenting and fundamental research. Product and process patents, Patent infringement, Copyright infringement and Trademarks. Data analysis using Excel: Analysis of quantitative data and effective presentation with tables, graphs etc., Use of Excel for Formulae Function, Charts and Graphs, Table formula, t-test, Anova and Correlation. | 6 hrs |

| | | |
|---------------------|---|--------------|
| MODULE V | Scientific writing: Research resources: reviews, abstracts, books, journal and magazine articles- Exploration and communication; Resources: online and print; Review of latest literature (peer reviewed). Logical format for writing thesis and papers. Essential features of abstract, introduction, review of literature, materials and methods, and discussion. Reference styles. Understanding Plagiarism: definition, unintentional plagiarism and consequences; Collaborative work. | 6 hrs |
|---------------------|---|--------------|

REFERENCE BOOKS

- [1] Holmes, Moody & Dine ,”*Research Methods for the Biosciences*”, Oxford University Press.
- [2] David J. Glass ,”*Experimental Design for Biologists*”, Cold Spring Harbor Laboratory.
- [3] Ruxton & Colegrave ,”*Experimental Design for the Life Sciences*”, Oxford University Press.
- [4] Kothari, C. R(2005),”*Research Methodology*”, New Delhi, Vikas Publication House.
- [5] Matthews “*Successful Scientific writing: A step-by- step Guide for Biomedical Scientists*”, 2nd ed.. Cambridge University Press, 2001..
- [6] Swain AKPC (2008),” *A Textbook Of Research Methodology*”, 1st Edition, Ludhiana, Kalyani Publishers
- [7] Sunder rao and Richardb (2006), “*An introduction to bio statistics, a manual for students in health science*”, 4th edition, New Delhi, Prentice Hall
- [8] Gupta S.P.,Statistical methods, 28th ed. Sultan chand and Co, New Delhi,
- [9] Sinha, S.Cand Dhiman,A.K.(2002) ,”*Research methodology*”” Ess Publication 22 Volumes

2MCAEC11: CYBER SECURITY

Total No. of Hours: 52

Hours per week: L:T:P(3:2:0)

Course Objective: To introduce the concept of Cyber Security and its real time applications.

Course Outcomes:

CO1: Apply IT ACT (Cyber law) to the given case/problem and infer from the given case and analyze the gap if exists.

CO2: Analyze the working of cyber security principles in designing the system.

CO3: Analyze the given problem (cyber-crime, vulnerability, threat), develop a strategy (physical, logical or administrative controls) to mitigate the problem and articulate consequences on Society and National Economy.

CO4: Examine relevant network defence / web application tool to solve given cyber security problem evaluate its suitability.

CO5: Investigate the influence of Block chain technology for the cyber security problem and evaluate its role.

CO6: Evaluate provisions available in Indian cyber law to handle infringement of intellectual property rights that happens on the cyber platform.

| | | |
|-------------------|--|---------------|
| MODULE I | Introduction to Cybercrime and Laws: Introduction, Cybercrime: Definition and Origins of the word, Cyber-crime and information Security Who are Cyber-criminals? Classifications of Cyber-crimes. How Criminal Plan Them – Introduction, How Criminals Plan the Attacks Cybercafe and Cyber-crimes, Bot-nets, Attack Vector, The Indian IT ACT 2000 and amendments. | 12 hrs |
| MODULE II | Tools and Methods used in Cyber-crime : Introduction, Proxy Serve and Anonymizers, Password Cracking, Key loggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack SQLinjection, Buffer Overflow. | 08 hrs |
| MODULE III | Phishing and Identity Theft: Introduction, Phishing – Methods of Phishing, Phishing Techniques, Phishing Toolkits and Spy Phishing. Identity Theft PII, Types of Identity Theft, Techniques of ID Theft. Digital Forensic Science, Need for Computer Cyber forensics and Digital Evidence, Digital Forensics Life Cycle. Exploration and Application. | 12 hrs |
| MODULE IV | Introduction to Intellectual Property Law – The Evolutionary Past - The IPR Tool Kit- Para -Legal Tasks in Intellectual Property Law Ethical obligations in Para Legal Tasks in Intellectual Property Law types of intellectual property rights– Innovations and Inventions, Trad related Intellectual Property Right. | 12 hrs |

| | | |
|---------------------|--|---------------|
| MODULE V | Network Defense tools and block chain technology: Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall Snort: Intrusion Detection System, introduction to block chain technology (definition, tools used for implementation) and its applications. | 08 hrs |
|---------------------|--|---------------|

TEXT BOOKS

- [1] Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and SunitBelpure, Publication Wiley. (Chapters: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.5, 2.6, 2.7, 6.4, 5.2.1, 5.2.2, 5.2.5, 5.3.1, 5.3.2, 5.3.3)
- [2] Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication McGraw Hill. (Chapters: 2, 7, 8,11)

REFERENCE BOOKS

- [3] DebiragE.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
- [4] Marjie T. Britz - Computer Forensics and Cyber Crime: An Introduction - Pearson
- [5] Chwan-Hwa (John) Wu,J. David Irwin - Introduction to Computer Networks and Cyber security - CRC Press
- [6] Bill Nelson, Amelia Phillips, Christopher Steuart - Guide to Computer Forensics and Investigations - Cengage Learning

CYBER SECURITY – TUTORIAL SESSION
Total No. of Hours: 26**Hours per week: L:T:P(0:2:0)**

| Ex.No. | Experiment |
|---------------|---|
| 1 | Study of steps to protect your personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security. |
| 2 | Study the steps to protect a Microsoft Word Document of different version with different operating system. |
| 3 | Write a Java program to perform encryption and decryption using the following algorithms: a) Ceaser Cipher b) Substitution Cipher c) Hill Cipher. |
| 4 | Write a C/JAVA program to implement the DES algorithm. |
| 5 | Write a C/JAVA program to implement RSA Algorithm. |
| 6 | Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (Bob). |
| 7 | Write a C/JAVA program to implement the BlowFish algorithm. |
| 8 | Write a C/JAVA program to implement the Rijndael algorithm. |
| 9 | Study of the features of firewall in providing network security and to set Firewall Security in windows. |
| 10 | Study of Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome) |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

2MCAEC12: DATA WAREHOUSING AND KNOWLEDGE MINING

Total No. of Hours: 52

Hours per week:L:T:P(3:2:0)

Course Objective: To introduce the concept of Data Mining techniques and its applications.

Course Outcomes:

CO1: Understand the concepts of data warehouse and data mining

CO2: Use data preprocessing techniques to build data warehouse

CO3: Analyze transaction databases for association rules.

CO4: Use classification methods and prediction techniques on transaction databases.

CO5: Understand various clustering techniques for categorizing data.

CO6: Understand methods for outlier analysis.

| | | |
|-------------------|---|---------------|
| MODULE I | <p>Data Warehousing and Online Analytical Processing: Basic concepts, Data warehouse Modeling: Data cube and OLAP, Data Warehouse Design and Usage, Data warehouse implementation.</p> <p>Data Preprocessing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.</p> | 12 hrs |
| MODULE II | <p>Data Mining: Introduction, Kinds of Data, Patterns and Technologies, Architecture of Data Mining Systems, Applications, Primitives and Issues in Data Mining.</p> <p>Exploring the Data: Data Objects and Attributes, Data Quality, Statistical Descriptions of Data, Measuring Data Similarity and Dissimilarity, Data Visualization.</p> | 08 hrs |
| MODULE III | <p>Mining Frequent Patterns Associations and correlations: Basic concepts, Frequent Item set Mining Methods, Patterns evaluation Methods.</p> <p>Advanced Pattern Mining: Pattern Mining: A Road Map, Pattern Mining in Multilevel, Multidimensional Space, Constraint Based Frequent Pattern Mining, Mining High-Dimensional Data and Colossal Patterns, Mining Compressed or Approximate Patterns, Pattern Exploration and Application.</p> | 12 hrs |
| MODULE IV | <p>Classification: Basic Concepts, Decision tree induction, Bayes classification Methods, Bayesian Belief Networks, Rule Based Classification, Lazy Learners, Model Evaluation and Selection.</p> <p>Clustering: Clustering Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid Based Methods, Evaluation of Clustering.</p> | 12 hrs |
| MODULE V | <p>Data Mining Trends and Research Frontiers- Mining complex Data types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.</p> <p>Application –Implementation using Data Mining tool.</p> | 08 hrs |

TEXT BOOKS

- [1] Jaiwei Han and Micheline Kamber, “*Data Mining: Concepts and Techniques*”, Morgan Kaufman Publishers, Third Edition, San Francisco, USA 2002.(Chapter 1,2 3,4,6,7,8,9,10,13)

REFERENCE BOOKS

- [2] Pang-Ning Tan, Michael Steinbach, Vipin Kumar, “*Introduction to Data Mining*”, Addison-Wesley, 2006.
- [3] Arun K Pujari, “*Data Mining Techniques*”, University Press 2nd Edition, 2009
- [4] Alex Berson and Stephen J. Smith, “*Data Warehousing, Data Mining & OLAP*”, Tata McGraw – Hill Edition, Tenth Reprint 2007.
- [5] Claudia Imhoff, Nicholas & et al “*Mastering Data Warehouse Design*”, J. Wiley.

DATA WAREHOUSING AND KNOWLEDGE MINING – TUTORIAL SESSION

Total No. of Hours: 26

Hours per week:L:T:P(0:2:0)

| Exercise | Experiment |
|----------|---|
| 1 | Study and working on data interfaces – CSV, Excel, Binary Files |
| 2 | Study of data preprocessing using any datasets. |
| 3 | Demonstrating Data Exploration – Descriptive and Dispersion measures. |
| 4 | Demonstrating Data Visualization |
| 5 | Problem Exercises and Implementation of Apriori Algorithm |
| 6 | Problem Exercises and Implementation of Frequent Pattern Growth Algorithm |
| 7 | Study and implementation of any two Classification algorithm- Naïve Bayes Classifier, Decision trees and Random Forest K-Nearest Neighbor |
| 8 | Study and implementation of any two Clustering algorithm- Partitioning clustering, Hierarchical Clustering, Density-based |
| 9 | Study of Data Mining Trends |
| 10 | Case study exercises on Data Mining application |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

2MCAEC13: OPTIMIZATION TECHNIQUES

Total No. of Hours: 52

Hours per week: L:T:P(3:2:0)

Course Objective: To introduce the concept of Optimization techniques and its applications.

Course Outcomes:

CO1: Model and Use computational techniques to solve problems

CO2: Learn fundamental concepts of Optimization Techniques

CO3: Make the learners aware of the importance of optimizations in real scenarios

CO4: Provide the concepts of various classical and modern methods for constrained and unconstrained problems

CO5: Construct and Analyze networks for optimal cost utilization

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction- Classification of problems, Operation Research mathematical modeling, Mathematical formulation of linear problems, solution using graphical method for LPP, Dynamic programming, Integer programming, a Goal programming- Identifying various problems and its mathematical Formulation | 10 hrs |
| MODULE II | Linear Programming- Introduction, concept of linear programming model, simplex method, Duality theory, dual simplex method, Two phase method. | 10 hrs |
| MODULE III | Transportation & Assignment problem- Introduction to Transportation problem, mathematical model, types of transportation problem, Optimization techniques for transportation problem, methods to find basic solution, Northwest Corner cell method, Least cost cell method, Vogel Approximation method, optimizing the basic feasible solution using U-V method. Assignment Problem - Introduction, zero one programming model for Assignment problems, type of assignment problems. | 10 hrs |
| MODULE IV | Introduction to sequencing problem- problem of sequencing, basic terms in sequencing, processing n-jobs through two machines, processing n jobs through k machines, two jobs through k machines, dynamic programming algorithm | 10 hrs |
| MODULE V | Introduction to Game Theory- minimax, maximum, pure strategies, mixed strategies & expected payoff, solution of $2 \times n$ games, $m \times 2$ games, Introduction to PERT/CPM Network- basic components, network construction, critical path analysis, probability of completing events on schedule. | 12 hrs |

TEXT BOOKS

- [1] Kasana H.S, “*Optimization techniques*”, Springer Verlag.(Chapter 1,2,3,4,5)

REFERENCES BOOKS

- [2] S Srao, “*Optimization technique*”, Willy
[3] Sharma, S.D., *Operations Research*, Kedar Nath& Ram Nath, Meerut, 1996.
[4] Gupta S.C, Kapoor V.K, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi, 1994.
[5] Gupta P.K, Hira and D.S., *Operation Research*, Sultan Chand & Sons, New Delhi, 1994.

OPTIMIZATION TECHNIQUES-TUTORIAL SESSION

Total No. of Hours: 52

Hours per week:L:T:P(0:2:0)

| Sl. No. | Problem |
|---------|---|
| 1 | Numerical methods of Optimization a) Linear programming b) Quadratic programming c) Nonlinear programming d) Dynamic programming e) Combinatorial optimization |
| 2 | Linear Programming Problems a) Graphical Method b) Big-M Method c) Two Phase Method |
| 3 | Find the initial basic feasible solution for any five-transportation problem using a) North-West corner rule b) Least Cost Method c) Vogel's Approximation Method |
| 4 | Find the optimum solution for any five transportation problems using MODI's method |
| 5 | Assignment Problem a) Using Hungarian Method |
| 6 | Network Model a) Implementation of CPM b) PERT-Network representation |
| 7 | Explore any one application of Game Theory in strategic management |
| 8 | Dynamic Programming: Implementing Game Theory |
| 9 | Queuing System: a) Implementation of Pure birth and death models b) Implementation of Generalized Poisson Queuing model |
| 10 | Queuing System: a) Implementation of Multiple and Sever Models |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

2MCAEC14: THEORY OF COMPUTATION

Total No. of Hours: 52

Hours per week:L:T:P(3:2:0)

Course Objective: Insight to theory of computation and formal languages for aspiring systems level programming.

Course Outcomes:

CO1: Learn the fundamentals of finite state machines

CO2: Design deterministic finite state automaton using NFA, RE, CFG

CO3: Learn the importance of applications in areas of automated systems

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction -Strings, Alphabets and Languages, Deterministic Finite Automaton (DFA), Non Deterministic Automaton (NFA). Equivalence of NFA and DFA without proof, Automaton with ϵ - moves, DFA design techniques, Moore and Mealy machines, conversion from NFA to DFA, Application of DFA. | 10 hrs |
| MODULE II | Regular expressions- ϵ -NFA from RE – Kleen's theorem, RE from FA, elimination states method, Applications of RE, Regular languages, properties of regular languages, Pumping lemma, Minimization of FA, Table fill algorithm | 10 hrs |
| MODULE III | Context Free grammar and Languages- Definition of grammar, Chomsky Hierarchy, grammar from FA, Grammar from RE, Derivation, Derivation tree, ambiguous grammar, Application of CFG | 12 hrs |
| MODULE IV | Pushdown Automata – Transitions, Graphical representation of PDA, language accepted by PDA, Construction of PDA, Deterministic and non-deterministic PDA, CFG to PDA, Application of GNF, PDA to CFG, Chomsky Normal Form, Properties of CFL's | 10 hrs |
| MODULE V | Turing machines- Model, transition table, Acceptance of a language by TM, Construction of TM, counter machines, off line TM, Undecidability - Language not recursively enumerable, halting Problem | 10 hrs |

TEXT BOOKS

- [1] John E Hopcroft and Jeffrey D Ullman, "*Introduction to Automata Theory*", Addison-Wesley, Third Edition.(Chapter 1,2,3,4,5,6,7)
- [2] Gyorgy E Revesz, "*Introduction to Formal Languages*", Jones and Bartlett Publishers, Fourth Edition.(Chapter 1 ,4,6)

REFERENCE BOOKS

- [3] Dick Grune, Henri E Bal, Cerial J. H. Jacobs, Kone G. Langendoen, "*Modern Compiler Design*", Wiley dreamtech India Pvt. Ltd., Edition 2003.
- [4] Derick Wood, "*Theory of Computation*", Longman Higher Education.
- [5] Daniel Cohen, "*Theory of Computation*", ISBN Publications.

THEORY OF COMPUTATION – TUTORIAL SESSION

Total No. of Hours: 52

Hours per week:L:T:P(0:2:0)

| Sl. No. | Exercise |
|---------|--|
| 1. | Explore the applications finite automata and formal languages and prepare a report on any one application in detail |
| 2. | Construct DFA for the following: <ul style="list-style-type: none"> ✓ To accept strings of 0's and 1's starting with 01 ✓ To accept strings of a's and b's ending with ab or ba ✓ To accept strings from $\Sigma = \{ @, \\$, * \}$ starting from symbol @ followed by odd number of \$ and ending with * |
| 3. | Convert NFA to DFA (Any five problems of your choice) <ul style="list-style-type: none"> ✓ Using subset conversion method ✓ Using Lazy evaluation method Compare both the methods and conclude |
| 4. | Minimize the following DFA using Table Fill algorithm <div style="text-align: center; margin-top: 10px;"> </div> |
| 5. | Write regular expressions for the following: <ul style="list-style-type: none"> ✓ Set of strings of a's and b's of any length including the null string ✓ Set of strings of a's and b's ending with the string abb ✓ Set of strings of even number of 1's including empty string ✓ Set of strings consisting of even number of a's followed by odd number of b's ✓ Set of strings with at least three consecutive 0's over $\Sigma = \{0, 1\}$ |
| 6. | Show that $L = \{ w / n_a(w) = n_b(w) \}$ is not regular |
| 7. | Obtain a grammar to generate palindrome over $\{a, b\}^*$ |
| 8. | Explore any one application of CFG |
| 9. | Construct PDA to accept $L = \{ w \in \{a, b\}^* : w = w^R \}$ |
| 10. | Study and report different types of Turing machines |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

3MCACC01: MACHINE LEARNING

Total No. of Hours: 52

Hours per week: L:T:P(4:0:0)

Course Objective: To understand the basic theory underlying Machine Learning and apply the algorithms to solve problems of complexity.

Course Outcomes:

CO1: Understand the fundamental issues and challenges of machine learning, data model selection and its complexity

CO2: Understand the strengths and weaknesses of machine learning approaches

CO3: Analyze the underlying relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning

| | | |
|-------------------|--|---------------|
| MODULE I | <p>Introduction to Machine Learning: Introduction, What is Human Learning, Types of Human Learning, What is Machine Learning? Types of Machine Learning, Applications of Machine Learning, Tools in Machine Learning, Issues in Machine Learning.</p> <p>Exploring Data: Elements of structured Data, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing.</p> | 10 hrs |
| MODULE II | <p>Modelling, Evaluation and Feature Engineering: Introduction, Selecting a Model, Training a Model, Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.</p> <p>Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection.</p> | 12 hrs |
| MODULE III | <p>Supervised Learning: Introduction, Example, Classification Model, Classification Learning Steps, Common Classification Algorithms (k- Nearest Neighbour, Decision Tree, Random Forest Model, Support Vector Machines)</p> | 12 hrs |
| MODULE IV | <p>Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Applications of Unsupervised Learning, Clustering, Finding Patterns using Association Rule</p> | 10 hrs |
| MODULE V | <p>Other Types of Learning: Bayesian Concept Learning- Introduction, importance, Bayes' Theorem and Concept Learning, Bayesian Belief Network.</p> <p>Neural Network: Introduction, Understanding the Biological Neuron, Exploring the Artificial Neuron, Types of Activation Functions, Early implementations of ANN, Architectures of Neural Network, Learning Process in ANN, Back Propagation, Deep Learning.</p> <p>Representation Learning: Supervised, Neural Networks and Multilayer Perception, Independent Component Analysis, Autoencoders, Various forms of Clustering.</p> | 08 hrs |

TEXT BOOKS

- [1] Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “*Machine Learning*”, Pearson Education.(Chapter 1,2,3,4,5,6,7)

REFERENCE BOOKS

- [2] E. Alpaydin, “*Machine Learning*”, MIT Press.
[3] T. Hastie, R. Tibshirani and J. Friedman, “*Elements of Statistical Learning*”, Springer.
[4] C. Bishop, “*Pattern Recognition and Machine Learning*”, Springer.
[5] ShaiShalev-Shwartz, Shai Ben-David, “*Understanding Machine Learning: From Theory to Algorithms*”, Cambridge University Press.

3MCAP01: MACHINE LEARNING LAB

Total No. of Hours: 52

Hours per week :L:T:P(0:0:4)

| Ex. No | Part – A |
|-----------------|---|
| 1 | Exploratory Data Analysis |
| 2 | Model building |
| 3 | Supervised Learning –Any three <ul style="list-style-type: none"> • KNN • Decision Tree • Random Forest • SVM |
| 4 | Unsupervised Learning <ul style="list-style-type: none"> • Clustering Hierarchical Clustering |
| 5 | Neural Network Model <ul style="list-style-type: none"> • Single Layer Networks Multi-layer Networks |
| Part – B | |
| | Mini project: Implement a machine learning algorithm for a specific domain. |

Scheme of Evaluation

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|---------------|---------------------------------|-----------|
| PART A | Writing ONE programs | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCACC02: ADVANCED ALGORITHMS

Total No. of Hours: 52

Hours per Week: L: T:P (4:0:0)

Course Objective: To study the algorithms for solving practical problems efficiently, and theoretical analysis of their behavior.

Course Outcomes:

- CO1:** Understand the problem type, pick an appropriate algorithm design, analyze the worst-case running time of the algorithm using asymptotic analysis
- CO2:** Familiarize and analyze the approximation factor of an algorithm
- CO3:** Understand major string matching algorithms and their analyses
- CO4:** Analyze randomized algorithms and demonstrate difference between a randomized algorithm and an algorithm with probabilistic inputs
- CO5:** Understand the need for parallel algorithm design, choose necessary parameters for implementing parallel algorithms and deploy it in correct scenarios.

| | | |
|-------------------|--|---------------|
| MODULE I | <p>Algorithm Analysis: Analysis framework, Asymptotic notations, Basic efficiency classes, Analysis of recursive and non-recursive algorithms. Recurrence relation, Substitution method, Master Theorem.</p> <p>Algorithm Design Techniques : Brute force : Selection sort. Divide and Conquer: Design Principles and Strategy, Analyzing Divide and Conquer Algorithms, Merge Sort , quick sort, Binary Search. Decrease and Conquer : various types with examples.</p> <p>Transform and Conquer : Horner’s Rule. Space and Time trade off : Sorting by Counting.</p> | 12 hrs |
| MODULE II | <p>Greedy approach: Design Principles and Strategy, Prim’s and Kruskal algorithms. Huffman Trees.</p> <p>Dynamic programming strategies: Design Principles and Strategy, 0/1 Knapsack Problem, optimal binary search tree..</p> | 10 hrs |
| MODULE III | <p>Backtracking: Design Principles and Strategy, Sum of Subset, n queens problem.</p> <p>Branch-and-bound techniques: Design Principles and Strategy, Traveling Salesman Problem..</p> | 08 hrs |
| MODULE IV | <p>Parallel Algorithms :Design approach to parallel algorithms, constraints, performance measures of parallel algorithms, parallel sorting (merge sort), matrix addition in parallel, minimum spanning tree in parallel.</p> | 12 hrs |
| MODULE V | <p>String Matching and Text Processing : The naïve string matching algorithm, The Boyer-Moore String matching algorithm, Karp-Rabin String matching algorithm,. Text Processing : Introduction to vectorization, Text vectorization methods : Term frequency, Bag of Words.</p> | 10 hrs |

TEXT BOOKS

- [1] Annany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Education, 3 rd Edition, 2017 (Module I, Module II, Module III)
- [2] E. Horowitz and S. Sahani, “Fundamentals of Computer Algorithms”, Galgotia Publications, 2 nd Edition, 2008. (Module IV)
- [3] Thomas H Corman, Charles E Leiserson and Ronald L Rivest, Clifford Stien, “Introduction to Algorithms”, Prentice Hall of India Pvt. Ltd, Third Edition. (Module V)
- [4] Kenneth A. Berman and Jerome L. Paul, “Algorithms : Special Topics”, Sanat Printers, 2018 (Module IV, Module V)

3MCACC03: DATA COMMUNICATION AND COMPUTER NETWORKS

Total No. of Hours: 52

Hours Per Week: L:T:P (3:2:0)

Course Objective: To understand various computer networks, network technologies and application protocols.

Course Outcomes:

CO1: Understand the types of networks, network models and its related terminologies

CO2: Describe the layer functionalities of OSI and TCP/IP model

CO3: Comprehend the working of various layer protocols of network models

CO4: Apply sub netting techniques to solve problems on classless and classful addressing

CO5: Analyze and interpret concepts of network security and cryptography

| | | |
|-------------------|--|---------------|
| MODULE I | <p>Introduction : Data Communication - Networks- Network Types – Internet History – Standards and Administration</p> <p>Network Models: Protocol Layering – TCP/IP Protocol Suite – The OSI model.</p> <p>Wired LANs Ethernet: Ethernet Protocol – Standard Ethernet – Fast Ethernet – Gigabit Ethernet – 10 Gigabit Ethernet – Connecting Devices – Hubs- Link Layer Switches – Virtual LANs. Wireless LANs : Introduction – IEEE802.11 Project – Bluetooth – Other Wireless Networks – WiMAX – Cellular Telephony – 1G, 2G, 3G 4G</p> | 12 hrs |
| MODULE II | <p>Physical Layer : Data and Signals – Periodic Analog Signals – Digital Signals – Transmission Impairment – Data Rate Limits – Performance – Multiplexing – FDM- WDM-TDM – Transmission Media – Guided Media – Unguided Media – Switching – Circuit Switched Networks – Packet Switching- Structure of Switch</p> <p>Data Link Layer : Introduction – Link Layer Addressing –Error Detection and Correction – Introduction – Block Coding- Cyclic codes – Forward Error Correction – Data Link Control – DLC Services- DLL Protocols – HDLC – PPP – Media Access Control – Random Access – ALOHA-CSMA- CSMA/CD – CSMA/CA</p> | 12 hrs |
| MODULE III | <p>Network Layer :Network Layer Services – Network Layer Performance – IPv4 Addresses – Address Space – Classful – Classless Addressing</p> <p>Network Layer Protocols – IP –Mobile IP – Unicast Routing – Routing Algorithms – Distance Vector Routing – Link State Routing – Path Vector Routing – Unicast Routing Protocols – RIP-OSPF-BGP4- Multicast Routing Basics –IPv6 Protocol – Transition from IPv4 to IPv6</p> <p>Transport Layer : Introduction – Transport Layer Protocols – Transmission Control Protocol – TCP Services – TCP features – Segment – A TCP connection- State Transition Diagram – Windows in TCP- Flow Control – Error Control – TCP Congestion Control – TCP timers</p> | 12 hrs |
| MODULE IV | <p>Application Layer: WWW – HTTP-FTP-Electronic Mail – TELNET- SSH-DNS.</p> <p>Network Management : Introduction – SNMP- Managers and Agents – Management Components – SMI –MIB</p> | 10 hrs |
| MODULE V | <p>Cryptography and Network Security : Introduction – Security Goals – Attacks – Services and Techniques – Symmetric Key ciphers – Asymmetric – Key Ciphers – Message Integrity – Message Authentication – Digital Signature – Entity Authentication – Key management</p> | 06 hrs |

TEXT BOOKS

- [1] Behrouz A. Forouzan “*Data Communications and Networking*”, Tata Mcgraw Hill, Fifth Edition. (Chapters 1,2, 3, 6.1, 7 , 8, 9, 10.1, 10.2, 10.3, 10.5, 11,12.1, 13,15,16,17, 18.1,18.3,18.4,19.1,19.3,20.1,20.2,20.3,21.2,22.2,22.4,23,24.3, 26, 27.1, 27.2, 31.1, 31.2, 31.3

REFERENCE BOOKS

- [2] Andrew S. Tanenbaum, “*Computer Networks*”, Pearson, Fifth Edition
[3] Atul Kahate, “*Cryptography and Network Security*”, Tata Mcgraw Hill, Second Edition.
[4] Douglas E. Comer, “*Computer Networks and Internets with Internet Applications*”, Pearson, Third Edition.
[5] William Stalling, “*Cryptography and Network Security*”, Prentice Hall, Fourth Edition.

Data Communication and Computer Networks – Tutorial Session

| Exercise | Experiment |
|-----------------|---|
| 1 | Study of network devices and types of networks in detail |
| 2 | Connect the computers in Local Area Network |
| 3 | Implementation of Data link framing method - Bit stuffing and De stuffing. |
| 4 | Problem Exercises and Implementation of Error detection method - even and odd parity, CRC Polynomials |
| 5 | Problem Exercises on IP addressing |
| 6 | Implementation of any one routing algorithms – Dijkstra, Distance Vector , Path Vector Algorithms |
| 7 | Implementation of any one HTTP, FTP, e-mail, Telnet, SSH protocols |
| 8 | Problem Exercises on cryptography and case studies on network security |
| 9 | Study and Working on Network Protocol Analyzer Tool (Ethereal/Wireshark) |
| 10 | Study and Working on NMAP Tool for Port scanning |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks.

3MCAEC21: DIGITAL IMAGE PROCESSING

Total No. of Hours: 40

Hours per week:L:T:P(3:0:0)

Course Objective: To study the basic concepts and methodologies for digital image processing

Course Outcomes:

- CO1:** Understand fundamentals of Digital image processing and various stages of Digital image processing
- CO2:** Learn spatial operations and use it for various image processing applications namely image enhancement, image sharpening and image resampling
- CO3:** Understand the frequency domain concepts and operations namely frequency domain filtering and apply it to enhance the images
- CO4:** Identify various noise and image degradation models and restore the images using filters
- CO5:** Understand various segmentation techniques and use it for object segmentation
- CO6:** Identify various morphological operations and apply to segment objects based on shapes

| | | |
|-------------------|--|---------------|
| MODULE I | Fundamentals of Digital Image Processing: Fundamental steps in digital image processing, Components of image processing visual perception, image sensing and acquisition, sampling and quantization, mathematical tools used in digital image processing. | 08 hrs |
| MODULE II | Image transformations: Intensity transformation functions, Fundamentals of spatial filtering, smoothing and sharpening spatial filters, Intensity transformations using fuzzy sets. | 08 hrs |
| MODULE III | Filtering in the frequency domain: Fourier series, Fourier transform of functions of continuous variable, Convolution, Discrete Fourier transformation of one variable, Sampling, Image interpolation and resampling, Moiré patterns, Properties of 2D discrete Fourier transform. Filtering basics and fundamentals. | 10 hrs |
| MODULE IV | Image restoration and reconstruction: Image degradation/restoration process, Noise models- spatial and frequency properties of noise, noise probability density functions, image construction from projection. | 08 hrs |
| MODULE V | Morphological Processing: Dilation and Erosion, Opening and Closing, Hit-or-miss transform. Image Segmentation: Point, line and edge detection, Thresholding (Different Techniques), Region growing, Region splitting and merging. | 06 hrs |

TEXT BOOKS

- [1] Rafael C Gonzalez, Richard E Woods, “*Digital Image Processing*”, Pearson Education, Third Edition.(Chapter 1,2,3,4,5,9,10)

REFERENCE BOOKS

- [2] William K Pratt, “*Digital Image Processing*”, John Willey, June 2010.
[3] A.K. Jain, “*Fundamentals of Digital Image Processing*”, Prentice Hall of India, 2011.
[4] Chanda Dutta, Magundar, “*Digital Image Processing and Applications*”, Prentice Hall.

3MCAECP21: DIGITAL IMAGE PROCESSING LAB**Total No. of Hours: 52****Hours per week :L:T:P(4:0:0)**

| Ex. No | Part – A |
|-----------------|--|
| 1 | Image Manipulation. Read, write, and view images and conversion between different image formats. [imread(), imwrite(), imshow(), gray2ind(), ind2gray(), ind2rgb(), mat2gray(), rgb2gray(), rgb2ind()] |
| 2 | Spatial Transformations. Convolution and Correlation.[imfilter(), conv2(), filter2()] |
| 3 | Perform algebraic operations. [Image addition, subtraction, multiplication, division] |
| 4 | Explore Image histogram. Histogram equalization and Histogram matching operations. |
| 5 | Perform Geometric transformations. [Image negative, logarithmic, gamma and contrast stretching transformations]. |
| 6 | Perform frequency Transformations. Fourier transforms. [fft2(), ifft2(), fftshift()] |
| 7 | Implement Low Pass Filter , High Pass Filter |
| 8 | Noise identification and filtering techniques to remove it. [imnoise(), medfilt2(), ordfilt2(), wiener2()]. |
| 9 | Morphological Transformations. Dilatation and erosion as fundamental morphological operations.[imdilate(), imerode(), imclose(), imopen(), bwmorph()] |
| 10 | Discontinuity based Segmentation : Edge Detection, Detection of boundaries between two regions using different gradient approximations |
| 11 | Similarity based Segmentation: Thresholding, Divide the image in regions depending on the gray level. |
| 12 | Demonstrate various models for representing the color and methods of processing the color plane |
| Part – B | |
| | Mini project: Implement a simple GUI based application that will appropriately apply various image operations specific to the chosen problem. |

Scheme of Evaluation

| Sections | Criteria | Marks |
|-----------------|---------------------------------|--------------|
| PART A | Writing ONE programs | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCAEC22: INTERNET OF THINGS

Total No. of Hours: 40

Hours Per Week: L:T:P (3:0:0)

Course Objective: To introduce the implementation of web based services on IoT devices.

Course Outcomes:

CO1: Understand constraints and opportunities of wireless and mobile networks for Internet of Things

CO2: Analyze the societal impact of IoT systems and its domains

CO3: Develop critical thinking skills

CO4: Analyze, design or develop parts of an Internet of Things solution and map it toward selected business models

CO5: Evaluate the impact of cloud technology and its issues related to the Internet of Things

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction to Internet of Things :Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates - Domain Specific IoT's – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle | 10 hrs |
| MODULE II | IoT and M2M : Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER | 10 hrs |
| MODULE III | IoT Platforms Design Methodology : Introduction – IoT Design Methodology – Case Study on IoT System for Weather Monitoring – Motivation for Using Python | 05 hrs |
| MODULE IV | IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming : Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins | 05 hrs |
| MODULE V | IoT Physical Servers and Cloud Offerings : Introduction to Cloud Storage models and communication APIs Webserver : Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API | 10 hrs |

TEXT BOOKS

- [1] Arshdeep Bahga and Vijay Madiseti, “*Internet of Things - A Hands-on Approach*”
Universities Press, 2015 (Chapters 1, 2, 3, 4, 5, 7, 8)

REFERENCE BOOKS

- [2] Matt Richardson & Shawn Wallace, “*Getting Started with Raspberry Pi*”, O'Reilly (SPD), 2014
[3] Marco Schwartz, “*Internet of Things with the Arduino Yun*”, Packt Publishing, 2014.

3MCAECP22: INTERNET OF THINGS LAB

Total No. of Hours: 52

Hours per week :L:T:P(4:0:0)

Students are to execute PART – A exercises according the choice of the IoT board chosen and also have to design an IoT system as a mini project- PART - B using Arduino/Raspberry Pi/ equivalent boards

| Ex. No | Part – A |
|--|--|
| Arduino Exercises – Using Arduino IDE | |
| 1 | Blink an LED |
| 2 | Read an analog input and set the rate of an LED blink |
| 3 | Use a switch sensor to turn a dimmable LED on or off |
| 4 | Use a switch to toggle the LED on and off |
| 5 | Read analog accelerometer |
| OR | |
| Part – A | |
| Raspberry Pi Exercises – Python Programming | |
| 1 | GPIO Programming - Programming of available GPIO pins and interfacing of I/O devices like LED/Switch |
| 2 | Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value |
| 3 | Building and hosting a simple website (static/dynamic) on the device and make it accessible online |
| 4 | Simple exercise to implement Wifi Connectivity |
| Part – B | |
| | Implement a mini project for a specific domain |

Scheme of Evaluation

| Sections | Criteria | Marks |
|-----------------|---------------------------------|--------------|
| PART A | Writing ONE programs | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCAEC23: SYSTEM MODELING AND SIMULATION

Total No. of Hours: 40

Hours per week: L:T:P(3:0:0)

Course Objective: To provide concept of simulation and modeling and practice to design simulation models for various case studies like inventory, traffic flow networks.

Course Outcomes:

CO1: Explain the basic system concept and definitions of system

CO2: Discuss techniques to model and to simulate various systems

CO3: Analyze a system and to make use of the information to improve the performance

CO4: Model dynamic and queuing problems

CO5: Understand general purpose simulation software used for simulation

| | | |
|-------------------|--|---------------|
| MODULE I | Modeling and Simulation: Nature of Simulation systems, Models and Simulation, Continuous and Discrete Systems, System Modeling, Concept of Simulation, Components of Simulation study, Principles used in modeling, Static and Dynamic physical models, Static and Dynamic Mathematical models. Introduction to Static and Dynamic System Simulation, Advantages, Disadvantages and pitfalls of Simulation. | 08 hrs |
| MODULE II | System Simulation and Continuous System: Types of System Simulation, Monte Carlo Method, Comparison of analytical and Simulation methods, Numerical Computation techniques for Continuous and Discrete Models, Distributed Lag Models, Cobweb Model, Continuous System Models, Analog and Hybrid computers, Digital- Analog Simulators, Continuous system simulation languages, Hybrid simulation, Real Time Simulations. | 08 hrs |
| MODULE III | System Dynamics & Probability Concepts in Simulation: Exponential growth and decay models, logistic curves, Generalization of growth models, System dynamics diagrams, Multi segment models, Representation of Time Delays, Discrete and Continuous Probability functions, Continuous Uniformly Distributed Random Numbers, Generation of Random Numbers, Generating Discrete Distributions, Non-Uniform Continuously Distributed Random Numbers, Rejection Method. | 08 hrs |
| MODULE IV | Simulation of Queuing Systems and Discrete System: Simulation Poisson arrival patterns, Exponential Distribution, Service Times, Normal Distribution Queuing Disciplines, Simulation of Single and Two Server Queue. Application of queuing theory in computer system, Discrete Events. Generation of arrival patterns, Simulation Programming tasks, Gathering Statistics, Measuring Occupancy and Utilization, Recording Distribution and Transmit Times | 10 hrs |

| | | |
|---------------------|--|---------------|
| MODULE V | Introduction to Simulation Languages and Analysis of Simulation Output GPSS: Action Times, Succession of events, Choice of paths, Conditional Transfers, Program Control Statements SIMSCRIPT: Organization of SIMSCRIPT Program, Names & Labels, SIMSCRIPT statements Estimation Methods, Replication of Runs, Batch Means, Regenerative Techniques, Time Series Analysis, Spectral Analysis and Auto regressive Processes | 06 hrs |
|---------------------|--|---------------|

TEXT BOOKS:

- [1] Jerry Banks, John S Carson, “*Discrete event System Simulation*”, Pearson Education.(Chapter 1.2.3.4.5.6.7)

REFERENCE BOOKS:

- [2] Jerry Banks, John S Carson, “*Discrete event System Simulation*”, Pearson Education.
[3] Gordon G., “*System Simulation*”, PHI Learning India.
[4] Dr. Shailendra Jain, “*Modeling & Simulation Using Matlab and Simulink*”, Wiley.
[5] David Cloud, Larry Rainey, “*Applied Modeling and Simulation*”, TMGH.
[6] Frank L Severence, “*System Modeling and Simulation An Introduction*”, Wiley.
[7] Thomas J Sciber, “*Simulation using GPSS*”, Wiley & Sons.
[8] James Harrington, Kerim Tumay, “*Simulation Modeling Methods*”, TMGH.

3MCAECP23: SYSTEM MODELING AND SIMULATION LAB**Total No. of Hours: 52****Hours per week :L:T:P(4:0:0)**

Students have to develop a mini project using any open source.
Statistical/mathematical/programming tools.

Scheme of Evaluation

| Criteria | Marks |
|-----------------------------|--------------|
| Project Presentation & demo | 15 |
| Add-On Module | 10 |
| Viva-voce | 10 |
| Total | 35 |

3MCAEC24: UI DESIGN

Total No. of Hours: 40

Hours Per Week: L:T:P (3:0:0)

Course Objective: To learn how to design, prototype and evaluate user interfaces to effectively browse and search systems.

Course Outcomes:

CO1: Describe design principles

CO2: Demonstrate impactful visual design and color concepts

CO3: Apply design principles and skills for design prototype

CO4: Design an intuitive design for software products

CO5: Understand user documentations and information search

| | | |
|-------------------|--|---------------|
| MODULE I | Introduction and Overview: Usability of interactive systems: Usability Goals and Measures, Usability Motivations, Universal Usability, Goals for our Design Profession. Guidelines, Principles, and Theories of Design. | 05 hrs |
| MODULE II | UI Design Process and Interaction styles: Design process introduction, designing to address a problem w/o solution ideas, designing for a known solution direction, designing to iterate on/improve an existing solution, common elements, usability engineering and task-centered approaches, use cases, personas, tasks and scenarios, intro to design centered approaches, design centered methods and when they work best. Direct manipulation and virtual environments-Introduction- Examples of direct Manipulation, discussion of Direct Manipulation, 3D interfaces, teleoperation, Virtual and Augmented Reality. Menu Selection, Form Fill-in, and Dialog Boxes- Introduction- Task related menu organization, single menus, combinations of multiple menus, content organization, fast movement through menus, Data entry with Menus, audio menus and menus for small displays. | 10 hrs |
| MODULE III | Psychology and human Factors for User interface Design: Fitt's Law, Short and long term memory, attention, perception and visualization, hierarchy, mistakes, errors and slips, conceptual models, the gulf of execution and the gulf of evaluation, design principles: visibility, feedback, mappings, constraints, interacting beyond individuals (social psychology), high-level models: distributed cognition, activity theory, situated action, assignment video: interface critiques. | 05 hrs |
| MODULE IV | Information search and information visualization and UX: Information Search - Introduction- Searching in Textual Documents and Database Querying- Multimedia Document Searches- Advanced Filtering and Search Interfaces. Information Visualization- Introduction- Data type by Task Taxonomy- Challenges for Information Visualization. UX process, user research, creating user personas, information architecture, user flowchart & user journey y making low fidelity wireframes. | 10 hrs |
| MODULE V | DESIGN TOOLS and USE CASES: Use Cases, Personas, tasks, and Scenarios Adobe Illustrator, Adobe Photoshop, InVision, Adobe XD, Figma, Sketch. | 10 hrs |

TEXTBOOKS

- [1] Ben Shneiderman, Plaisant, Cohen, Jacobs, “*Designing the User Interface*”, 5th Edition, Pearson ,Education, 2010.(Chapters 1,2,3,5,6,13,14)

REFERENCE BOOKS

- [2]]Alan Dix, Janet Finalay, Gregory D Abiwdm Russel Bealel, “*Human-Computer Interaction*”, III Edition, Pearson , Education, 2008.
- [3] Eberts: “*User Interface Design*”, Prentice Hall.
- [4] Wilber O Galitz: “*The Essential Guide to User Interface Design- An Introduction to GUI Design, Principles and Techniques*”, Wiley-Dreamtech India Pvt Ltd, 2011.

3MCAECP24: UI DESIGN LAB

Total No. of Hours: 52

Hours per week :L:T:P(4:0:0)

| Ex. No | Part – A |
|-----------------|---|
| 1 | Identifying design problems / understanding the problem. a. Task/ Scenario evaluation #1 b. Task/Scenario evaluation #2 |
| 2 | Intro to UI Design: UI design process a. Test your knowledge #1 b. Test your knowledge #2 |
| 3 | Psychology and Human factor in designing #1 |
| 4 | Psychology and Human factor in designing #2 |
| 5 | Designing for problem #1 |
| 6 | Designing for a problem #2 |
| 7 | Fine tuning for existing solution #1 |
| 8 | Fine tuning for existing solution #2 |
| 9 | Build a wireframe for mobile app / responsive websites |
| 10 | Design a portfolio |
| Part – B | |
| | Mini project: Implement a miniproject for a specific domain. |

Scheme of Evaluation

| Sections | Criteria | Marks |
|-----------------|---------------------------------|--------------|
| PART A | Writing ONE program | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCAEC31: BIG DATA ANALYTICS

Total No. of Hours: 40

Hours per Week: L:T:P (3:0:0)

Course Objective: To provide an overview of an exciting growing field of big data analytics and to introduce the tools required to manage and analyze big data like Hadoop, NoSql, MapReduce.

Course Outcomes:

CO1: Understand the fundamentals of data analytics techniques and platforms

CO2: Design and Apply data analytics ecosystem and visualization techniques to solve various problems

CO3: Analyze the results of data analytics and visualization for various problems

CO4: Evaluate the solutions of data analytics ecosystems

| | | |
|-----------------------|---|---------------|
| MODULE I | Data Science in a Big world: Benefits and uses of Data Science in Big data, Facets of data, Big data ecosystem and Data Science, Data Science process. | 06 hrs |
| MODULE II | Hadoop Fundamentals: Data, Data Analysis and storage, Comparison with other systems – Relational Database Management Systems, Grid Computing, Volunteer Computing, History of Apache Hadoop The Hadoop Distributed File system The Design of HDFS, HDFS Concepts – Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability, The command-Line Interface, Hadoop File system – Interfaces The Java Interface – Reading data from Hadoop URL, Reading Data using File system API, Writing Data, Directories, Querying the File system, Deleting Data Data Flow – Anatomy of a File Read, Anatomy of a File Write, Coherency Model Parallel Copying with distcp – Keeping an HDFS cluster Balanced | 10 hrs |
| MODULE III | Map Reduce: Data format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop, Scaling Out Working of Map Reduce – Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort, Task Execution Map Reduce Formats – Input Formats, Output Formats | 08 hrs |
| MODULE IV | Pig Environment: Execution types, Running Pig programs, Grunt, Pig Latin Editors An Example – Generating Examples, Comparison with databases Pig Latin – Structure, Statements, Expressions, Types, Schemas, Functions, Macros User-Defined Functions – A Filter UDF, An Eval UDF, A Load UDF Data Processing Operators – Loading and storing of data, Filtering data, Grouping and Joining data, Sorting data, Combining and splitting data Pig in Practice– Parallelism, Anonymous Relations, Parameter Substitution | 10 hrs |
| MODULE V | Hive: Installing Hive – The Hive shell, An Example; Running Hive – Configuring hive, Hive services, the Meta store Comparison with Traditional Databases: Schema on Read Versus Schema on Write, Updates, Transactions and Indexes, SQL-on-Hadoop Alternatives Hive QL – Data Types, operators and functions Tables – Managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables, Dropping Tables Querying Data – Joins, Sub queries, Views. | 06 hrs |

TEXT BOOKS

- [1] Cielen, D., Meysman, A., & Ali, M. (2016). *“Introducing data science: big data, machine learning, and more using Python tools.”* Manning Publications Co (Chapter 1.2.4.5.6.7.8)

REFERENCE BOOKS

- [2] Tom White, *“Hadoop – The Definitive Guide; Storage and Analysis at Internet scale”*, O’Reilly, Shroff Publishers & Distributers Pvt. Ltd., 4th Edition, 2015.
- [3] DT Editorial Services *“Big Data – Black Book”* Dreamtech Press, Edition – 2015
- [4] Dirk deRoos, Paul C. Zikopoulos, Roman B. Melnyk, Bruce Brown, Rafael Coss *“Hadoop for Dummies”*, John Wiley & Sons, Inc., 2014.
- [5] Nathan Marz and James Warren , *“Big Data Principles and Best Practices of Scalable Real time data systeMs”*, 2015.

BIG DATA ANALYTICS LAB

Total No. of Hours: 52

Hours per week :L:T:P(4:0:0)

| PART A | |
|---------------|--|
| 1 | <p>HDFS Review the commands available for the Hadoop Distributed File System:</p> <ol style="list-style-type: none"> a) Copy file foo.txt from local disk to the user's directory in HDFS b) Get a directory listing of the user's home directory in HDFS c) Get a directory listing of the HDFS root directory d) Display the contents of the HDFS file user / fred / bar.txt e) Move that file to the local disk, named as baz.txt f) Create a directory called input under the user's home directory g) Delete the directory input old and all its contents h) Verify the copy by listing the directory contents in HDFS |
| 2 | <p>Map Reduce</p> <ol style="list-style-type: none"> a) Create a Job and submit to cluster b) Track the job information c) Terminate the job d) Counters in MR Jobs e) Listing of Jobs |
| 3 | <p>Pig</p> <ol style="list-style-type: none"> a) Load the data into Apache Pig from the file system (HDFS/ Local) using Load operator b) Store data in Apache Pig using the Store operator. c) Execute the Diagnostic operators d) Group the data in one or more relations e) Perform various join operations in Pig Latin f) Display the contents of a relation in a sorted order based on one or more fields. |
| PART B | |
| 1 | <p>Advanced Concepts in Pig:</p> <ol style="list-style-type: none"> a) Merge the content of two relations b) Split a relation into two or more relations. c) Select the required tuples from a relation based on a condition. d) Remove redundant (duplicate) tuples from a relation. e) Explore the built-in functions provided by Pig. |
| 2 | <p>Hive:</p> <ol style="list-style-type: none"> a) Create and Drop database in Hive b) Create, Alter and Drop Table in Hive c) Create and Drop Views in Hive d) Demonstrate the built-in functions in Hive |
| 3 | <p>Process and analyze structured data using Hive QL: Select Where, Select Order By, Select Group By, Select Join</p> |

Scheme of Evaluation

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|---------------|---|-----------|
| PART A | Writing TWO programs from each Part A and Part B | 10 |
| | Execution of TWO program | 20 |
| | Viva | 05 |
| Total | | 35 |

3MCAEC32: MOBILE APPLICATIONS DEVELOPMENT

Total No. of Hours: 40

Hours per Week: L:T:P (3:0:0)

Course Objective: To introduce network, system, techniques and applications in Mobile Wireless Computing.

Course Outcomes:

CO1: Design and implement the user interfaces of mobile applications

CO2: Design the mobile applications that is aware of the resource constraints of the mobile devices

CO3: Develop advanced mobile applications that accesses the databases and the web

CO4: Develop useful mobile applications in the current scenario using Google Android and Eclipse simulator

| | | |
|-------------------|--|---------------|
| MODULE I | Introduction to Android: Open Platform for Mobile Development - Android SDK Features - Introduction to Development Framework - Android Development Tools - The Application Manifest File - External Resources - The Android Application Lifecycle - Android Activities. | 10 hrs |
| MODULE II | Android User Interface: Layouts - Fragments - Widgets toolbox - Views - Adapters - Introduction to Intent - Intent Filters and Broadcast receivers - File system Introduction to Android Database - SQLite - Content Providers. | 12 hrs |
| MODULE III | Introduction to Action bar: Creating and Using Menus and Action Bar Action Items - Introduction to Dialogue, Toast and Notification - Using Speech Recognition - Using Sensors and the Sensor Manager. | 10 hrs |
| MODULE IV | Emulator with Location-Based Services: Creating Map-Based Activities - Playing Audio and Video - Using camera, taking pictures and recording video. | 10 hrs |
| MODULE V | Bluetooth and WiFi: Introduction to Telephony SMS and MMS - Publishing app through Google Playstore - Using Bluetooth and WiFi. | 10 hrs |

TEXT BOOKS

- [1] Reto Meier, "*Professional Android 4 application Development*", Wiley Publications, 2012. (Chapter 1,2,3, 4,5,6,7,14,15, 8,11,12,13))

REFERENCE BOOKS

- [2] Jerome (J.F) DiMarzio, "*Android -A programmer's Guide*", Tata Mcgraw Hill, 2010.
 [3] Paul Deitel, Harvey Deitel, Abbey Deitel, Michael Morgano, "*Android for Programmers An App-Driven Approach*", Pearson Education Inc., 2012.
 [4] Wei-Meng Lee, "*Beginning android 4 application Development*", John Wiley & sons, Inc, 2012.

MOBILE APPLICATION DEVELOPMENT LAB

Total No. of Hours: 52

Hours per week :L:T:P(0:0:4)

| Ex. No | Part – A |
|------------------------------|---|
| 1 | Develop an application using GUI Components |
| 2 | Develop an application using Layout Managers and Event Listeners |
| 3 | Develop an application using of database |
| 4 | Develop a native application using GPS location information |
| 5 | Implement an application that writes data to the SD card |
| 6 | Write an application that draws basic graphical primitives on the screen |
| 7 | Implement an application that creates an alert upon receiving a message |
| 8 | Write a mobile application that creates alarm clock |
| Part B (Mini Project) | |
| | Students should develop a mini project based on any domain of their choice. |

Scheme of Evaluation

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|---------------|---------------------------------|-----------|
| PART A | Writing ONE program | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCAEC33: NoSQL

Total No. of Hours: 40

Hours per Week: L:T:P (3:0:0)

Course Objective: To understand the essential concepts of NoSQL products.

Course Outcomes:

CO1: Demonstrate the concepts of unstructured data

CO2: Analyze and Manage the Data using CRUD operations

CO3: Develop the applications using NoSQL

CO4: Realize the concept of Map Reduce its applicability in the real world application development

CO5: Analyze the framework of NOSQL

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction to NoSQL: Definition and Introduction-Sorted Ordered Column-Oriented Stores- Key/Value Stores- Document Databases-Graph Databases-Examining Two Simple Examples-Location Preferences Store-Car Make and Model Database. | 08 hrs |
| MODULE II | Interacting with NoSQL: If NoSQL Then What-Language Bindings for NoSQL Data Stores-Performing Crud Operations- Creating Records-Accessing Data- Updating and Deleting Data. | 08 hrs |
| MODULE III | NoSQL Storage Architecture: Working with Column-Oriented Databases-HBase Distributed Storage Architecture-Document Store Internals-Understanding Key/Value Stores in Memcached And Redis-Eventually Consistent Non-Relational Databases-Neo4J Storage Architecture. | 08 hrs |
| MODULE IV | NoSQL Stores: Accessing Data from Column-Oriented Databases Like HBase- Querying Redis Data Stores- Querying in Neo4J-Changing Document Databases- Schema Evolution in Column-Oriented Databases-HBase Data Import and Export- Data Evolution in Key/Value Stores-Map-Reduce- Basic Map-Reduce-Map-Reduce Calculations-2 stage example. | 08 hrs |
| MODULE V | Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index- Indexing and Ordering in MongoDB-Creating and Using Indexes in MongoDB- Indexing and Ordering in CouchDB-Indexing in Apache Cassandra- Indexing and Ordering in Neo4J. | 08 hrs |

TEXT BOOKS:

[1] Shashank Tiwari, “*Professional NoSQL*”, Wrox Press, Wiley, 2011.

REFERENCE BOOKS:

[2] Gaurav Vaish, “*Getting Started with NoSQL*”, Packt Publishing, 2013.

[3] Pramod Sadalage and Martin Fowler, “*NoSQL Distilled*”, Addison-Wesley Professional,

2012.

[4] Dan McCreary and Ann Kelly, “*Making Sense of NoSQL*”, Manning Publications, 2011.

NoSQL LAB

Total No. of Hours: 52

Hours per week :L:T:P(4:0:0)

| Ex. No | Part – A |
|-----------------|---|
| 1 | NoSql Crud Operations |
| 2 | NoSql Aggregate Functions |
| 3 | Language Bindings |
| 4 | Creating NoSql Applications |
| 5 | Accessing Datastore |
| 6 | Implementing Storage Architecture |
| 7 | Map-Reduce |
| 8 | NoSql Data Import And Export |
| 9 | Data Indexing |
| 10 | Data Ordering |
| Part – B | |
| | Mini project: Implement a miniproject for a specific domain. |

Scheme of Evaluation

Three Programs from the list will be given by the examiner out of which students will be executing any one along with project demo

| Sections | Criteria | Marks |
|---------------|---------------------------------|-----------|
| PART A | Writing ONE program | 5 |
| | Execution of ONE program | 10 |
| PART B | Project Presentation & Demo | 15 |
| | Viva – Voce | 5 |
| Total | | 35 |

3MCACC34: ENTERPRISE RESOURCE PLANNING

Total No. of Hours: 40

Hours per week :L:T:P(3:0:0)

Course Objective: To understand and explore how ERP enriches a business organization.

Course Outcomes:

CO1: Analyze the essentials of supply chain management in ERP

CO2: Analyze the implementation of ERP in the context of business of different Organization

CO3: Analyze and apply ERP for different business modules for the given problem

CO4: Analyze the given case study of ERP marketing

CO5: Analyze the design of ERP with future E-commerce and internet

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction to Supply Chain Management: Objectives ,Importance Decision phases, Process View, Competitive and Supply Chain Strategies, Strategic Fit, Supply Chain Drivers, Obstacles, Framework facilities, Inventory, Transportation, Information, Sourcing, Pricing. | 08 hrs |
| MODULE II | ERP Implementation: Implementation of Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring | 08 hrs |
| MODULE III | Business Modules: Business Modules in an ERP Package, Finance, Manufacturing, Human Resource, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution | 08 hrs |
| MODULE IV | ERP Market : ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD , System Software Associates | 08 hrs |
| MODULE V | ERP–Present And Future : Turbo Charge the ERP System, EIA, ERP and E–Commerce, ERP and Internet, Future Directions in ERP. | 08 hrs |

TEXT BOOK

[1] Alexis Leon, “*ERP Demystified*”, Tata McGraw Hill.(Part I,II,III,V,VI,VII)

REFERENCE BOOKS:

[2] Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, “*Concepts in Enterprise Resource Planning*”, Thomson Learning.

[3] Vinod Kumar Garg and N.K .Venkata Krishnan, “*Enterprise Resource Planning concepts and Planning*”, Prentice Hall.

[4] Jose Antonio Fernandez, “*The SAP R/3 Hand book*”, Tata McGraw Hill

[5] Sunil Chopra and Peter Meindl, “*Supply Chain Management – Strategy, Planning and Operation*”, Pearson/PHI, 3rd Edition.

OPEN TECHNOLOGIES LAB**Total No. of Hours: 52****Hours per week :L:T:P(4:0:0)**

Students are to design and develop a project using open source tools - Perl, Python, PHP and MySQL.

Scheme of Evaluation

| Criteria | Marks |
|-----------------------------|--------------|
| Project Presentation & Demo | 15 |
| Add on module | 10 |
| Viva-voce | 10 |
| Total | 35 |

3MCAOE:3D ANIMATION USING MAYA

Total No. of Hours: 26

Hours per week :L:T:P(2:0:0)

Course Objective: To understand the basics of 3D Animation, Techniques of animating on Object, Polygons, NURBS and Rendering in Maya.

Course Outcome: Students can efficiently work with 3D animation tool – Maya and create stunning 3D Projects

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction to Maya - Installation and Exploring the User Interface of Maya Working with Scene, Projects and Objects: Working with Projects and Scenes – Viewing the workspace – working with Objects – grouping, ungrouping and duplicating objects. Polygon modeling: Components of a Polygon Mesh – creating Polygon Mesh – Modifying Polygon Mesh NURBS Modeling: NURBS curve – creating NURBS curve – Editing NURBS curve – Creating NURBS surface – Editing NURBS surface. | 10 hrs |
| MODULE II | Animating Objects: Types of Animation – Using Animation Controls – Animating Objects using Key frame – Adding Sound – Previewing Animation | 10hrs |
| MODULE III | Adding Special Effects: Shader types – Shader attributes – Lights – Adding shadow. Rendering Scenes: Types of Rendering – setting Window – Camera – Adding Depth field –Software Rendering - Rendering Nodes | 06 hrs |

TEXT BOOKS

[1] Kognet Solutions ,”*Maya 20018 in simple steps*”, Dreamtech Press, 9th Edition.

REFERENCE BOOKS

[2] Dariush Derakhshani, “*Introducing Autodesk Maya 2013*”, Autodesk Official Training guide, SYBEX.

[3]Patrica Beckman and Phil Young, “3d Animation with Maya 7”.

[4] Paul Naas, “*Maya 2014 Essentials*”, Autodesk Press.

4MCACC01: CLOUD COMPUTING

Total No. of Hours: 52

Hours per week :L:T:P(3:2:0)

Course Objective: To explore massive parallel architecture and distributed computing that enable cloud technology.

Course Outcomes:

CO1: Understand basics of Cloud computing

CO2: Understand the importance of virtualization

CO3: Analyze various cloud computing services

CO4: Understand the key concepts of Cloud Deployment using AWS as case studies

| | | |
|-----------------------|---|---------------|
| MODULE I | Distributed System Models and Enabling Technologies: Scalable Computing over internet, Technology for network-based systems, System models for distributed and cloud computing, Software environments for distributed systems and clouds, Performance , Security and energy efficiency | 10 hrs |
| MODULE II | Computer Clusters for scalable Parallel Computing: Cluster development trends, Design objectives of computer clusters, Design issues, Cluster organization and resource sharing, Node architecture and MPP Packaging, Hardware, software and middleware support, Design principles of computer clusters, Cluster job and resource management | 12 hrs |
| MODULE III | Virtual Machines and Virtualization of Clusters and Data Centers: Implementation levels of virtualization, Virtualization structure/tools and mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation | 10 hrs |
| MODULE IV | Cloud Computing and Service Models, Data-Center Design and Interconnection Networks, Architectural design of compute and storage clouds, Inter cloud resource management, Cloud security and trust management, | 10 hrs |
| MODULE V | Public cloud platform: Google App Engine, Amazon Web Services, Microsoft Azure, service oriented architecture, Cloud Programming and Software Environments: Programming on Amazon AWS and Microsoft Azure | 10 hrs |

TEXT BOOKS

- [1] Kai Hwang, Jack Dungaree, and Geoffrey Fox, “*Distributed and Cloud Computing*”, MK Publishers, 2012 .(Chapter 1,2,3,4,5,6,7,0

REFERENCE BOOKS

- [2] Michael Miller, “*Cloud Computing-Web-Based Applications that change the Way you work and collaborate Online*”, Pearson Publication, 2012.
- [3] Anthony T. Volte, Toby J. Volte, Robert Elsenpeter, “*Cloud Computing, A Practical Approach*”, McGraw Hill, 2010.

CLOUD COMPUTING – TUTORIAL SESSION

Total No. of Hours: 26

Hours per week: L:T:P(3:2:0)

| Sl. No. | Case Study |
|---------|--|
| 1. | Advantages and disadvantages of virtual machines and virtual clusters in cloud computing systems |
| 2. | Network threats in distributed computing systems |
| 3. | Cloud computing service models |
| 4. | Latest top supercomputer system |
| 5. | Open source virtualization software |
| 6. | Amazon Web Services <ul style="list-style-type: none"> ✓ Amazon-EC2 ✓ Amazon-S3 ✓ Amazon-RDS |
| 7. | Google Services <ul style="list-style-type: none"> ✓ Google Compute Engine ✓ Google Cloud Storage ✓ Google Cloud SQL |
| 8. | Windows Azure <ul style="list-style-type: none"> ✓ Azure -VM ✓ Azure - Storage ✓ Azure - SQL database |
| 9. | Choice unlimited - Identify any topic in cloud computing Explore practically the trends and prepare a report. |

Note: The students are continually evaluated during every tutorial session for a total of 50 marks

4MCACC02: INTERNSHIP PROJECT

Students are expected to do an internship project in an industry or an in-house project for a minimum period of four months. Internal Guides will be interacting and monitoring the progress of the projects through four interactive sessions.

Scheme of Evaluation

| Criteria | Marks |
|--------------------------|--------------|
| Review 1 & Review 2 | 50 |
| Project Report | 10 |
| CIA Total | 60 |
| Industry Evaluation | 40 |
| End Semester Viva Voce | 100 |
| ESE Total | 140 |
| Total (CIA + ESE) | 200 |

4MCAEC41:SOFTWARE DEFINED NETWORKS

Total No. of Hours:40

Hours per Week: L:T:P(3:0:0)

Course Objective: To understand advanced networking research skills and apply software defined network operations to solve real world problems.

Course Outcomes:

CO1: Differentiate between traditional networks and software defined networks and learn the fundamentals of software defined networks

CO2: Understand advanced and emerging networking technologies, separation of the data plane and control plane

CO3: Understand SDN Programming and analyse the performance of varying and complex networking tasks

CO4: Understand SDN concepts and apply it to solve real time world problems

| | | |
|-------------------|--|---------------|
| MODULE I | Basic Packet Switching Terminology, Historical Background, The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Open Source and Technological Shifts. Why SDN?, Genesis of SDN. | 05 hrs |
| MODULE II | Working of SDN- Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods. Introduction to OpenFlow Specification, Improving OpenFlow Interoperability, OpenFlow Limitations, Optical Transport Protocol Extensions | 05 hrs |
| MODULE III | Introduction to Open SDN and its limitations, SDN via APIs, SDN via Hypervisor Based Overlays, SDN via Opening up the Device, Introduction of SDN Controllers and its general concepts, Layer 3 Centric, Plexxi, Cisco OnePK. Introduction of Network Programmability, Management Interface, Application-Network Divide, Modern Programmatic Interfaces, I2RS, Modern Orchestration | 10 hrs |
| MODULE IV | SDN in the Data Center- Introduction of Data Center and its demands, Tunneling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Comparison of Open SDN, Overlays and APIs, Real-World Data Center Implementations | 10 hrs |
| MODULE V | Introduction SDN application and its usages, SDN in the Data Center - SDN in Other Environments - SDN Applications - SDN Use Cases - The Open Network Operating System. | 10 hrs |

TEXT BOOKS

- [1]] Paul Goransson and Chuck Black, *Software Defined Networks: A Comprehensive Approach*, Second Edition, Morgan Kaufmann, 2014 (Chapters 1, 2, 3,4,5,7, 8, 10)

REFERENCES BOOKS

- [2] *SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization* 1st Edition, Kindle Edition, by Jim Doherty.
- [3] Anand Rajaraman and Jeffrey David Ullman, “*Mining of Massive Datasets*”, Cambridge University Press, 2012.
- [4] *Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud* 1st Edition, Kindle Edition, by William Stallings.

4MCAEC42: STORAGE AREA NETWORKS

Total No. of Hours: 40

Hours per week :L:T:P(3:0:0)

Course Objective: To understand the fundamentals of storage centric and server centric systems and metrics used for designing storage area networks.

Course Outcomes:

CO1: Understand the basic concepts of Server centric and storage centric systems

CO2: Evaluate storage architectures, including storage subsystems - DAS, SAN and NAS

CO3: Apply the techniques used for data maintenance and realize strong virtualization concepts

CO4: Understand the importance of RAID concepts

CO5: Understand the concept of security in storage networks and best practices

| | | |
|-------------------|---|---------------|
| MODULE I | Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access., Business applications defined for storage, maintenance and support applications | 08 hrs |
| MODULE II | Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems, Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID and different RAID levels. Caching: Acceleration of Hard Disk Access, disk subsystems, Availability of disk subsystems. I/O Techniques: The Physical I/O path from the CPU to the Storage System, SCSI, Fibre Channel Protocol, FC-switch, I/O buses. | 08 hrs |
| MODULE III | Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems, Network file Systems and file servers, Shared Disk file systems, Comparison of fiber Channel and NAS. | 08 hrs |
| MODULE IV | Storage Networks: Evolution and development of SAN, SAN configuration using HUB, SAN Configuration using fabric architecture, SAN for data access and size. Creating network for storage, components of SAN. Storage Virtualization: Definition of Storage virtualization, Implementation Considerations, Storage virtualization on Block or file level, Storage virtualization on various levels of the storage Network, Symmetric and Asymmetric storage virtualization in the Network, SAN Hardware device: The fibre channel switch, Host Bus Adapter, Putting the storage in SAN, Fabric operation from Hardware perspective. | 10 hrs |
| MODULE V | Software Components of SAN: The switch’s Operating system, Device Drivers, Device sharing, Data sharing, Configuration options for SAN. Role of SAN in Business Continuity, Managing availability metrics, Maintaining Serviceability, Capacity planning, Security considerations. | 06 hrs |

TEXT BOOKS

- [1] Ulf Troppens, Rainer Erkens and Wolfgang Muller: “*Storage Networks Explained*”, Wiley.
(Chapter 1,2,3,4,5,6,7)

REFERENCE BOOKS

- [2] Marc Farley: Storage Networking Fundamentals – “*An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems*”, Cisco Press, 2005.
- [3] Robert Spalding: “*Storage Networks The Complete Reference*”, Tata McGraw-Hill.
- [4] Richard Barker and Paul Massiglia: “*Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs*”, Wiley.

4MCAE C43: BLOCKCHAIN TECHNOLOGY

Total No. of Hours: 40

Hours per week :L:T:P(3:0:0)

Course Objective: To familiarise the functional aspects of Cryptocurrency and understand the emerging Blockchain technology.

Course Outcomes:

CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies

CO2: Analyze the role of block chain applications in different domains including Cybersecurity

CO3: Evaluate the usage of Block chain implementation/features for the given problem

CO4: Exemplify the usage of bitcoins and its impact on the economy

CO5: Analyze the application of specific block chain architecture for a given problem

| | | |
|-------------------|--|---------------|
| MODULE I | Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin | 12 hrs |
| MODULE II | Blockchain Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications. | 10 hrs |
| MODULE III | Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy , payment verification , Resolving Conflicts , Creation of Blocks | 10 hrs |
| MODULE IV | Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency | 10 hrs |
| MODULE V | Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study. | 10 hrs |

TEXT BOOKS

- [1] Singhal, Bikramaditya, Dhameja, Gautam, Panda, Priyansu Sekhar, “Beginning Blockchain”, Apress, 2018.

REFERENCE BOOKS

- [2] Vijay Madiseti ,“Blockchain Applications: A Hands-On Approach” Bahga publishers.
 [3] Aravind Narayan, Joseph Bonneau, Andrew Miller, Steven Goldfeder, “*Bitcoin and Cryptocurrency Technologies*”Princeton University Press, 2016.
 [4] Arthur T Brooks, “*Bitcoin and Blockchain Basics: A non-technical introduction for beginners*”.

4MCAEC44: DIGITAL MARKETING

Total No. of Hours: 40

Hours per Week: L:T:P (3:0:0)

Course Objective: To enable the learners to create a structured digital marketing plan and prioritize the strategic options for boosting customer acquisition, conversion and retention..

Course Outcomes:

CO1: Understand emerging trends in digital marketing and critically assess the use of digital marketing tools

CO2: Analyze SEO techniques, social media marketing and web analytics for business success

CO3: Demonstrate cognitive knowledge of the skills required in conducting research on digital market opportunities

| | | |
|-------------------|--|---------------|
| MODULE I | Going Digital - The Evolution of Marketing: The changing face of advertising, The technology behind digital marketing, Need of digital marketing strategy, business and digital marketing, Defining the digital marketing strategy , Understanding the digital consumer, Mind the Ps – Place, Price, Product and Promotion. | 08 hrs |
| MODULE II | The Search For Success : Search: the online marketer’s holy grail, About the engines, Optimizing the site for the engines, Advertising on the search engines, Black Hat - the darker side of search, Universal search – more opportunities to rank. Website intelligence and return on investment - Measuring the way to digital marketing success, Information measuring, Measuring what’s important to you, Harness the power of online data, and watch the ROI take off. | 10 hrs |
| MODULE III | Search Engine Optimization: Introduction to SEO, On-Page SEO, Off-Page SEO, Local SEO, Steps involved: On-Page SEO, Site structure, Good site structure, Creating a sitemap, Conducting keyword research, Optimizing your site content, Link building process, White Hat vs Black Hat SEO, SEO tools and helpful sites. | 08 hrs |
| MODULE IV | Email Marketing And Social Media Marketing: Email Marketing - Introduction to Email Marketing, Steps involved: Email Marketing, Email List Segmentation, Metrics to Analyze, Email Marketing tools and helpfulesites. Social Media Marketing: Facebook, twitter, LinkedIn, Pinterest, Google+, Youtube, Advertising on social platforms, Social Media Marketing tools and helpfulesites. | 08 hrs |
| MODULE V | Web Analytics: Installing Introducing Google Analytics- Digital Analytics, Working of Google Analytics, Google Analytics setup, How to set up views with filters, The Google Analytics Interface, Navigating Google Analytics, Google Analytics reports- Case studies. | 06 hrs |

TEXT BOOKS

- [1] Damian Ryan & Calvin Jones, “*Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation*”, Kogan Page Limited, Fourth Edition, 2016.
(Chapter 1,4,5,6,7)

REFERENCE BOOKS

- [2] Shivani Karwal, “*Digital Marketing Handbook: A Guide to Search Engine Optimization, Pay Per Click Marketing, Email Marketing, Social Media Marketing and Content Marketing*”, Create Space Independent Publishing Platform, 2015.
- [3] Ian Dodson, “*The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns*”, Wiley, First Edition, 2016.
- [4] Deepak Bansal, “*A Complete Guide To Search Engine Optimization*”, B.R. Publishing Corporation, First Edition.
- [5] Justin Cutroni, “*Google Analytics: Understanding Visitor Behavior*”, Shroff, First Edition.

4MCACDP: COMMUNITY DEVELOPMENT PROJECT

CDP is a service oriented activity that should be taken up by students and will be assessed for 50 marks with 1 credit for about 30 hours.