PROGRAM STRUCTURE FOR MCA (2-YEARS)
KHONGNANGTHABA UNIVERSITY (W.E.F 2023-24)

For the graduates, not having graduation in Computer Science/ Information Technology/ Computer Applications, need to complete the bridge course in first year of MCA along with the semester I and II of MCA.

Total Credits: 100 Credits.

OUTLINE OF SYLLABUS

Semester I

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCABR1	Computer Organization & Architecture (Bridge Course 1)	3-1-0	0		
KMCABR2	Introduction to UNIX & C Programming (Bridge Course 2)	3-1-0	0		
KMCA-101C	Object Oriented Programming using JAVA	3-1-0	4	25	75
KMCA-102C	Mathematical Foundation for Computer Applications	3-1-0	4	25	75
KMCA-103C	Problem Solving with Python	3-1-0	4	25	75
KMCA-104C	Operating System	3-1-0	4	25	75
KMCA-105C	Advanced Web Technology	3-1-0	4	25	75
KMCA-106CL	Java programming + Web Tech	0-1-6	2	10	40
KMCA-107CL	Python + UNIX/Shell Programming Lab	0-1-6	2	10	40
Semester Total			24	600	

Semester II

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCABR3	Data Structure (Bridge Course 3)	3-1-0	0		
KMCA-201C:	Probability and Statistics	3-1-0	4	25	75
KMCA-202C:	Computer Networks	3-1-0	4	25	75
KMCA-203C:	Database Management Systems	3-1-0	4	25	75
KMCA-204C	Formal Language and Automata Theory	3-1-0	4	25	75
KMCA-205C	Software Engineering	3-1-0	4	25	75
KMCA-206C	Elective 1	3-1-0	4	25	75
KMCA-207CL	Data Structure Lab	0-1-6	2	10	40
KMCA-208CL	DBMS Lab	0-1-6	2	10	40
Semester Total			28	700	

Semester II Elective - 1

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-206C E1.1	Combinatorics and Graph Theory	3-1-0	4	25	75
KMCA-206C E1.2	Digital Image Processing	3-1-0	4	25	75
KMCA-206C E1.3	Machine Learning	3-1-0	4	25	75
KMCA-206C E1.4	Data Visualization	3-1-0	4	25	75
KMCA-206C E1.5	Neural Network	3-1-0	4	25	75

Semester III

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-301C	Artificial Intelligence	3-1-0	4	25	75
KMCA-302C	Design and Analysis of Algorithm	3-1-0	4	25	75
KMCA303C	Computer Graphics	3-1-0	4	25	75
CBCS1	IT Tools and Applications	3-1-0	4	25	75
KMCA-304C	Elective 2	3-1-0	4	25	75
KMCA-305C	Elective 3	3-1-0	4	25	75
KMCA-306CP1	Minor Project	0-1-6	4	25	75
Semester Total				28	700

Semester III Elective - 2

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-304C E2.1	Natural Language Processing (NLP)	3-1-0	4	25	75
KMCA-304C E2.2	Computer and Network Security	3-1-0	4	25	75
KMCA-304C E2.3	Data Analytics	3-1-0	4	25	75
KMCA-304C E2.4	Blockchain	3-1-0	4	25	75
KMCA-304C E2.5	Data Mining	3-1-0	4	25	75
KMCA-304C E2.6	DevOps	3-1-0	4	25	75
KMCA-304C E2.7	Text Mining and Analytics	3-1-0	4	25	75

Semester III Elective - 3

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-305C E3.1	Internet-of-Things	3-1-0	4	25	75
KMCA-305C E3.2	Deep Learning	3-1-0	4	25	75
KMCA-305C E3.3	Cloud Computing	3-1-0	4	25	75
KMCA-305C E3.4	Computer Vision	3-1-0	4	25	75
KMCA-305C E3.5	Big Data Analytics	3-1-0	4	25	75
KMCA-305C E3.6	Wireless Sensor Network/ Mobile Adhoc Network	3-1-0	4	25	75
KMCA-305C E3.7	High Performance Parallel Programming	3-1-0	4	25	75

Semester IV

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
CBCS2	Web Technology/Data Analysis using Python Programming	3-1-0	4	25	75
KMCA-401CP2	Major Project	0-1-6	12	300	
KMCA-401IV	Industrial Visit		4		
Semester Total			20	400	

DETAILED SYLLABUS

Semester I

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCABR1	Computer Organization & Architecture (Bridge Course 1)	3-1-0	0		
KMCABR2	Introduction to UNIX & C Programming (Bridge Course 2)	3-1-0	0		
KMCA-101C	Object Oriented Programming using JAVA	3-1-0	4	25	75
KMCA-102C	Mathematical Foundation for Computer Applications	3-1-0	4	25	75
KMCA-103C	Problem Solving with Python	3-1-0	4	25	75
KMCA-104C	Operating System	3-1-0	4	25	75
KMCA-105C	Advanced Web Technology	3-1-0	4	25	75
KMCA-106CL	Java programming + Web Tech	0-1-6	2	10	40
KMCA-107CL	Python + UNIX/Shell Programming Lab	0-1-6	2	10	40
Semester Total			24	600	

Subject : Computer Organization & Architecture

Subject Code :KMCABR1

Credit : 0 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Familiar with baisc logic gates -- AND, OR & NOT, XOR, XNOR; Independently or work in team to build simple logic circuits using basic
2. Be able to design and analyze combinational logic circuits.
3. Be able to design and analyze sequential logic circuits.
4. Understanding of modern computer systems, semiconductor memory organization.

Unit **L+T Hour**

Unit-I :Number System:- **6Hours**

Binary, Octal and Hexadecimal. Positive and negative numbers; Fixed point and floating point quantities.

Arithmetic operations: Addition, subtraction etc.

Character Code: ASCII, EBCDIC and Unicode.

Redundant coding for error detection and correction: Concept of Hamming distance, parity codes, Hamming codes, block codes, Cyclic redundancy codes.

Unit-II :Boolean Algebra:- **6 Hours**

Boolean variables and functions-canonical and standard forms, truth table, minimisation of boolean function.

Unit-III:Karnaugh map:- **6 Hours**

Simplification of Boolean function using Karnaugh map – octet, quad, pair mappings; with two, three, and four variable functions; using don't care functions.

Unit-IV :Combinational logic circuits:- **6 Hours**

AND, OR, NOT, NAND, NOR, X-OR gates and tri-state buffer; implementation of Boolean functions using logic gates; Multiplexers, decoders, encoders, simple arithmetic and logic circuits.

Unit-V: Sequential Circuits:-6 Hours

filp-flops, triggering of flip-flops, registers, shift registers and counters (asynchronous and synchronous).

Unit-VI :Semiconductor memory:-6 Hours

RAM, ROM; magnetic core and surface memory- disk, drum, tape; Solid state disk, Flash memory; Access time and cost considerations; concepts of volatility, random access, serial access, direct access, online and backup storage.

Unit-VII : CPU Block Diagram:- **6 Hours**

Simple functional block diagram of a CPU with its relevant units. Generations of digital computers.

Unit-VIII : Microprocessor Programming :- **6 Hours**

Introduction to microcontroller, microprocessor, 8085/8086 programming concepts.

Reference Books:

1. Mano, M.M.: "Digital Logic and Computer Design", Pearson, 2004.
2. Rajaraman, V., Radhakrishan: " An Introduction to Digital Computer Design," 4th edition, PHI(EEE).
3. Mano, M.M.: "Computer System Architecture," 3rd edition, Pearson.
4. Hamacher, Vranesic, Zaky, "Computer Organization", 5th Tata McGraw-Hill.
5. Albert Paul Malvino& Jerald Brown: "Digital Computer Electronics," 3rd edition, McGraw-H

Subject : Introduction to UNIX & C Programming

Subject Code :KMCABR2

Credit : 0 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe the architecture and features of UNIX Operating System and distinguish it from other Operating System
2. Demonstrate UNIX commands for file handling and process control
3. Write Regular expressions for pattern matching and apply them to various filters for a specific task
4. Analyze a given problem and apply requisite facets of SHELL programming in order to devise a SHELL script to solve the problem

Unit **L+T Hour**

Unit -I: Overview :- **7 Hours**

Algorithms, Flow Charts, Variables, Data types, Constants, Declarations, Operators, Precedence, Associativity, Order of evaluation, Type conversion, Storage classes, Programming Examples

Unit -II :Input and output statements:- **7 Hours**

scanf, getchar, gets, printf, putchar, puts; Control Statements – if, else-if, switch, Control Structures – while, for, do-while, break and continue, goto, Programming Examples

Unit -III :Arrays:- **7 Hours**

Single dimension, Two dimensional, Multi dimensional Arrays, Strings, Programming Examples

Unit -IV :Functions:- **7 Hours**

Categories of functions, Pointers, Pointer arithmetic, Call by value, Pointer Expression, Pointer as function arguments, , recursion, Passing arrays to functions, passing strings to functions, Call by reference, Functions returning pointers, Pointers to functions, Programming Examples

Unit -V :Structures and Unions:- **7 Hours**

defining, declaring, initialization, accessing, comparing, operations on individual members; array of structures, structures within structures, structures and functions, pointers and structures, bit fields, Programming Examples

Unit -VI:Files:- **6 Hours**

defining, opening, closing, input and output operations, error handling, random access; Command line arguments;

Unit -VII:Dynamic Memory Allocation:- **7 Hours**

definition, malloc, calloc, realloc, free, dynamic arrays

Preprocessor – definition, macro substitution, file inclusion, compiler control directives, Programming Examples

Text Books

1. Programming in ANSI C, Balaguruswamy, Tata McGraw-Hill, 6thEdn.
2. The C Programming Language, Brian W Kernighan, Dennis M Rtchie, PHI, 2ndEdn.

Reference Books

1. Programming with C, Byron Gottfried, Tata McGraw-Hill edition
2. Simplifying C, HarshalArolkar, Sonal Jain, Wiley Publications
3. Head First C, David Griffiths, & Dawn Griffiths, O'Riley.
4. C Programming, Dr. Vishal M Lichade, Dreamtech press. 2ndEdn.

Subject : Object Oriented Programming using JAVA

Subject Code :KMCA-101C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
2. Understand dynamic memory management techniques
3. using pointers, constructors, destructors, etc
4. Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.
5. Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming.
6. Demonstrate the use of various OOPs concepts with the help of program

Unit **L+T Hour**

PART A

Unit I : An Overview of Java: -- **7+2=9 Hours**

Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Using Blocks of Code, Lexical Issues, The Java Class Libraries, Data Types, Variables, and Arrays: Java Is a Strongly Typed Language, The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays, A Few Words About Strings

Unit II : Operators: - **7+2=9 Hours**

Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses, Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.

Unit III : Object and Class 1: - **7+2=9 Hours**

Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, The this Keyword, Garbage Collection, The finalize( ) Method, A Stack Class, A Closer Look at Methods and Classes: Overloading Methods, Using Objects as Parameters, A Closer Look at Argument Passing, Returning Objects, Recursion

Unit IV : Class 2: - **7+2=9 Hours**

Introducing Access Control, Understanding static, Introducing final, Arrays Revisited, Inheritance: Inheritance, Using super, Creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.

Unit V : Interface and Packages: - **8+2=10 Hours**

Defining Interfaces, Extending Interfaces, Implementing Interfaces, Accessing Interface Variables. Java API Packages, Using System Packages, Naming Conventions, Creating Packages, Accessing a Package, Using a Package, Adding a Class to a Package, Hiding Classes, Static Import.

Unit VI : Exception Handling and I/O: - **7+2=9 Hours**

Exceptions-Handling-Fundamentals, exception types, using try and catch, multiple catch clause, nested try statements – throw, throws and finally, built-in exceptions, creating own exceptions. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

Unit VII : Multithreaded Programming: - **7+2=9 Hours**

Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the 'Runnable' Interface, Inter-thread communication. vectors, lists, maps.

Textbook

1. Java: The Complete Reference, Twelfth Edition Paperback – 23 December 2021 by Herbert Schildt

References

1. Java Performance: The Definitive Guide: Getting the Most Out of Your Code by Scott Oaks

Subject : Mathematical Foundation for Computer Applications

Subject Code : KMCA-102C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the notation of mathematical thinking, mathematical proofs, and algorithmic thinking and be able to apply them in problem solving.
2. Understanding the basics of combinatorics, and be able to apply the methods from these subjects in problem solving.
3. Be able to use effectively algebraic techniques to analyse basic discrete structures and algorithms.
4. Understand basic properties of graphs and related discrete structures, and be able to relate these to practical examples.

Unit **L+T Hour**

Unit -I :Set Theory:- **5 Hours**

Sets and Subsets, set operations and the laws of Set theory, counting and Venn diagrams, cardinality-countable and uncountable sets.

Unit -II :Relations and Functions :- **6 Hours**

Cartesian products and relations. Computer representation of relations -diagraphs, Hasse diagrams, zero-one matrices . Partial orders, equivalence relation and partitions. Functions-injective, surjective, bijective. The Pigeon-hole principle, composition of functions and inverse functions.

Unit -III :Fundamentals of Logic :- **6 Hours**

Basic connectives and Truth tables, Logic equivalence- The laws of logic, Logical implication- Rules of inference, Predicate Calculus; Predicate and Quantifiers. Definitions and Proofs of Theorems.

Unit -IV :Properties of integers:- **5 Hours**

Mathematical Induction, Well ordering principle-Mathematical induction, Recursive definitions.

Unit -V :Algebraic Structures, Codding theory and Rings :- **7 Hours**

Groups, Subgroups, Monoids, Submonoids, Normal subgroups, Homomorphisms, Isomorphism and Cyclic groups.

Elements of coding theory, the Hamming metric, the parity check and generator matrices.

Unit -VI : Matrices and Boolean Algebra :- **6 Hours**

Lattice and its properties, Axiomatic definition of Boolean Algebra as algebraic structure ; Duality ; Basic results; Boolean Algebra of truth values; Applications (switching circuits,

decision tables).

Unit-VII **7 Hours**

Matrices and system of linear equations, operation of matrices; Solution of system of linear equations using matrix method. Eigen values, eigen vectors, diagonalisation of matrices.

Text Book

1. Ralph P Grimaldi, “Discrete & Combinatorial Mathematics,” 5th Edition, Pearson Education, 2004.

Reference Books

1. Alan Doerr, Kenneth Levasseur : “Applied Discrete Structures for Computer Science”, Galgotia Publications Pvt. Ltd.
2. Kenneth H Rosen, “Discrete Mathematics & its Applications," 7th edition, McGraw-Hill, 2010

Subject : Problem Solving with Python

Subject Code : KMCA-103C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

1. Develop algorithmic solutions to simple computational problems.
2. Demonstrate programs using simple Python statements and expressions
3. Explain control flow and functions concept in Python for solving problems.
4. Use Python data structures –lists, tuples & dictionaries for representing compound data.
5. Explain files, exception, modules and packages in Python for solving problems.

Unit **L+T Hour**

UNIT – I 6+2=8 Hours

Introduction: History of Python, Need of Python Programming, Applications, Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT – II: 8+2=10 Hours

Types, Operators, and Expressions: Types – Numbers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.

UNIT – III: 7+3=10 Hours

Data Structures: Lists, Tuples, Sets, Dictionaries, Sequences. Operations on Data Structures. Slicing, Methods. List Comprehensions.

UNIT – IV: 9+3=12 Hours

Functions: Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Scope of the Variables in a Function, Global and Local Variables, Lambda Expression, Anonymous Functions.

Modules: Using Python Packages - Creating modules, import statement, namespacing, Python packages, Introduction to PIP, Installing Packages via PIP.

UNIT – V: 9+3=12 Hours

Object-Oriented Programming in Python: Classes, self-variable, Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

UNIT – VI: 9+3=12 Hours

Brief Tour of the Standard Library – Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Multithreading, GUI Programming, Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

Text/Reference.

1. The Fundamentals of Python: First Programs, by Kenneth A. Lambert, 2 Edition,Cengage Learning India Pvt. Ltd., 2019.

2. W3schools.com/python

Subject: Operating Systems

Subject Code :KMCA-104C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basics of operating systems like kernel, shell, types and views of operating systems
2. Describe the various CPU scheduling algorithms and remove deadlocks.
3. Explain various memory management techniques and concept of thrashing
4. Use disk management and disk scheduling algorithms for better utilization of external memory.
5. Recognize file system interface, protection and security mechanisms.
6. Explain the various features of distributed OS like Unix, Linux, windows etc.

Unit **L+T Hour**

UNIT-1: Introduction and Operating-System Structures:- 6+2=8 Hours

Introduction: What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Operations, Resource Management, Security and Protection, Virtualization, Distributed Systems, Kernel Data Structures, Computing Environments, Free and Open-Source Operating Systems, **Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, System Services, Linkers and Loaders, Why Applications Are Operating-System Specific, Operating-System Design and Implementation, Operating-System Structure, Building and Booting an Operating System, Operating-System Debugging

UNIT-2: Process Management :- 6+2=8 Hours

Processes: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems, Examples of IPC Systems, Communication in Client – Server Systems, **Threads & Concurrency:** Overview of Threads, Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues, **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multi-Processor Scheduling, Real-Time CPU Scheduling, Operating-System Examples, Algorithm Evaluation

UNIT-3: Process Synchronization:- 6+2=8 Hours

Synchronization Tools: Background, The Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors, Liveness, Evaluation **SynchronizationExamples:** Classic Problems of Synchronization, Synchronization within the Kernel, POSIX Synchronization, Synchronization in Java, Alternative Approaches, **Deadlocks:** System Model, Deadlock in Multithreaded Applications, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock

UNIT-4: Memory Management:- **6 +2=8 Hours**

Main Memory: Background ,Contiguous Memory Allocation ,Paging ,Structure of the Page Table ,Swapping ,Example: Intel 32- and 64-bit Architectures ,Example: ARMv8 Architecture ,**Virtual Memory :**Background **,**Demand Paging ,Copy-on-Write ,Page Replacement ,Allocation of Frames ,Thrashing ,Memory Compression ,Allocating Kernel Memory ,Other Considerations ,Operating-System Examples

UNIT-5: Storage Management: **6+2=8 Hours**

Mass-Storage Structure: Overview of Mass-Storage Structure ,HDD Scheduling ,NVM Scheduling ,Error Detection and Correction ,Storage Device Management ,Swap-Space Management ,Storage Attachment ,RAID Structure ,**I/O Systems :** Overview ,I/O Hardware ,Application I/O Interface ,Kernel I/O Subsystem ,Transforming I/O Requests to Hardware Operations ,STREAMS ,Performance

UNIT-6: File System:- **6+2=8 Hours**

File-System Interface: File Concept, Access Methods ,Directory Structure ,Protection ,Memory-Mapped Files,**File-System Implementation:** File-System Structure ,File-System Operations ,Directory Implementation ,Allocation Methods ,Free-Space Management ,Efficiency and Performance ,Recovery ,Example: The WAFL File **System,File-System Internals:** File Systems ,File-System Mounting ,Partitions and Mounting ,File Sharing ,Virtual File Systems ,Remote File Systems ,Consistency Semantics ,NFS

UNIT-7: Security And Protection:- **6+2=8 Hours**

Security :The Security Problem ,Program Threats ,System and Network Threats ,Cryptography as a Security Tool ,User Authentication ,Implementing Security Defenses ,An Example: Windows 10 ,**Protection :**Goals of Protection ,Principles of Protection ,Protection Rings ,Domain of Protection ,Access Matrix ,Implementation of the Access Matrix ,Revocation of Access Rights ,Role-Based Access Control ,Mandatory Access Control (MAC) ,Capability-Based Systems ,Other Protection Improvement Methods ,Language-Based Protection

UNIT-8: Case Studies :- **6+2=8 Hours**

The Linux System :Linux History ,Design Principles ,Kernel Modules ,Process Management ,Scheduling ,Memory Management ,File Systems ,Input and Output ,Interprocess Communication ,Network Structure ,Security,**Windows 10 :**History **,**Design Principles ,System Components **,**Terminal Services and Fast User Switching ,File System, Networking,Programmer Interface

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Concepts, 10th Edition, Wiley India, 2018.(Listed topics only from Chapters 1 to 17, 20,21)

Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson,2018
2. Andrew S.Tanenbaum, Herbert Bos, Modern Operating Systems, Fourth Edition, Pearson,2014

Subject : Advanced Web Technology

Subject Code : KMCA-105C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

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

Unit **L+T Hour**

PART-A

UNIT 1 **6+2=8 Hours**

Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples.

UNIT 2 :CGI Scripting:- **6+2=8 Hours**

What is CGI? Developing CGI Applications, Processing CGI, Introduction to CGI.pm, CGI.pm methods,

Creating HTML Pages Dynamically, Using CGI.pm – An Example, Adding Robustness, Carp, Cookies

UNIT 3 :Building Web Applications with Perl :- **6+2=8 Hours**

Uploading files, Tracking users with Hidden Data, Using Relational Databases, using lib www,

UNIT 4 :Introduction to PHP :- **6+2=8 Hours**

Origins and uses of PHP , Overview of PHP , General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files.

UNIT 5 :Building Web applications with PHP :- **6+2=8 Hours**

Tracking users, cookies, sessions, Using Databases, Handling XML.

UNIT 6:Introduction to Ruby:- **6+2=8 Hours**

Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

UNIT 7 :Introduction to Rails and web 2.0:- **6+2=8 Hours**

Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.

What is Web 2.0?, Folksonomies and Web 2.0, Software As a Service (SaaS), Data and Web 2.0, Convergence,

Iterative development, Rich User experience, Multiple Delivery Channels, Social Networking.

UNIT8: WebServices:- **6+2=8 Hours**

Web Services: SOAP, RPC Style SOAP, Document style SOAP, WSDL, REST services, JSON format, What is JSON?,

Array literals, Object literals, Mixing literals, JSON 0053yntax, JSON Encoding and Decoding, JSON versus XML.

Text Books:

1. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006 (Chapter 10,11,13)

2. Robert W. Sebesta: Programming the World Wide Web, 4thEdition, Pearson Education, 2008. (Chapters 8,11,13, 14, 15)3. Francis Shanahan: Mashups, Wiley India 2007(Chapters 1, 6)

Reference Books:

1. M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, 3rd Edition, Pearson Education / PHI, 2004.2. Xue Bai et al: The Web Warrior Guide to Web Programming, Thomson, 2003.

3. Joel Murach's PHP and MySQL. Mauch's Publications, First Edition.

Subject : Java Pogramming + Web Tech

Subject Code : KMCA-106L

Credit : 2 **Class Hour : (L-0+ T-1+ P-6=7/ week**

Lecture Hours (L) : 0 **Tutorial Hour (T) : 16**

Exam Marks: 40 **I.A. Marks : 10**

Exam Hours: 03

Practical Questions:

Q1 Write a Java Program to practice using String class and its methods.

Q2. Write a Java Program to implement inheritance and demonstrate use of method overriding.

Q3. Write a Java Program to implement multilevel inheritance by applying various access control to its data members and methods.

Q4. Write a Java Program to demonstrate use of extending interfaces.

Q5. Write a Java Program to implement the concept of importing classes from user defined package and creating packages.

Q6. Write a Java Program to implement the concept of Exception Handling by creating user defined exceptions.

Q7. Create an XHTML page to demonstrate the usage of
a) Text Formatting tags b) Links c) Images d) Tables

Q8. Develop and demonstrate the usage of inline and external style sheet using CSS

Q9. Develop and demonstrate a XHTML file that includes JavaScript script for the following problems:

a**) Input**: A number n obtained using prompt
Output: The first n Fibonacci numbers
b) **Input**: A number n obtained using prompt
Output: A table of numbers from 1 to n and their squares using alert

Q10. Develop and demonstrate using JavaScript, a XHTML document that displays random numbers (integers).

Q11. Develop and demonstrate, using JavaScript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected.

Q12. Develop and demonstrate, using JavaScript script, a XHTML document that contains three images, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.

Q13. Develop using JavaScript script, an XHTML document that use of onload and onfocus events

Subject : Python + UNIX/Shell Programming

Subject Code : KMCA-107L

Credit : 2 **Class Hour : (L-0+ T-1+ P-6=7)/ week**

Lecture Hours (L) : 0 **Tutorial Hour (T) : 16**

Exam Marks: 40 **I.A. Marks : 10**

Exam Hours: 03

Practical Questions:

Q1. Create a list and perform the following methods

(i) insert ( ) (ii) remove ( ) (iii) append ( ) (iv) len ( ) (v) pop( ) (vi) clear ( )

Q2. Create a list dictionary and apply the following methods

(i) Print the dictionary items (ii) access items (iii) useget ( ) (iv) change values (v) use len ( )

Q3. Write a Python program to read a number and check for its prime.

Q4. Write a Python program to read a number N and print the first n terms for Fibonacci number.

Q5. Write a Python program to read N to generate a pyramid. **Hint**: for input **N=5**

```
    1
   1 2 1
  1 2 3 2 1
1 2 3 4 5 4 3 2 1
```

Q6 Write a Python program to read N to generate a pyramid. **Hint**: for input **N=5**

```
1 2 3 4 5 4 3 2 1
  1 2 3 4 3 2 1
    1 2 3 2 1
      1 2 1
        1
```

Q7. Write a Python Program to read N and output the following output.

Hint: for input N= 4

1

2 2

3 3 3

4 4 4 4

Q8. Write a Python program to red N to generate a pyramid.

Hint For input N=4

```
   *
  * * *
 * * * * *
* * * * * * *
```

Q9. Write a Python program to read N, and print the sum of first N even positive number.

Q10. Write a program to create a menu with the following options

1. TO PERFROM ADDITION
2. TO PERFROM SUBTRACTION
3. TO PERFROM MULTIPICATION
4. TO PERFROM DIVISION

Accepts users input and perform the operation accordingly. Use functions with arguments

Q11. Write a Python program to check whether the given string is palindrome or not.

Q12. Write a Python program to find factorial of a given number using number functions

Q13. Write a program to double a given number and add two number using ***lambda*** ( )

Q14. Write a program for ***Filter*** ( ) to Filter only even numbers from a given list.

Q15. Write a program for ***map*** ( ) function to double all the items in the list?

Q16. Write a program to find sum of the number for the elements of the list by using ***reduce*** ( )

Q17. Write a Python program to open and write “hello world” into a file

Q18. Write a Python program to get python version.

Q19. Write a python program to print date, time using date and time functions

Q20. Write a Python program to print all the months of given year.

Q21. Write a shell script to accept a number and print the sum of its digits.

Q22. Write a shell script program to convert Fahrenheit to Celsius digit.

Q23. Write shell script to read 5 digit number and calculate the sum of digit.

Q24. Write shell script to read a number and find whether the number is odd or even.

Q25. Write shell script to check entered character is uppercase lowercase numeric digit or special character.

Q26. Write a shell script to check whether the number is Armstrong or not.

Q27. Write a shell script to reverse a number

Q28. Write a shell script to find smallest of three numbers that are read from keyboard.

Q29. Write a shell script to check the entered no is palindrome or not.

Q30. Write a shell script to perform mathematical operations using menu. (+-*/)

Semester II

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCABR3	Data Structure (Bridge Course 3)	3-1-0	0		
KMCA-201C:	Probability and Statistics	3-1-0	4	25	75
KMCA-202C:	Computer Networks	3-1-0	4	25	75
KMCA-203C:	Database Management Systems	3-1-0	4	25	75
KMCA-204C	Formal Language and Automata Theory	3-1-0	4	25	75
KMCA-205C	Software Engineering	3-1-0	4	25	75
KMCA-206C	Elective 1	3-1-0	4	25	75
KMCA-207CL	Data Structure Lab	0-1-6	2	10	40
KMCA-208CL	DBMS Lab	0-1-6	2	10	40
Semester Total			28	700	

Semester II Elective - 1

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-206C E1.1	Combinatorics and Graph Theory	3-1-0	4	25	75
KMCA-206C E1.2	Digital Image Processing	3-1-0	4	25	75
KMCA-206C E1.3	Machine Learning	3-1-0	4	25	75
KMCA-206C E1.4	Data Visualization	3-1-0	4	25	75
KMCA-206C E1.5	Neural Network	3-1-0	4	25	75

Subject : Data Structures

Subject Code :KMCABR3

Credit : 0 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the concept of Dynamic memory management, data types, algorithms, Big O notation
2. Understand basic data structures such as arrays, linked lists, stacks and queues.
3. Describe the hash function and concepts of collision and its resolution methods
4. Solve problem involving graphs, trees and heaps
5. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

Unit **L+T Hour**

PART A

UNIT - 1 :BASIC CONCEPTS:- **6+2=8 Hours**

Pointers and Dynamic Memory Allocation, Algorithm Specification, Data Abstraction, Performance Analysis, Performance Measurement.

UNIT - 2 :ARRAYS and STRUCTURES:- **6+2=8 Hours**

Arrays, Dynamically Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays.

UNIT - 3 :STACKS AND QUEUES:- **7+1=8 Hours**

Stacks, Stacks Using Dynamic Arrays, Queues, Circular Queues Using Dynamic Arrays, Evaluation of Expressions, Multiple Stacks and Queues.

UNIT - 4 :LINKED LISTS:- **6+2=8 Hours**

Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials, Additional List operations, Sparse Matrices, Doubly Linked Lists.

PART - B

UNIT - 5 : TREES – 1:- **6+2=8 Hours**

Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees, Heaps, Binary Search Trees.

UNIT - 6 :HASHING:- **5+3=8 Hours**

Introduction, Static hashing: Hashing Tables, hashing functions, Overflow handling, Dynamic Hashing: motivation for Dynamic hashing, Dynamic hashing using directories, DirectorylessDynamic hashing.

UNIT - 7 **6+2=8 Hours**

MULTIWAY SEARCH TREES: M-way Search Trees, B-Trees, B+ Trees. Insertion deletion in B-Tree, B+ Trees.

UNIT - 8 :EFFICIENT BINARY SEARCH TREES:- **6+2=8 Hours**

Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Splay Trees.

Text Book:

1. Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2 Edition, University Press, 2007 (Chapters 1, 2.1 to 2.6, 3, 4, 5.1 to 5.3, 5.5 to 5.7, 8.1 to 8.3, 10, 11)

Reference Books:

1. Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2 Edition, Pearson Education, 2003.

Subject: Probability and Statistics

Subject Code: KMCA-201C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Solve problems by thinking logically, making conjectures, and constructing valid mathematical arguments
2. Make valid inferences from numerical, graphical and symbolic information
3. Apply mathematical reasoning to both abstract and applied problems, and to both scientific andnon-scientific problems.

Unit **L+T Hour**

PART A

UNIT-1.: Probability **6+2=8 Hours.**

Sample space, Events, Probability of an Event, Rules of Probability, Counting Sample Points, Additive Rules, Conditional Probability, Independent events and Product Rules, Bayes' Rule.

UNIT-2: **6+2=8 Hours.**

Random Variables, Probability Density and Probability Distributions

Discrete, Continuous and Mixed Random Variables, Function of a Random Variable, Probability Mass, Probability Density and Distribution Functions, Mathematical Expectations, Moments, Probability and Moment Generating Function, Median and Quartiles, Markov Inequality, Chebyshev's Inequality Problems.

UNIT-3: Special Distributions **6+2=8 Hours.**

Discrete Uniform, Binomial, Geometric, Negative Binomial, Hyper-Geometric, Poisson, Continuous Uniform, Exponential, Gamma, Beta, Normal, Inverse Gaussian, Double Exponential Distributions.

UNIT-4: Joint Distributions **6+2=8 Hours.**

Joint, Marginal and Conditional Distributions, Product Moments, Independence of Random Variables, Bivariate Normal Distribution Problems.

PART B

UNIT-5: Sampling Distributions **6+2=8 Hours.**

Random Sampling and Sampling Distributions, The Central Limit Theorem, Distributions of the Sample Mean and the Sample Variance for a Normal population, Chi-Square, t and F distributions, problems.

UNIT-6: Sample Estimation Problems **6+2=8 Hours.**

Statistical Inference, Classical Methods of Estimation, Single Sample: Estimating the Mean, Standard Error of a Point Estimate, Prediction Intervals, Tolerance Limits, Single Sample: Estimating the Variance.

UNIT-7: Regression and Correlation **6+2=8 Hours.**

Linear and Non-linear Regression, Least Square Method of Curve Fitting, Coefficient of Determination, Confidence Intervals in Linear Regression, Correlation Analysis, Principal Component Analysis, Factor Analysis, Analysis of Variance.

UNIT-8: Testing of Hypothesis **6+2=8 Hours.**

Statistical Hypotheses: General Concepts, Testing a Statistical Hypothesis, the Use of P-Values for Decision Making in Testing Hypotheses.

References:

1. JOHN E. FREUND'S; Mathematical Statistics with Applications, PEARSON.
2. AFFI. A.A.; Statistical Analysis: A Computer Oriented Approach, Academic Press Inc., 1779.
3. MORRIS, C.; ROLPH, J. Introduction to Data Analysis and Statistical Inference, Prentice Hall, 1981.
4. SCALZO, F.: Elementary Computer Assisted Statistics, Van NostrandReinherd Co. Ltd., 1978.
5. DRAPER, N.A.; SMITH, H: Applied Regression Analysis, John Wiley & sons, Inc.
6. ANDERSON, T.W.: An Introduction to Multivariate Statistical Analysis, John Wiley & sons, Inc.

Subject : Computer Networks

Subject Code :KMCA-202C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand computer network basics, network architecture, TCP/IP and OSI reference models.
2. Identify and understand various techniques and modes of transmission.
3. Describe data link protocols, multi-channel access protocols and IEEE 802 standards for LAN
4. Describe routing and congestion in network layer with routing algorithms and classify IPV4 addressing scheme.
5. Discuss the elements and protocols of transport layer.
6. Understand network security and define various protocols such as FTP, HTTP, Telnet, DNS

Unit **L+T Hour**

PART A

UNIT I :Introduction to Computer Networks:- **5+2=7 Hours**

Networking Devices, Classification of Computer Networks, Network Protocol Stack (TCP/IP and ISO-OSI), Network Standardization and Examples of Networks.

UNIT II: Physical Layer:- **6+2=8 Hours**

Data Transmission Concepts, Analog and Digital Data Transmission, Transmission Impairments and Channel Capacity, Guided and Wireless transmission, communication media, Digital modulation techniques (FDMA,TDMA,CDMA) and mobile telephone systems (1G,2G,3G and 4G).

UNIT III :Data Link layer:-6+2=8 Hours

Framing, Error control, Flow Control, Error Detection and Correction Codes, Data Link Protocols and Sliding window protocols.

UNIT IV :Medium Access Sub Layer:- **6+2=8 Hours**

Multiple access protocols and Examples : Ethernet, Wireless LAN, Broadband Wireless and Bluetooth, Data Link Layer Switching.

PART B

UNIT V: Hours Network Layer:-7+2=9 Hours

Network Layer Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking and The Network Layer in the Internet.

UNIT VI: The Transport Layer:- 6+2=8 Hours

The Transport Service, Elements of Transport Protocols, Congestion Control, The Internet Transport Protocol: UDP,The Internet Transport Protocols – TCP, Performance Issues.

UNIT VII: The application Layer:- 6+2=8 Hours

DNS, Email, WWW, Streaming audio and Video and Content Delivery

UNIT VIII: Network Security:- 6+2=8 Hours

Cryptography, Symmetric key, Public key Cryptography, Digital Signature.

Text Books

1. "Computer Networks" by Andrew S Tanenbaum, David J Wetheral, 5th Edition, Pearson 2012.
2. "Data and Computer Communications" by William Stallings , Above 7th edition , 2004

Reference:

1. Behrouz A. Forouzan,: Data Communication and Networking, 4th Edition Tata McGraw-Hill, 2006.

Subject :Database Management Systems

Subject Code : KMCA-203C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe DBMS architecture, physical and logical database designs, database modeling, relational, hierarchical and network models.
2. Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing.
3. Learn and apply Structured query language (SQL) for database definition and database manipulation.
4. Demonstrate an understanding of normalization theory and apply such knowledge to thenormalization of a database.
5. Understand various transaction processing, concurrency control mechanisms and database protection mechanisms.

Unit **L+T Hour**

PART A

UNIT – 1 Introduction: - **5+3=8 Hours**

Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT – 2 Entity-Relationship Model:- **6 +2=8Hours**

Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT – 3 Relational Model and Relational Algebra :- **7+1=8 Hours**

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT – 4 SQL – 1:- **6+2=8 Hours**

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries.

PART - B

UNIT – 5 SQL – 2: - **6+2=8 Hours**

Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures.

UNIT – 6 Database Design – 1:- **5+3=8 Hours**

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form

UNIT – 7 Database Design -2: - **6+2=8 Hours**

Properties of Relational Decompositions; Algorithms for Relational Database Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal Forms.

UNIT – 8 Transaction Management:- **7+1=8 Hours**

The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery; 2PL, Serializability and Recoverability; Lock Management; Introduction to ARIES; The log; Other recovery-related structures; The write-ahead log protocol; Checkpointing; Recovering from a System Crash; Media Recovery; Other approaches and interaction with concurrency control.

Text Books:

1. Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

(Chapters 1, 2, 3 except 3.8, 5, 6.1 to 6.5, 7.1, 8, 9.1, 9.2 except SQLJ, 9.4, 10)

2. Alexis Leon & Mathews Leon, Database Management Systems, Vikas Publishing House Pvt. Ltd. (Chapter 5,7,8,9,10,11,12,14,15,16,17,18,19,21,26,27,28,29,30,32)

Reference Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.

Subject :Formal Language and Automata Theory

Subject Code : KMCA-204C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basic concepts of formal languages, automata and grammar types, as well as the use of formal languages and reduction in normal forms
2. Demonstrate the relation between regular expressions, automata, languages and grammar with formal mathematical methods
3. Design push down automata, cellular automata and turing machines performing tasks of moderate complexity
4. Analyze the syntax and formal properties, parsing of various grammars such as LL(k) and LR(k)
5. Describe the rewriting systems and derivation languages

Unit **L+T Hour**

PART - A

UNIT – 1:Introduction to Finite Automata:- **6+2=8 Hours**

Introduction to Finite Automata; The central concepts of Automata theory; Deterministic finite automata; Nondeterministic finite automata

UNIT – 2 :Finite Automata, Regular Expressions:- **6+2=8 Hours**

An application of finite automata; Finite automata with Epsilon-transitions; Regular expressions; Finite Automata and Regular Expressions; Applications of Regular Expressions

UNIT – 3 :Regular Languages, Properties of Regular Languages:- **6+2=8 Hours**

Regular languages; Proving languages not to be regular languages; Closure properties of regular languages; Decision properties of regular languages; Equivalence and minimization of automata

UNIT – 4 :Context-Free Grammars And Languages :- **6+2=8 Hours**

Context –free grammars; Parse trees; Applications; Ambiguity in grammars and Languages.

PART – B

UNIT – 5:Pushdown Automata:- **6+2=8 Hours**

Definition of the Pushdown automata; the languages of a PDA; Equivalence of PDA's and CFG's; Deterministic Pushdown Automata

UNIT – 6 : Properties of Context-Free Languages:- **6+2=8 Hours**

Normal forms for CFGs; The pumping lemma for CFGs; Closure properties of CFLs

UNIT – 7 :Introduction To Turing Machine:- **6+2=8 Hours**

Problems that Computers cannot solve; The turning machine; Programming techniques for Turning Machines; Extensions to the basic Turning Machines; Turing Machine and Computers.

UNIT – 8 :Undecidability:- **6+2=8 Hours**

A Language that is not recursively enumerable; An Undecidable problem that is RE; Post's Correspondence problem; Other undecidable problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: Introduction to Automata Theory, Languages and Computation, 3th Edition, Pearson Education, 2007.(Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6, 7, 8.1 to 8.4, 8.6, 9.1, 9.2, 9.4.1, 9.5)

Reference Books:

1. K.L.P. Mishra: Theory of Computer Science, Automata, Languages, and Computation, 3th Edition, PHI Learning, 2009.

2. Raymond Greenlaw, H.James Hoover: Fundamentals of the Theory of Computation, Principles and Practice, Elsevier, 1998.

3. John C Martin: Introduction to Languages and Automata Theory, 3th Edition, Tata McGraw-Hill, 2007.

4. Thomas A. Sudkamp: An Introduction to the Theory of Computer Science, Languages and Machines, 3th Edition, Pearson Education, 2006.

5. C.K.Nagpal: Formal Languages and Automata Theory, Oxford Higher Education.

Subject : Software Engineering

Subject Code :KMCA-205C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.
2. Able to elicit, analyze and specify software requirements through a productive working relationship with various stakeholders of the project
3. Analyze and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
4. Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
5. Able to use modern engineering tools necessary for software project management, time management and software reuse.

Unit **L+T Hour**

PART – A

UNIT – 1 :Overview:- **6+2=8 Hours**

Introduction: FAQ's about software engineering, Professional and ethical responsibility. Socio-Technical systems: Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

UNIT – 2 :Critical Systems, Software Processes:- **6+2=8 Hours**

Critical Systems: A simple safety- critical system; System dependability; Availability and reliability.SEPSoftware Processes: Models, Process iteration, Process activities; The Rational Unified Process; Computer Aided Software Engineering.

UNIT – 3 : Requirements:- **6+2=8 Hours**

Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; Interface specification; The software requirements document.

Requirements Engineering Processes: Feasibility studies; Requirements

UNIT – 4 : System models, Project Management::- **6+2=8 Hours**

System Models**,** Context models; Behavioral models; Data models; Object models; Structured methods.Project Management: Management activities; Project planning; Project scheduling; Risk management

PART - B

UNIT – 5 : Software Design:- **6+2=8 Hours**

Architectural Design: Architectural design decisions; System organization; Modular decomposition styles; Control styles.

Object-Oriented design: Objects and Object Classes; An Object-Oriented design process; Design evolution.

UNIT – 6 : Development:- **6+2=8 Hours**

Rapid Software Development: Agile methods; Extreme programming; Rapid application development.Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.

UNIT – 7 :Verification and Validation:- **6+2=8 Hours**

Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Software testing: System testing; Component testing; Test case design; Test automation.

UNIT – 8 : Management: **6+2=8 Hours -**

Managing People: Selecting staff; Motivating people; Managing people; The People Capability Maturity Model.Software Cost Estimation: Productivity; Estimation techniques; Algorithmic cost modeling, Project duration and staffing.

Text Books:

1. Ian Sommerville: Software Engineering, 8th Edition, Pearson Education, 2007.(Chapters-: 1, 2, 3, 4, 5, 6, 7, 8, 11, 14, 17, 21, 22, 23, 25, 26)

Reference Books:

1. Roger.S.Pressman: Software Engineering-A Practitioners approach, 7th Edition, Tata McGraw Hill, 2007. 2. Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009.

Subject : Combinatorics and Graph Theory

Subject Code : KMCA-206CE1.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Describe important types of combinatorial optimization problems
2. Formulate combinatorial optimization problems as mathematical models and determine the difficulty of the problems with the help of complexity theory
3. Explain the design of and the principles behind efficient solution methods and use the methods for solving combinatorial optimization problems
4. Use available software for solving optimization problems take part of development of software for optimization problems

Unit **L+T Hour**

PART – A

UNIT - 1 :Introduction to Graph Theory:- **6+2=8 Hours**

Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits.

UNIT – 2 :Introduction to Graph Theory *contd*.:- **6+2=8 Hours**

Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials.

UNIT - 3 :Trees:- **6+2=8 Hours**

Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes.

UNIT - 4 :Optimization and Matching:- **6+2=8 Hours**

Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory.

PART – B

UNIT – 5:Fundamental Principles of Counting:- **6+2=8 Hours**

The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalan Numbers.

UNIT - 6 :The Principle of Inclusion and Exclusion:- **6+2=8 Hours**

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

UNIT - 7 :Generating Functions:- **6+2=8 Hours**

Introductory Examples, Definition and Examples – Calculation Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator.

UNIT - 8 :Recurrence Relations:- **6+2=8 Hours**

First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions.

Text Book:

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004.(Chapter 11, Chapter 12.1 to 12.4, Chapter 13, Chapter 1, Chapter 8.1 to 8.4, Chapter 9 Chapter 10.1 to 10.4).

Reference Books:

1. D.S. Chandrasekharaiah: Graph Theory and Combinatorics, Prism, 2005.
2. Chartrand Zhang: Introduction to Graph Theory, TMH, 2006.
3. Richard A. Brualdi: Introductory Combinatorics, 4th Edition, Pearson Education, 2004.
4. GeirAgnarsson& Raymond Geenlaw: Graph Theory, Pearson Education, 2007.

Subject : Digital Image Processing

Subject Code : KMCA-206CE1.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Review the fundamental concepts of a digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image restoration.
4. Categorize various compression techniques.
5. Interpret Image compression standards.
6. Interpret image segmentation and representation techniques.
7. Image Classification using CNN

Unit **L+T Hour**

UNIT – 1 :Digitized Image and its properties:- **6+2=8 Hours**

Basic concepts, Image digitization, Digital image properties

UNIT – 2 :Image Preprocessing:- **6+2=8 Hours**

Image pre-processing: Brightness and geometric transformations, local preprocessing.

UNIT – 3: Segmentation :- **6+2=8 Hours**

Thresholding, Edge-based segmentation, Region based segmentation, Matching.

UNIT – 4: Image Enhancement:- **6+2=8 Hours**

Image enhancement in the spatial domain: Background, Some basic gray level transformations, Histogram processing, Enhancement using arithmetic/ logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Image enhancement in the frequency domain: Background, Introduction to the Fourier transform and the frequency domain, Smoothing Frequency-Domain filters, Sharpening Frequency Domain filters, Homomorphic filtering.

UNIT – 5: Image Compression:- **6+2=8 Hours**

Image compression: Fundamentals, Image compression models, Elements of information theory, Error-Free Compression, Lossy compression.

UNIT – 6: Shape representation:- **6+2=8 Hours**

Region identification, Contour-based shape representation and description, Region based shape representation and description, Shape classes.

UNIT – 7 : Morphology:- **6+2=8 Hours**

Basic morphological concepts, Morphology principles, Binary dilation and erosion, Gray-scale dilation and erosion, Morphological segmentation and watersheds

UNIT – 8 : Image Pattern Classification:- **6+2=8 Hours**

Neural Networks and Deep Learning, Deep Convolutional Neural Networks (CNN)

Text Books:

1. Rafel C Gonzalez and Richard E Woods: Digital Image Processing, 4th Edition, Pearson Education, 2018.

2. Milan Sonka, Vaclav Hlavac and Roger Boyle: Image Processing, Analysis and Machine Vision, 4th Edition, Thomoson Learning, 2013.

Reference Books:

1. Anil K Jain, "Fundamentals of Digital Image Processing", PHI, 1997, Indian Reprint 2009.

2. B.Chanda, D Dutta Majumder, "Digital Image Processing and Analysis", 2nd Edition, PHI, 2011.

Subject : Machine Learning

Subject Code :KMCA-206C E1.3

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques
5. Design application using machine learning techniques.

Unit **L+T Hour**

PART-A

UNIT 1: Overview and Introduction to Bayes Decision Theory:- **6 +3=9 Hours**

Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches.

UNIT 2: Linear machines:- **7+2=9 Hours**

General and linear discriminants, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptrons: two-layers universal approximators, backpropagation learning, on-line, off-line error surface, important parameters.

UNIT 3:Learning decision trees:- **7+2=9 Hours**

Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data.

UNIT 4 :Instance-based Learning:- **7+2=9 Hours**

Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability

UNIT 5 : Machine learning concepts and limitations:- **7+3=10 Hours**

Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff.

UNIT 6 :Machine learning assessment and Improvement:- **7+2=9 Hours**

Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

UNIT 7: Support Vector Machines:- **7+2=9 Hours**

Margin of a classifier, dual perceptron algorithm, learning non- linear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Text Book

6. E. Alpaydin**, Introduction to Machine Learning**, Prentice Hall of India, 2006.
7. T. M. Mitchell, **Machine Learning**, McGraw-Hill, 1997.

Readings

1. C. M. Bishop, **Pattern Recognition and Machine Learning**, Springer, 2006.
2. R. O. Duda, P. E. Hart, and D.G. Stork, **Pattern Classification**, John Wiley and Sons, 2001.
3. Vladimir N. Vapnik, **Statistical Learning Theory**, John Wiley and Sons, 1998.
4. Shawe-Taylor J. and Cristianini N., Cambridge, **Introduction to Support Vector Machines**, University Press, 2000.

Subject : Data Visualization

Subject Code :KMCA-206CE1.4

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Identify the different data types, visualization types to bring out the insight.

2. Relate the visualization towards the problem based on the dataset to analyze and bring out valuable insight on large datasets.

3. Able to design interactive data visualization.

4. Demonstrate the analysis of large datasets using various visualization techniques and tools.

Unit **L+T Hour**

UNIT I: INTRODUCTION 10 hours

Context of data visualization – Definition, Methodology, Visualization design objectives. Key Factors – Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT II : VISUALIZING DATA METHODS 9 hours

Mapping - Time series - Connections and correlations - Scatterplot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics

UNIT III: VISUALIZING DATA PROCESS 10 hours

Acquiring data, - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV: INTERACTIVE DATA VISUALIZATION 9 hours

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – D3.js, tableau, Matplotlibsns.

UNIT V: SECURITY DATA VISUALIZATION 10 hours

Port scan visualization - Vulnerability assessment and exploitation - Firewall log visualization -Intrusion detection log visualization -Attacking and defending visualization systems - Creating security visualization system.

REFERENCES:

1. Scott Murray, “Interactive data visualization for the web”, O‟Reilly Media, Inc., 2013.

2. Ben Fry, “Visualizing Data”, O‟Reilly Media, Inc., 2007.

3. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.

Subject :Neural Networks

Subject Code :KMCA-206C(E1.5)

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the basic ideas and principles of neural networks.

2.Characterize the paradigms of supervised, unsupervised learning and Reinforcement (semi-supervised)

3.Understand the basic concepts of Perceptron, Multi-Layer Perceptron and the role of Backpropagation algorithms using gradient descent in neural applications.

4.Implement, train ,validate and test their own neural networks with real world problems.

5.Be able to apply fundamental knowledge of artificial neural network principles to understand and use modern machine learning tools

Unit **L+T Hour**

UNIT –1: Introduction: **8 Hours**

What is a Neural Network?, Human Brain, Models of Neuron, Network Architectures, Knowledge representation, Artificial Intelligence and Neural Networks. Examples of various Learning Paradigms.

UNIT –2 :Perceptrons: **8 Hours**

What is a Perceptron, Limitation of Perceptron, XOR Gate , Perceptron learning rule and proof of convergence, Delta Rule, limitations of Perceptron.

Activation Functions :

Sigmoid, ReLU, Hyperbolic Functions, Softmax,

UNIT –3 :

Multilayer Perceptrons: **10 Hours**

Introduction, Some preliminaries, Back-propagation Algorithm, Summary of back-propagation algorithm, XOR problem, Heuristics for making the back-propagation algorithm perform better, Gradient Descent, Stochastic Gradient Descent, Output representation and decision rule, Computer experiment, Feature detection, Back-propagation and differentiation.

Chain Rule, Backpropagating the Sensitivities. Various Loss Functions. Heuristics for avoiding bad local minima.

Optimization and Regularization :

Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyperparameters

UNIT 4:

Introduction to Deep Neural Netwiorks(DNN) , Some application programs using swallow neural networks such as two layers MLP architecture and Deep Neural Netwiorks(DNN), Generative Adversarial Networks

UNIT 5: Introduction to Convolutional Neural Networks: 10 Hours

Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications

UNIT 6: Introduction to Recurrent Neural Networks: 10 Hours

Introduction to RNNs, Hopfield Net, LSTM, RNN applications.,Generative Adversarial Networks(GANs) and generative modeling,

Text Books:

1.SimonHaykin: Neural Networks -A Comprehensive Foundation, 2nd Edition, Pearson Education, 1999.

2.KishanMehrotra, Chilkuri K. Mohan, Sanjay Ranka: Artificial Neural Networks, Penram International Publishing, 1997.

3. GANs in Action: Deep learning with Generative Adversarial Networks, J. Langr, V. Bok, Manning Publications, 2019

4. Philip D Washerman, Van strand Reinhold, New york, Neural Computing Theory and practice ,1989.

Reference Books and Links available on the web:

1. B.Y egnanarayana: ArtificialNeural Networks, PHI, 2001.

2.Introduction to Deep Learning, S. Kansi, Springer 2018

3.Deep Learning, I. Goodfellow, Y, Bengio, A. Courville, MIT Press, 2016.

4.Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006

5.UmbertoMichelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018

6. Video lectures for UofT Professor Geoffrey Hinton’s Coursera course. https://www.youtube.com/playlist?list=PLoRl3Ht4JOcdU872GhiYWf6jwrk SNhz9

7. Deep Learning, a textbook by YoshuaBengio, Ian Goodfellow, and Aaron Courville. http://www.deeplearningbook.org/

8. Andrej Karpathy’s lecture notes on convolutional networks. http://cs231n.github.io/

9. Richard Socher’s lecture notes, focusing on RNNs. http://cs224d.stanford.edu/syllabus.html

Subject :Data Structure Lab

Subject Code :KMCA-207CL

Credit : 2 **Class Hour : (L-0+ T-1+ P-6=7)/ week**

Lecture Hours (L) : 0 **Tutorial Hour (T) : 16**

Exam Marks: 40 **I.A. Marks : 10**

Exam Hours: 03

Practical Questions:

1. Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
2. Design, develop, and execute a program in C to convert a given valid parenthesized infix arithmetic expression to postfix expression and then to print both the expressions. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply), / (divide) and ^(power).
3. Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), * (multiply), / (divide) and ^(power).
4. Design, develop, and execute a program in C to simulate the working of a (linear & circular) queue of integers using an array. Provide the following operations: a) Insert b) Delete c) Display.
5. Design, develop, and execute a program in C to read a sparse matrix of integer values and to search the sparse matrix for an element specified by the user. Print the result of the search appropriately. Use the triple <row, column, value> to represent an element in the sparse matrix.
6. Design, develop, and execute a program in C to create a max heap of integers by accepting one element at a time and by inserting it immediately in to the heap. Use the array representation for the heap. Display the array at the end of insertion phase.
7. Design, develop, and execute a program in C to implement a doubly linked list where each node consists of integers. The program should support the following operations:
   - (i) Create a doubly linked list by adding each node at the front.
   - (ii) Insert a new node to the left of the node whose key value is read as an input.
   - (iii) Delete the node of a given data if it is found, otherwise display appropriate message.
   - (iv) Display the contents of the list.

   (**Note:** Only either (i, ii and iv) or (i, iii and iv) may be asked in the examination)
8. Create a link list P and perform the following operations.

(i)Insert an element x just before the element y in the list. If not found y insert at the end.

(ii)Delete an element x from the list. If not found x give proper message.

9. Create a binary search tree T and operate the following operations

   (i) Traverse the tree in the following orders In-order, Pre-order and Post-order.

   (ii)To delete a node from a binary search tree.

   (iii)To find the depth of a binary tree.

10. Design, develop, and execute a program in C to store a set integers in a hash table. Use the hashing function $h(x)=x \bmod N$, where x is the integer to be store and N is the size of the hash table which is a prime number. Search the hash table for a particular number y and print with appropriate message whether y is found or not.

Subject :DBMS Lab

Subject Code :KMCA-208CL

Credit : 2 **Class Hour : (L-0+ T-1+ P-6=7)/ week**

Lecture Hours (L) : 0 **Tutorial Hour (T) : 16**

Exam Marks: 40 **I.A. Marks : 10**

Exam Hours: 03

Practical Questions:

1. Consider the insurance database given below. The primary keys are made bold and the data types are specified.

   PERSON(**driver_id**:string , name:string , address:string) CAR(**regno**:string , model:string , year:int) ACCIDENT(**report_number**:int , accd_date:date , location:string)OWNS(**driver_id**:string , **regno**:string) PARTICIPATED(**driver_id**:string , **regno**:string , **report_number**:int , damage_amount:int)

   i) Create the above tables by properly specifying the primary keys and foreign keys.

   ii) Enter at least five tuples for each relation.

   iii) Demonstrate how you

      a. Update the damage amount for the car with specific regno in the accident with report number 12 to 25000.

      b. Add a new accident to the database.

   iv) Find the total number of people who owned cars that were involved in accidents in the year 2008.

   v) Find the number of accidents in which cars belonging to a specific model were involved.

2. Consider the following relations for a order processing database application in a company.

   CUSTOMER(**custno**:int , cname:string , city:string) ORDER(**orderno**:int , odate:date , custno:int , ord_amt:int) ORDER_ITEM(**orderno**:int , **itemno**:int , quantity:int) ITEM(**itemno**:int , unitprice:int) SHIPMENT(**orderno**:int , **warehouseno**:int , ship_date:date) WAREHOUSE(**warehouseno**:int , city:string)

   i) Create the above tables by properly specifying the primary keys and foreign keys.
   ii) Enter at least five tuples for each relation.
   iii) Produce a listing: custname , No_of_orders , Avg_order_amount , where the middle column is the total number of orders by the customer and the last column is the average order amount for that customer.

iv) List the orderno for orders that were shipped from ***all*** the warehouses that the company has in a specific city.

v) Demonstrate the deletion of an item from the ITEM table and demonstrate a method of handling the rows in the ORDER_ITEM table that contains this particular item.

3. Consider the following database of student enrollment in courses and books adopted for that course.

STUDENT(**regno**:string , name:string , major:string , bdate:date) COURSE(**courseno**:int , cname:string , dept:string) ENROLL(**regno**:string , **courseno**:int , **sem**:int , marks:int) BOOK_ADOPTION(**courseno**:int , **sem**:int , book_isbn:int) TEXT(**book_isbn**:int , book_title:string , publisher:string , author:string)

i) Create the above tables by properly specifying the primary keys and foreign keys.
ii) Enter atleast five tuples for each relation.
iii) Demonstrate how you add a new text book to the database and make this book to be adopted by some department.
iv) Produce a list of text books (includes courseno , book_isbn , book_title) in the alphabetical order for courses offered by the 'CS' department that use more than two books.
iv) List any department that has ***all*** its books published by a specific publisher.
v)

4. The following are maintained by abook dealer.

AUTHOR(**author_id**:int , name:string , city:string , country:string) PUBLISHER(**publisher_id**:int , name:string , city:string , country:string) CATALOG(**book_id**:int , title:string , author_id:int , publisher_id:int , category_id:int , year:int , price:int) CATEGORY(**category_id**:int , description:string) ORDER_DETAILS(**order_no**:int , **book_id**:int , quantity:int)

i) Create the above tables by properly specifying the primary keys and foreign keys.
ii) Enter at least five tuples for each relation.
iii) Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
iv) Find the author of the book that has maximum sales.
v) Demonstrate how you increase the price of books published by a specific publisher by 10%.

5. Consider the following database for a banking enterprise.

BRANCH(**branch_name**:string , branch_city:string , assets:real) ACCOUNT(**accno**:int , branch_name:string , balance:real) DEPOSITOR(**customer_name**:string , **accno**:int) CUSTOMER(**customer_name**:string , customer_street:string , customer_city:string) LOAN(**loan_number**:int , branch_name:string , amount:real) BORROWER(**customer_name**:string , **loan_number**:int)

i) Create the above tables by properly specifying the primary keys and foreign keys.

ii) Enter at least five tuples for each relation.
iii) Find ***all*** the customers who have at least two accounts at the ***main*** branch.
iv) Find all the customers who have an account at ***all*** the branches located in a specific city.
v) Demonstrate how you delete all account tuples at every branch located in a specific city.

Instructions:

1. The exercises are to be solved in an RDBMS environment like MySql, Oracle or DB2.
2. Suitable tuples have to be entered so that queries are executed correctly.
3. Front end may be created using either VB or VAJ or any other similar tool.
4. The student need not create the front end in the examination. The results of the queries may be displayed directly.
5. Relevant queries other than the ones listed along with the exercises may also be asked in the examination.
6. Questions must be asked based on lots.

Semester III

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-301C	Artificial Intelligence	3-1-0	4	25	75
KMCA-302C	Design and Analysis of Algorithm	3-1-0	4	25	75
KMCA303C	Computer Graphics	3-1-0	4	25	75
CBCS1	IT Tools and Applications	3-1-0	4	25	75
KMCA-304C	Elective 2	3-1-0	4	25	75
KMCA-305C	Elective 3	3-1-0	4	25	75
KMCA-306CP1	Minor Project	0-1-6	4	25	75
Semester Total				28	700

Semester III Elective - 2

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-304C E2.1	Natural Language Processing (NLP)	3-1-0	4	25	75
KMCA-304C E2.2	Computer and Network Security	3-1-0	4	25	75
KMCA-304C E2.3	Data Analytics	3-1-0	4	25	75
KMCA-304C E2.4	Blockchain	3-1-0	4	25	75
KMCA-304C E2.5	Data Mining	3-1-0	4	25	75
KMCA-304C E2.6	DevOps	3-1-0	4	25	75
KMCA-304C E2.7	Text Mining and Analytics	3-1-0	4	25	75

Semester III Elective - 3

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
KMCA-305C E3.1	Internet-of-Things	3-1-0	4	25	75
KMCA-305C E3.2	Deep Learning	3-1-0	4	25	75
KMCA-305C E3.3	Cloud Computing	3-1-0	4	25	75
KMCA-305C E3.4	Computer Vision	3-1-0	4	25	75
KMCA-305C E3.5	Big Data Analytics	3-1-0	4	25	75
KMCA-305C E3.6	Wireless Sensor Network/ Mobile Adhoc Network	3-1-0	4	25	75
KMCA-305C E3.7	High Performance Parallel Programming	3-1-0	4	25	75

Subject : Artificial Intelligence

Subject Code :KMCA-301C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**
Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**
Exam Marks: 75 **I.A. Marks : 25**
Exam Hours: 03

Course Outcomes:

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
4. Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.
5. Demonstrate proficiency in applying scientific method to models of machine learning.
6. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Unit **L+T Hour**

PART – A

Unit-I: Introduction:- **6+2=8 Hours**

Introduction to Artificial Intelligence, various definitions of AI, AI Applications and Techniques, Turing Test and Reasoning - forward & backward chaining.

Unit-II:Intelligent Agents:- **6+2=8Hours**

Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

Unit-III:Problem Solving by Search:- **6+2=8 Hours**

Defining the problem as a State Space Search Strategies: Breadth – first Search, Depth- first search, Depth limited search, Iterative Depending depth first search.

Heuristic Search Techniques**:** Hill Climbing, Simulated Annealing, Best First Search: OR Graphs, Heuristic Functions, A* Algorithm, AND –OR graphs, AO* Algorithm.

Unit-IV:Knowledge Acquisition and Representation:- **6+2=8 Hours**

Introduction to Knowledge Acquisition and Representation, Hypothesis, Knowledge Levels, Knowledge Classification, Knowledge Representation Schemas; Logic based, Procedural, Network and Structural Representations, Unification, Semantic Nets, Conceptual

Dependencies, Semantic Networks, Frames System, Production Rules, Conceptual Graphs, Ontologies.

PART – B

Unit-V:Planning:- **6+2=8 Hours**

Basic representation for planning, Planning and Acting in the Real world, Uncertain Knowledge and Reasoning: Uncertainty- Probabilistic Reasoning- Making Simple Decisions.

Unit-VI:Reasoning with Uncertain Knowledge:- **6+2=8 Hours**

Different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty such as Dempster-Shafer theory and fuzzy sets/logic.

Unit - VII: Learning:- **6+2=8 Hours**

Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory. Learning from Observations-Knowledge in Learning-Statistical Learning Methods-Reinforcement Learning.

Unit - VIII:AI Present and Future:- **6+2=8 Hours**

Agent components; Agent architectures; Are we going in the right direction? What if AI does succeed?

Text Books:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2017.
3. DAN.W. Patterson, Introduction to A.I. and Expert Systems – PHI, 2007.
4. Michael Wooldridge, An Introduction to MultiAgent Systems, 2nd edition, John Wiley & Sons, 2009.
5. Fabio Luigi Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multi-Agent Systems with JADE, Wiley Series in Agent Technology, John Wiley & Sons, 2007.
6. W.F. Clocksin and C.S. Mellish, Programming in PROLOG, 5th edition, Springer, 2003.
7. Saroj Kaushik, Logic and Prolog Programming, New Age International Publisher, 2012.
8. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 4th edition, 2011.

Subject : Design and Analysis of Computer Algorithms

Subject Code :KMCA-302C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Apply design principle sand concepts to algorithm design
2. Have the mathematical foundation in analysis of algorithms
3. Understand different algorithmic design strategies like DAC, dynamic programming, greedy, backtracking.
4. Analyze the efficiency of algorithms using time and space complexity theory

Unit **L+T Hour**

UNIT – 1: **6+2=8 Hours**

INTRODUCTION : Notion of Algorithm, Review of Asymptotic Notations, Mathematical Analysis of Non-Recursive and Recursive Algorithms, Recurrence, Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

UNIT - 2: **6+2=8 Hours**

DIVIDE AND CONQUER: Divide and Conquer: General Method, Defective Chess Board, Binary Search, Merge Sort, Quick Sort, Heap sort and its performance.

UNIT - 3: **6+2=8 Hours**

THE GREEDY METHOD: The General Method, Amortized Complexity, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

UNIT – 4: **6+2= 8 Hours**

DYNAMIC PROGRAMMING : The General Method, Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, Single-Source Shortest Paths: General Weights, 0/1 Knapsack, The Traveling Salesperson problem.

UNIT – 5: **6+2=8 Hours**

DECREASE-AND-CONQUER APPROACHES, SPACE-TIME TRADEOFFS : Decrease-and-Conquer Approaches: Introduction, Insertion Sort, Depth First Search and Breadth First Search, Topological Sorting, Space-Time Tradeoffs: Introduction, Sorting by Counting, Input Enhancement in String Matching.

UNIT – 6 **6+2=8 Hours**

LIMITATIONS OF ALGORITHMIC POWER AND COPING WITH THEM : Lower-

Bound Arguments, Decision Trees, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.

UNIT - 7 **6+2=8 Hours**

COPING WITH LIMITATIONS OF ALGORITHMIC POWER : Backtracking: n - Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem. Approximation Algorithms for NP-Hard Problems, Traveling Salesperson Problem, Knapsack Problem.

UNIT – 8 **6+2=8 Hours**

PRAM ALGORITHMS: Introduction, Computational Model, Parallel Algorithms for Prefix Computation, List Ranking, and Graph Problems.

Text Books:

1. Anany Levitin: Introduction to The Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007. (Listed topics only from the Chapters 1, 2, 3, 5, 7, 8, 10, 11).
2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran: Fundamentals of Computer Algorithms, 2nd Edition Universities Press, 2007. (Listed topics only from the Chapters 3, 4, 5, 13)

Reference Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein: Introduction to Algorithms, 3rd Edition, PHI, 2010.

Subject : Computer Graphics

Subject Code :KMCA-303C

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**
Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**
Exam Marks: 75 **I.A. Marks : 25**
Exam Hours: 03

Course Outcomes:

1. Understand the basics of computer graphics, different graphics systems and applications of computer graphics.
2. Discuss various algorithms for scan conversion and filling of basic objects and their comparative analysis.
3. Use of geometric transformations on graphics objects and their application in composite form.
4. Extract scene with different clipping methods and its transformation to graphics display device.
5. Explore projections and visible surface detection techniques for display of 3D scene on 2D screen.
6. Render projected objects to naturalize the scene in 2D view and use of illumination models for this.

Unit **L+T Hour**

PART - A

UNIT – 1 :Introduction:- **6 +2=8 Hours**

Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance Characteristics Graphics Programming: The Sierpinski gasket; Programming Two Dimensional Applications.

UNIT – 2 :The OpenGL:- **6 +2=8 Hours**

The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; The three- dimensional gasket; Plotting Implicit Functions.

UNIT – 3: Input and Interaction:- **6 +2=8 Hours**

Interaction; Input devices; Clients and Servers; Display Lists; Display Lists and Modeling; Programming Event Driven Input; Menus; Picking; A simple CAD program; Building Interactive Models; Animating Interactive Programs; Design of Interactive Programs; Logic Operations

UNIT – 4 :Geometric Objects and Transformations-I:- **6 +2=8 Hours**

Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Modeling a Colored Cube; Affine Transformations; Rotation, Translation and Scaling;

PART - B

UNIT – 5 :Geometric Objects and Transformations-II:- **6 +2=8 Hours**

Geometric Objects and Transformations; Transformation in Homogeneous Coordinates; Concatenation of Transformations; OpenGL Transformation Matrices; Interfaces to three-dimensional applications; Quaternion's.

UNIT – 6: Viewing:- **6 +2=8 Hours**

Classical and computer viewing; Viewing with a Computer; Positioning of the camera; Simple projections; Projections in OpenGL; Hidden- surface removal; Interactive Mesh Displays; Parallel-projection matrices; Perspective-projection matrices; Projections and Shadows.

UNIT – 7 :Lighting and Shading:- **6 +2=8 Hours**

Light and Matter; Light Sources; The Phong Lighting model; Computation of vectors; Polygonal Shading; Approximation of a sphere by recursive subdivisions; Light sources in OpenGL; Specification of materials in OpenGL; Shading of the sphere model; Global Illumination.

UNIT – 8 :Implementation:- **6 +2=8 Hours**

Basic Implementation Strategies; Four major tasks; Clipping; Line-segment clipping; Polygon clipping; Clipping of other primitives; Clipping in three dimensions; Rasterization; Bresenham's algorithm; Polygon Rasterization; Hidden-surface removal; Antialiasing; Display considerations.

Text Books:

1. Edward Angel: Interactive Computer Graphics A Top-Down Approach with OpenGL, 5th Edition, Pearson Education, 2008. (Chapters 1 to 7)

Reference Books:

1. Donald Hearn and Pauline Baker: Computer Graphics OpenGL Version 3th Edition, Pearson Education, 2004.

2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 3th Edition, PHI, 2909.

3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Pearson Education 1997.

Subject : IT Tools and Applications

Subject Code : CBCS1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 I.A. Marks : 25

Exam Hours: 03

Course Outcomes:

1. Understand the Importance of IT and its acts in India.
2. Understanding the basic concept of computer fundamentals and number systems
3. Describe about the basic components of computer.
4. Understand the applications of MS Word, MS Excel and MS Power Point in documentation and other areas.
5. Understanding the concept of DBMS and its importance in record maintenance.

Unit **L+T Hour**

Unit 1: Computer Appreciation **5+1=6 Hours.**

Characteristics of Computers, Input, Output, Storage units, CPU, Computer System, Binary number system, Binary to Decimal Conversion, Decimal to Binary Conversion, ASCII Code, Unicode.

Unit 2: Computer Organization **6+1=7 Hours**

Central Processing Unit - Processor Speed, Cache, Memory, RAM, ROM, Booting, Memory-Secondary Storage Devices: Floppy and Hard Disks, Optical Disks CD-ROM, DVD, Mass Storage Devices: USB thumb drive. Managing disk Partitions, File System Input Devices - Keyboard, Mouse, joystick, Scanner, web cam, Output Devices- Monitors, Printers – Dot matrix, inkjet, laser, Multimedia- What is Multimedia, Text, Graphics, Animation, Audio, Images, Video; Multimedia Application in Education, Entertainment, Marketing. Names of common multimedia file formats, Computer Software- Relationship between Hardware and Software; System Software, Application Software, Compiler, names of some high level languages, free domain software.

Unit 3: Operating System **5+3=8 Hours**

Microsoft Windows- An overview of different versions of Windows, Basic Windows elements, File management through Windows. Using essential accessories: System tools – Disk cleanup, Disk defragmenter, Entertainment, Games, Calculator, Imaging – Fax, Notepad, Paint, WordPad. Command Prompt- Directory navigation, path setting, creating and using batch files. Drives, files, directories, directory structure. Application Management: Installing, uninstalling, Running applications. Linux- An overview of Linux, Basic Linux elements: System Features, Software Features, File Structure, File handling in Linux: H/W, S/W requirements, Preliminary steps before installation, specifics on Hard drive repartitioning and booting a Linux system.

Unit 4: Information Technology and Society **5+1=6 Hours**

Internet and its applications, Web browsers, Web servers, URLs, HTTP, Security, Cyber laws, Indian IT Act, Intellectual Property Rights – issues. Application of information Technology in Railways, Airlines, Banking, Insurance, Inventory Control, Financial systems, Hotel management, Education, Video games, Telephone exchanges, Mobile phones, Information kiosks, special effects in Movies.

Unit 5: Word Processing **7 +3=10 Hours**.

Word processing concepts: saving, closing, Opening an existing document, Selecting text, Editing text, Finding and replacing text, printing documents, Creating and Printing Merged Documents, Character and Paragraph Formatting, Page Design and Layout. Editing and Profiling Tools: Checking and correcting spellings. Handling Graphics, Creating Tables and Charts, Document Templates and Wizards.

Unit 6: Spreadsheet Package **7+3=10 Hours**.

Spreadsheet Concepts, Creating, Saving and Editing a Workbook, Inserting, Deleting Work Sheets, entering data in a cell / formula Copying and Moving from selected cells, handling operators in Formulae, Functions: Mathematical, Logical, statistical, text, financial, Date and Time functions, Using Function Wizard. Formatting a Worksheet: Formatting Cells – changing data alignment, changing date, number, character or currency format, changing font, adding borders and colors, Printing worksheets, Charts and Graphs – Creating, Previewing, Modifying Charts. Integrating word processor, spread sheets, web pages.

Unit 7: Presentation Package **6+2=8 Hours**.

Creating, Opening and Saving Presentations, Creating the Look of Your Presentation, Working in Different Views, Working with Slides, Adding and Formatting Text, Formatting Paragraphs, Checking Spelling and Correcting Typing Mistakes, Making Notes Pages and Handouts, Drawing and Working with Objects, Adding Clip Art and other pictures, Designing Slide Shows, Running and Controlling a Slide Show, Printing Presentations.

Unit 8: Data Base Operations **7+2=9 Hours**.

Data Manipulation-Concept: Database, Relational Database, Integrity. Operations: Creating, dropping, manipulating table structure. Manipulation of Data: Query, Data Entry Form, Reports.

RECOMMENDED BOOKS MAIN READING

1. P.K. Sinha and P. Sinha, " Foundations of Computing" , BPB Publication, 2008.
2. Sagman S, "MS Office for Windows XP", Pearson Education, 2007.
3. ITL Educational Society, "Introduction to IT", Pearson Education, 2009.
4. Miller M, "Absolute Beginners Guide to Computer Basics", Pearson Education, 2009.

SUPPLEMENTARY READING

1. Turban, Mclean and Wetherbe, "Information Technology and Management" John Wiely& Sons.
2. Balagurusamy E, "Fundamentals of Computers", 2009, Tata McGraw-Hill
3. Kulkarni, "IT Strategy for Business", Oxford University Press Refer: Open Office/ MS Office Environment for practice.
4. Satish Jain, "O Level IT Tools and Business System", BPB Publications, 2010
5. Pankaj Kumar, "IT Tools and Business Systems", Choice International, Edn-2017

Subject : Natural Language Processing
Subject Code :KMCA-304CE2.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand approaches to syntax and semantics in NLP.
2. Understand approaches to discourse, generation, dialogue and summarization within NLP.
3. Understand current methods for statistical approaches to machine translation.
4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Unit **L+T Hour**

Unit 1: Regular Expressions & Tokenization**6+2= 8 hours**

Introduction to NLP, Regular Expression, Finite State Automata, Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance.

Unit 2: Morphology**6+2= 8 hours**

Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer.

Unit 3: Language Modeling**6+2= 8 hours**

Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models, Noisy Channel Model.

Unit 4: Hidden Markov Models and Part of Speech Tagging**6+2= 8 hours**

Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation.

Unit 5: Text Classification**6+2= 8 hours**

Text Classification, Naïve Bayes' Classifier, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques.

Unit 6: Context Free Grammar**6+2= 8 hours**

Introduction to Context Free Grammar, Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing, TreeBank.

Unit 7: Lexical Semantics**6+2= 8 hours**

Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity, Word Sense Disambiguation.

Unit 8: Information Retrieval**6+2= 8 hours**

Classical information retrieval models, term weighting- Boolean value, Term frequency(TF), Inverse Document Frequency(IDF), Term Frequency and Inverse Document Frequency(TF-IDF), Similarity Measures.

Textbook:

1. Daniel Jurafsky and James H Martin. *Speech and Language Processing, 2e*, Pearson Education, 2009

Reference Books:

1. James A..*Natural language Understanding 2e*, Pearson Education, 1994
2. Manning, C.D. and H. SchAtze: *Foundation of Statistical Natural Language Processing*. The MIT Press. 1999. ISBN 0-262-13360-1.
3. Bharati A., Sangal R., Chaitanya V..*Natural language processing: a Paninianperspective*,PHI, 2000
4. Siddiqui T., Tiwary U. S..*Natural language processing and Information retrieval*, OUP, 2008

Subject : COMPUTER & NETWORK SECURITY

Subject Code :KMCA-304CE2.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Identify the security issues in the network and resolve it.
2. Analyse the vulnerabilities in any computing system and hence be able to design a security solution.
3. Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions.
4. Demonstrate various network security applications, IPSec, Firewall, IDS, Web Security, Email Security and Malicious software etc.,

Unit **L+T Hour**

PART – A

UNIT 1 **6+2=8 Hours**

OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security.

UNIT 2 :Classical Encryption Technique:- **6+2=8 Hours**

Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

UNIT 3 :Block Ciphers, Data Encryption Standard and Advanced Encryption Standard :- **6+2=8 Hours**

Block Cipher Principles, The Data Encryption Standard, Block Cipher Design Principles and Modes of operation, Evaluation Criteria for AES, AES Cipher-Encryption and Decryption, Data Structure, Encryption Round.

UNIT 4 :Public Key Cryptography and Key Management :- **6+2=8 Hours**

Principles of Public Key Cryptosystem, RSA algorithm, Key management, Diffie Hellman Key exchange

PART – B

UNIT 5: Message Authentication and Hash Function :- **6+2=8 Hours**

Authentication Requirement, Authentication Functions, Message Authentication Code, Hash Functions, Digital Signatures, Digital Signature Standard

UNIT 6: IP Security:- **6+2=8 Hours**

IP Security Overview; IP Security Architecture; Authentication Header; Encapsulating Security Payload; Combining Security Associations; Key Management.

UNIT 7 : Web Security :- **6+2=8 Hours**

Web security Considerations; Secure Socket layer (SSL) and Transport layer Security (TLS); Secure Electronic Transaction (SET)

UNIT 8 :System Security:- **6+2=8 Hours**

Intruders, Intrusion Detection, Firewall Design Principles- Characteristics, Types of Firewall and Firewall Configuration.

Text Books:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 4th Pearson Education, 2009.
   (Chapters: 1, 2.1-2.3, 3.1,3.2,3.5, 5.1,5.2, 6.2, 9.1,9.2, 10.1,10.2, 11.1- 11.4, 13.1, 13.3, 14.1, 4.2, 15.1, 15.2, 16.1-16.6, 17.1-17.3, 18.1, 18.2, 20.1)

Reference Book:

1. Behrouz A. Forouzan and DebdeepMukhopadhyay: "Cryptography and Network Security", 2nd Edition TMH 2010.

2. AtulKahate, "Cryptography and Network Security" 2nd Edition, Tata McGraw-Hill.

Subject :Data Analytics

Subject Code :KMCA-304C E2.3

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. This course prepares students to gather, describe, and analyze data, and use advanced statistical tools to support decision making.
2. To gather sufficient relevant data, conduct data analytics using scientific methods, and understand appropriate connections between quantitative analysis and real - world problems.
3. Understand the exact scopes and possible limitations of each method to provide constructive guidance in decision making.
4. To Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
5. To make better decisions by using advanced techniques in data analytics.

Unit **L+T Hour**

UNIT I.
Data Definitions and Analysis Techniques: Elements, Variables, and Data Categorization, Levels of Measurement, Data Management and Indexing

UNIT II.
Descriptive Statistics: Measures of Central Tendency, Measures of Location of Dispersions, Error Estimation and Presentation (Standard Deviation, Variance), Introduction to Probability

UNIT III.
Basic Analysis Techniques: Statistical Hypothesis Generation and Testing, Chi-Square Test, T -Test, Analysis of Variance, Correlation Analysis, Maximum Likelihood Test

UNIT IV.
Data Analysis Techniques-I: Regression Analysis, Classification Techniques, Clustering Techniques (K-Means, K-Nearest Neighborhood)

UNIT V.
Data Analysis Techniques-II: Association Rules Analysis, Decision Tree

UNIT VI.
Introduction to R Programming: Introduction to R Software Tool, Statistical Computations using R (Mean, Standard Deviation, Variance, Regression, Correlation etc.)

UNIT VII.

Practice and Analysis with R and Python Programming, Sensitivity Analysis

REFERENCE BOOKS

● Probability and statistics for Engineers and Scientists (9 Edn.), Ronald E Walppole, Raymond H Myres, Sharon L. Myres and Leying Ye, Prentice Hall Inc

● The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2nd Edn.) Travor Hastie Robert Tibshirani Jerome Friedman, Springer, 2014

Subject :Blockchain

Subject Code :KMCA-304CE2.4

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1: Understand distributed database and different types of distributed file systems.

2: Understand advantages of blockchain over distributed databases and blockchainoperations.

3: Understand how distributed consensus are arrived in blockchain.

4: Understand cryptocurrency and how they are implemented using block chain.

Unit **L+T Hour**

Unit I: Basics:

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Unit II: Blockchain:

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit III: Distributed Consensus:

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Unit IV: Cryptocurrency:

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin

Unit V: Cryptocurrency Regulation:

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.

Tutorial & Practical: Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

Text Book

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).

Reference Books

1. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4. Nicola Atzei, Massimo Bartoletti, and TizianaCimoli, A survey of attacks on Ethereum smart contracts

Subject :Data Mining

Subject Code :KMCA-304CE2.5

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

- Ability to understand the types of the data to be mined and present a general classification of tasks and primitives to integrate a data mining system.
- Apply preprocessing methods for any given raw data.
- Extract interesting patterns from large amounts of data.
- Discover the role played by data mining in various fields.
- Choose and employ suitable data mining algorithms to build analytical applications
- Evaluate the accuracy of supervised and unsupervised models and algorithms.

Unit **L+T Hour**

UNIT - I **10 hours**

Data Mining: Data–Types of Data–, Data Mining Functionalities– Interestingness Patterns– Classification of Data Mining systems– Data mining Task primitives –Integration of Data mining system with a Data warehouse–Major issues in Data Mining–Data Preprocessing.

UNIT - II **9 hours**

Association Rule Mining: Mining Frequent Patterns–Associations and correlations – Mining Methods– Mining Various kinds of Association Rules– Correlation Analysis– Constraint based Association mining. Graph Pattern Mining, SPM.

UNIT - III **10 hours**

Classification: Classification and Prediction **–** Basic concepts–Decision tree induction– Bayesian classification, Rule–based classification, Lazy learner.

UNIT - IV **10 hours**

Clustering and Applications: Cluster analysis–Types of Data in Cluster Analysis–Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods–Density–Based Methods, Grid–Based Methods, Outlier Analysis.

UNIT - V **9 hours**

Advanced Concepts: Basic concepts in Mining data streams–Mining Time–series data—Mining sequence patterns in Transactional databases– Mining Object– Spatial–Multimedia–Text and Web data – Spatial Data mining– Multimedia Data mining–Text Mining– Mining the World Wide Web.

TEXT BOOKS:

1. Data Mining – Concepts and Techniques – Jiawei Han &MichelineKamber, 3rd Edition Elsevier.

2. Data Mining Introductory and Advanced topics – Margaret H Dunham, PEA.

REFERENCE BOOK:

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005.

Subject : DevOps

Subject Code :KMCA-304C E2.6

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Understand the principle of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility.
2. Describe DevOps and DevSecOps methodologies and their key concepts.
3. Explain the types of version control system, continuous integration tools, continuous monitoring tools and cloud models.
4. Set up complete private infrastructure using version control system and CI/CD tools.

Unit **L+T Hour**

UNIT I:
Phases of Software Development life cycle. Values and principles of agile software development.

UNIT II:
Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

UNIT III:
DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT IV:
CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment , Benefits of CI/CD, Metrics to track CICD practices

UNIT V:
Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Text Books:

1. The DevOPS Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations by Gene Kim , John Willis , Patrick Debois , Jez Humb,O'Reilly publications
2. What is Devops? Infrastructure as code By in Mike Loukides ,O'Reilly publications. 3. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, by Jez Humble and David Farley
3. Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps, and Microservices by Dave Harrison, Knox Lively

Reference Books:

1. Building a DevOps Culture by Mandi Walls, O'Reilly publications
2. The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline With Containerized Microservices by Viktor Farcic

Subject : Text Mining and Analytics

Subject Code :KMCA-304CE2.7

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Use basic methods for information extraction and retrieval of textual data
2. Apply text processing techniques to prepare documents for statistical modelling
3. Apply relevant machine learning models for analyzing textual data and correctly interpreting the results
4. Use machine learning models for text prediction
5. Evaluate the performance of machine learning models for textual data

Unit **L+T Hour**

PART-A

Unit 1: Introduction: **6 hours**

Background, motivation, dealing with information overload and information overlook, unstructured vs. (semi-) structured data, evolving information needs and knowledge management issues, enhancing user experience of information provision and seeking, the business case for text mining.

Unit 2: Processing and Understanding Text **6 hours**

Text Tokenization (Sentence tokenization, Word Tokenization), Text Normalization (cleaning text, tokenizing text, removing special characters, expanding contractions, case conversions, removing stopwords, correcting words, stemming, lemmatization), Scoring, Term Weighting, Vector Space Model.

Unit 3: Pipeline of Text Mining **6 hours**

The text mining pipeline: information retrieval, information extraction and data mining, Approaches to text mining: rule-based vs. machine learning based vs. hybrid; generic vs. domain specific; domain adaptation.

Unit 4: Information Extraction **6 hours**

Introduction, Design of an Information Extraction System, Entity Extraction (Rule-based methods and Statistical methods), Term extraction, Relationship Extraction, Fact and Event Extraction, Evaluating Information Extraction System.

Unit 5: Information Retrieval **6 hours**

Introduction, Design features of Information Retrieval Systems, Information Retrieval Models, Classical Information Retrieval models, Non-classical models of IR, Alternative Models of IR, and Evaluation of the IR system.

Unit 6: Text Categorization **6 hours**

Introduction, Overview of text categorization methods, Text categorization problem, features for text classification, classification algorithms, Evaluation of text categorization.

Unit 7: Text Clustering **6 hours**

Overview of clustering Techniques, Analyzing Term Similarity (Hamming Distance, Manhattan Distance, Euclidean Distance, Levenshtein Edit Distance, Cosine Distance and Similarity), Term Clustering, Analyzing Document Similarity (Cosine Similarity, Hellinger-Bhattacharya Distance, Okapi BM25 Ranking), Document Clustering, Evaluation of Text clustering.

Unit 8: Evaluation of text mining systems **6 hours**

Evaluation measures, role of evaluation challenges, visualization of results from text mining, issues in large scale processing of text: distributed text mining, scalable text mining systems.

Textbook:

1. Daniel Jurafsky and James H Martin. *Speech and Language Processing, 2e*, Pearson Education, 2009

Reference Books:

1. James A..*Natural language Understanding 2e*, Pearson Education, 1994
2. Manning, C.D. and H. SchAtze: *Foundation of Statistical Natural Language Processing*. The MIT Press. 1999. ISBN 0-262-13360-1.
3. Bharati A., Sangal R., Chaitanya V..*Natural language processing: a Paninianperspective*,PHI, 2000
4. Siddiqui T., Tiwary U. S..*Natural language processing and Information retrieval*, OUP, 2008

Subject :Internet-of-Things

Subject Code :KMCA-305CE3.1

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

OBJECTIVES:

- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

Unit **L+T Hour**

Unit-1: FUNDAMENTALS OF IoT

Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

Unit- II: IoT PROTOCOLS

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

Unit-111: DESIGN AND DEVELOPMENT 9

Pi - Interfaces and Raspberry Pi with Python Programming. Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry

Unit- IV DATA ANALYTICS AND SUPPORTING SERVICES

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Unit-V CASE STUDIES/INDUSTRIAL APPLICATIONS

Development of IoT-based system, Data Collection, Data Analysis, and Security Analysis

OUTCOMES: Upon completion of the course, the student should be able to:

- Explain the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry Pi/Arduino
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario

TEXT BOOK:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, ―Internet of Things – A hands-on approach‖, Universities Press, 2015
2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols‖, Wiley, 2012 (for Unit 2).
3. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things‖, Springer, 2011.

Subject :Deep Learning

Subject Code :KMCA-305CE3.2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course outcome **Exam Hours: 03**

1. Understand the role of deep learning in machine learning applications.
2. Understand and implement deep learning architectures.
3. Design and implement different neural network architectures, such as convolutional networks, recurrent neural networks, long short-term memory (LSTM) networks, and capsule networks.
4. Solve problems in the fields of computer vision, natural language processing (NLP), and speech recognition
5. Understand the reasons for the choice of neural network used, and the Python code to implement
   the given solution from scratch
6. Study model approaches such as variationalautoencoders and Generative Adversarial Networks (GANs) to generate images.
7. Understand the newly evolved areas of reinforcement learning with state-of-the-art algorithms.

Unit **L+T Hour**

Unit-I : Introduction:- **8+3=11 Hours**

Historical context and motivation for deep learning; basic supervised classification task, optimizing logistic classifier using gradient descent, stochastic gradient descent, momentum, and adaptive sub-gradient method.

Unit-II :Neural Networks:- **8+2=10 Hours**

Feedforward neural networks, deep networks, regularizing a deep network, model exploration, and hyperparameter tuning.

Unit-III : Convolution Neural Networks:- **8+3=11 Hours**

Introduction to convolution neural networks: stacking, striding and pooling, applications like image, and text classification.

Unit-IV : Sequence Modeling: Recurrent Nets:- **8+2=10 Hours**

Unfolding computational graphs, recurrent neural networks (RNNs), bidirectional RNNs, encoder-decoder sequence to sequence architectures, deep recurrent networks.

Unit-V :Autoencoders:- **8+3=11 Hours**

Undercompleteautoencoders, regularized autoencoders, sparse autoencoders, denoisingautoencoders, representational power, layer, size, and depth of autoencoders, stochastic encoders and decoders.

Unit-VI : Structuring Machine Learning Projects:- **8+3=11 Hours**

Orthogonalization, evaluation metrics, train/dev/test distributions, size of the dev and test sets, cleaning up incorrectly labeled data, bias and variance with mismatched data distributions, transfer learning, multi-task learning.

Readings :

1. Ian Goodfellow, **Deep Learning**, MIT Press, 2016.

2. Jeff Heaton, **Deep Learning and Neural Networks**, Heaton Research Inc, 2015.

3. Mindy L Hall, Deep Learning, VDM Verlag, 2011.

4. Li Deng (Author), Dong Yu, **Deep Learning: Methods and Applications (Foundations and Trends in Signal Processing)**, Now Publishers Inc, 2009.

Subject :CLOUD COMPUTING

Subject Code :KMCA-305CE3.3

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing
2. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Explain the core issues of cloud computing such as security, privacy, and interoperability.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
6. Provide the appropriate cloud computing solutions and recommendations according to the applications used.

Unit **L+T Hour**

PART – A

UNIT-1 :Distributed System Models and Enabling Technologies:- **6+2=8 Hours**

Scalable Computing Service over the Internet: The Age of Internet Computing, scalable computing Trends and New Paradigms,

Internet of Things and Cyber-Physical Systems. System Models for Distributed and Cloud Computing: Clusters of Cooperative Computers,

Grid Computing Infrastructures, Peer-to-Peer Network Families, Cloud Computing over the Internet. Software Environments for Distributed

Systems and Clouds: Service-Oriented Architecture (SOA), Trends towards Distributed Operating Systems, Parallel and

Distributed Programming Models. Performance, Security, and Energy-Efficiency: Performance Metrics and Scalability Analysis,

Fault-T olerance and System Availability, Network Threats and Data Integrity, Energy-Efficiency in Distributed Computing.

UNIT-2 :Computer Clusters for scalable parallel computing:- **6+2=8 Hours s**

Clustering for massive parallelism: Cluster Development Trends, Design Objective of Computer Clusters, Fundamental Cluster Design issues.

Virtual machines and Virtualization of clusters and Data centers: Implementation levels of virtualization: levels of virtualization Implementation,

VMM Design requirements and providers, Virtualization support at the OS level, Middleware Support for Virtualization.

UNIT-3 :Cloud Platform Architecture over Virtualized Data Centers:-

6+2=8 Hours

Cloud computing and Service Models: Public, Private, and Hybrid Clouds, Cloud Ecosystem and Enabling Technologies,

Infrastructure-as- a- Service (IaaS), Platform- and Software-as-a- Service (Paas, SaaS).

Architectural Design of Compute and Storage Clouds: A Generic Cloud architecture Design, Layered Cloud Architectural development, Virtualization Support and Disaster Recovery, Architectural Design Challenges.

UNIT-4 :Public Cloud Platforms:- **6+2=8 Hours**

GAE, AWS, and Azure: Smart Cloud, Public Clouds and Service Offerings, Google App Engine (GAE), Amazon Web Service (A WS),

Microsoft Windows Azure. Inter-cloud Resource Management: Extended Cloud Computing Services, Resource Provisioning and Platform Deployment,

Virtual Machine Creation and Management. Cloud Security and Trust management: Cloud Security Defense Strategies,

Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques.

PART – B

UNIT-5 :Cloud Programming and Software Environments:- **6+2=8 Hours**

Features of Cloud and Grid Platforms: Cloud Capabilities and Platform Features, Traditional Features Common to Grids and Clouds,

Data Features and Databases, Programming and Runtime Support. Parallel and Distributed Programming Paradigms:

Parallel Computing and Programming Paradigms, MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache.

UNIT-6 :Programming Support of App Engine:- **6+2=8 Hours**

Programming the Google App Engine, Google File System (GFS), Bigtable, Google's NOSQL system, Chubby, Google's Distributed Lock service.

Programming on Amazon AWS and Microsoft Azure: Programming on Amazon EC2, Amazon Simple Storage Service S3,

Amazon Elastic Block Store EBS and SimpleDB, Microsoft Azure programming support.

Emerging Cloud Software Environments: Open Source Eucalyptus and Nimbus, Open Nebula, Sector/Sphere, and OpenStack,

Manjrasoft Aneka Cloud and Appliances.

UNIT-7 :Ubiquitous Clouds and the Internet of Things:- **6+2=8 Hours**

Performance of Distributed Systems and the Cloud Data-intensive Scalable Computing (DISC), Quality of Service in Cloud computing,

Benchmarking MPI, Azure, EC2, MapReduce, and Hadoop. Online social and Professional Networking: Online Social Network Characteristics,

UNIT-8 : Graph-Theoretic Analysis : **6+2=8 Hours**

Graph-Theoretic Analysis of social networks, Communities and Applications of Social Networks, Facebook: The World's Largest Content-Sharing Network, Twitter for Micro blogging, News and Alert Services.

Text Book:

1. Kai Hwang, Jack Dungaree, and Geoffrey Fox: Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, MK Publishers, 2012. Chapters – 1,2,3,4,5,6,9

Reference Books:

1. Michael Miller, Cloud Computing: Web-Based Applications that change the Way you work and collaborate Online, Pearson Publication, 2012.

2. Anthony T. Volte, Toby J. Volte, Robert Elsenpeter: Cloud Computing, A Practical Approach, McGraw Fill, 2010.

3. Cloud Computing for Dummies: J. Hurwitz, ISBN 978-0-470-484-8

4. Dr. Kumar Sourabh, Cloud Computing, 2nd Edition, Wiley India.

Subject :Computer Vision

Subject Code :KMCA-305CE3.4

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes

1. Explain Concepts and Applications of Computer Vision
2. Apply image processing techniques to design Computer Vision applications
3. Implement algorithms of face recognition and motion detection.
4. Provide solutions to real world computer vision problems.

Unit **L+T Hour**

Unit 1: Introduction to Computer Vision 8hours

Definition of Computer Vision, Easy Vs Hard Problems, Computer Vision System, Components of a vision system, Applications of Computer vision, Image Sources for computer Vision, Image structure and Pixels, Frameworks for Computer Vision.

Unit 2: Basic Image Handling and Processing 8 hours

Geometric primitives and transformations, Plotting images, points and lines, Image contours and histograms, Histogram equalization, Interactive annotation, Gray level transforms, Image Transformations, Image Derivatives.

Unit 3: Local Image Descriptors and Image Mappings 8hours

Line Detection-Hough Transforms, Harris corner detector, Edge Detection, SIFT - Scale-Invariant Feature Transform, Matching Geotagged Images, Homographies, Warping images, Creating Panoramas :Camera Models and Augmented reality, Light effects

Unit 4: Exploring Structure from Motion 8 hours

Structure from Motion concepts, Estimating the camera motion from a pair of images, Reconstructing the scene , Reconstruction from many views , Refinement of the reconstruction, Visualizing 3D point clouds, Object Recognition and Bag-of Words Models .

Unit 5:Face Detection and Tracking 8 hours

Face detection, Pedestrian detection, Face recognition, Eigenfaces, Viola-Jones Algorithm, Haar-like Features, Integral Image, Training Classifiers, Adaptive Boosting (Adaboost)

Unit 6: Convolutional Nerual Networks for CV 8 hours

CNN Advantages,Architecture,Layers,TrainingCNNs,Build your own CNN,CNN applications.

Books and References

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer-Verlag.

2. Solem, Jan Erik. Programming Computer Vision with Python: Tools and algorithms foranalyzing images. " O'Reilly Media, Inc.", 2012.ISBN: 144934193

3. Demaagd, Kurt. Practical Computer Vision with SimpleCV: Making Computers See in Python. 2012.ISBN: 9781449337865

4. Jähne, Bernd, Horst Haussecker, and Peter Geissler, eds. Handbook of computer vision and applications. Vol. 2. San Diego: Academic press, 1999.ISBN: 0123797713

5. Jähne, Bernd, and Horst Haußecker. "Computer vision and applications." A Guide for Students and Practitioners (2000). ISBN:7302269157

6. Baggio, Daniel Lélis. Mastering OpenCV with practical computer vision projects. Packt Publishing Ltd, 2012.ISBN: 1849517827

7.Khan, Salman, et al. "A guide to convolutional neural networks for computer vision." Synthesis Lectures on Computer Vision 8.1 (2018).ISBN: 1681730219

Subject :Big Data Analytics

Subject Code :KMCA-305C E3.5

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes

1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.

2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.

3. Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.

4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Unit **L+T Hour**

UNIT 1 **10 hours**

Introduction to Big Data, Characteristics of Data, and Big Data Evolution of Big Data, Definition of Big Data, Challenges with big data. Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of big Data Analytics.

Big Data Analytics, Introduction to big data analytics, Classification of Analytics, Challenges of Big Data, Importance of Big Data, Big Data Technologies, Data Science, Responsibilities. Soft state eventual consistency. Data Analytics Life Cycle

UNIT 2 **9 hours**

Analytical Theory and Methods: Clustering and Associated Algorithms, Association Rules, Apriori Algorithm, Candidate Rules, Applications of Association Rules, Validation and Testing, Diagnostics, Regression, Linear Regression, Logistic Regression, Additional Regression Models.

UNIT 3 **10 hours**

Analytical Theory and Methods: Classification, Decision Trees, Naïve Bayes, Diagnostics of Classifiers, Additional Classification Methods, Time Series Analysis, Box Jenkins methodology, ARIMA Model, Additional methods. Text Analysis, Steps, Text Analysis Example, Collecting Raw Text, Representing Text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing Documents by Topics, Determining Sentiments

UNIT 4 **9 hours**

Data Product, Building Data Products at Scale with Hadoop, Data Science Pipeline and Hadoop Ecosystem, Operating System for Big Data, Concepts, Hadoop Architecture, Working with Distributed file system, Working with Distributed Computation, Framework for Python and Hadoop Streaming, Hadoop Streaming, MapReduce with Python, Advanced MapReduce. In-Memory Computing with Spark, Spark Basics, Interactive Spark with PySpark, Writing Spark Applications

UNIT 5 **10 hours**

Distributed Analysis and Patterns, Computing with Keys, Design Patterns, Last-Mile Analytics, Data Mining and Warehousing, Structured Data Queries with Hive, HBase, Data Ingestion, Importing Relational data with Sqoop, Injesting stream data with flume. Analytics with higher level APIs, Pig, Spark's higher level APIs.

Books and References

1. Big Data and Analytics, SubhashiniChellappan and Seema Acharya, wiley, First Edition.
2. Data Analytics with Hadoop Benjamin An Introduction for Data Scientists, Benjamin Bengfort and Jenny Kim, O'Reilly.
3. Big Data and Hadoop, V.K Jain, Khanna Publishing

Subject :MOBILE ADHOC NETWORK

Subject Code :KMCA-305C E3.6

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes:

1. Have gained an understanding of the current topics in MANETs and WSNs, both from an industry and research point of views.
2. Have an understanding of the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.
3. Understand how proactive routing protocols function and their implications on data transmission delay and bandwidth consumption.

Unit **L+T Hour**

PART – A

UNIT 1: Introduction:- **6+2=8 Hours**

Ad hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

UNIT 2 :MAC – 1:- **6+2=8 Hours**

MAC Protocols for Ad hoc wireless Networks: Introduction, Issues in designing a MAC protocol for Ad hoc wireless Networks,

Design goals of a MAC protocol for Ad hoc wireless Networks, Classification of MAC protocols, Contention based protocols with reservation mechanisms.

UNIT 3: MAC – 2:- **6+2=8 Hours**

Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols.

UNIT 4 :Routing – 1: **6+2=8 Hours**

Routing protocols for Ad hoc wireless Networks: Introduction, Issues in designing a routing protocol for Ad hoc wireless Networks, Classification of routing protocols, Table drive routing protocol, On-demand

PART- B

UNIT 5 :Routing – 2: - **6+2=8 Hours**

Hybrid routing protocol, Routing protocols with effective flooding mechanisms, Hierarchical routing protocols, Power aware routing protocols.

UNIT 6: Transport Layer:- **6+2=8 Hours**

Transport layer protocols for Ad hoc wireless Networks: Introduction, Issues in designing a transport layer protocol for Ad hoc wireless Networks, Design goals of a transport layer protocol for Ad hoc wireless Networks, Classification of transport layer solutions, TCP over Ad hoc wireless Networks, Other transport layer protocols for Ad hoc wireless Networks.

UNIT 7: Security:- **6+2=8 Hours**

Security: Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, Network security attacks, Key management, Secure routing in Ad hoc wireless Networks.

UNIT 8 :QoS:- **6+2=8 Hours**

Quality of service in Ad hoc wireless Networks: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks,

Classification of QoS solutions, MAC layer solutions, network layer solutions.

Text Books:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.

2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

3. C.K. Toh: Adhoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

High Performance Parallel Programming

Subject Code: KMCA-305C E3.7

Credit: 4 **Class Hour: (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L): 48 **Tutorial Hour (T): 16**

Exam Marks: 75 **I.A. Marks: 25**

Exam Hours: 03

Course Outcomes:

1. Able to implement efficient parallel programs in a wide array of domains including scientific and engineering computation, distributed machine learning applications and computational science..

2. Able to understand the wide choice of programming models, development environments, runtime systems, optimizations and high-performance architectural targets.

3. Efficient implementation of large-scale parallel programs.

Unit **L+T Hour**

UNIT 1: Introduction to HPC systems **8hours**

- Introduction to basic architecture and OS concepts
- Multi-core CPUs
- High-speed interconnects
- High performance file systems
- GPU systems
- High performance clusters

UNIIT 2: Parallel Programming Concept **8hours**

- Levels of parallelism (instruction, transaction, task, thread, memory, function)
- Models (SIMD, MIMD, SIMT etc)
- Architectures: multi-core, multi-threaded, GPU

UNIT 3: Fundamental Design Issues of Parallel Computing **8hours**

- Synchronization
- Scheduling
- Job Allocation
- Job Partitioning
- Dependency Analysis
- Performance Analysis of Parallel Algorithms

UNIT 4: Shared Memory-based Parallel Programming **8hours**

- Shared memory hardware structure

- Process, thread, multi-core
- Memory access
- Standard API: OpenMP
- Programming Practice: Array Processing, Matrix Multiplication, Numerical Computations.

UNIT 5: Distributed Shared Memory-based Parallel Computing 8hours

- Distributed memory model and architecture
- MPI, basic features of MPI, data types of MPI (C/C++), MPI communication using Send and Receive
- Workload Manager and Job Schedulers
- Programming practices: array sum, matrix dot product,

UNIT 6: Parallel Programming using CUDA 8hours

- CUDA/OpenCL, HW schedulers, Software runtime systems
- Hybrid Parallel Programming: Putting it together (Python, MPI, OpenMP, CUDA)

Tutorials

- Familiarization with HPC softwares: OpenMP and MPI, Spark Framework for Map-Reduce
- Benchmark based performance evaluation experiments on HPC systems
- HPC Application development: Drug design, Fault Simulation, Machine Learning Application development.

References

- "Computer Architecture – A Quantitative Approach" – John L. Hennessy and David A. Patterson
- "Heterogeneous Computing with OpenCL" – Benedict Gaster, Lee Howes, David R. Kaeli
- CUDA reference manual
- "Hadoop: The Definitive Guide, 4thEdition" – Tom White
- Spark Programming Guide.
- "Using OpenMP" by Barbara Chapman, Gabriele Jost and Ruud van der Pas
- "MPI: The Complete Reference" by Marc Snir, Jack Dongarra, Janusz S. Kowalik, Steven Huss-Lederman, Steve W. Otto, David W. Walker
- "Parallel Programming with MPI" by Peter Pacheco
- Web resource: http://openmp.org/wp/

Semester IV

Course Code	Title	L-T-P H/W	Total Credit	Full Marks	
				Internal	External
CBCS2	Web Technology/Data Analysis using Python Programming	3-1-0	4	25	75
KMCA-401CP2	Major Project	0-1-6	12	300	
KMCA-401IV	Industrial Visit		4		
Semester Total			20	400	

Subject :WEB TECHNOLOGIES

Subject Code : CBCS2

Credit : 4 **Class Hour : (L-3+ T-1+ P-0=4)/ week**

Lecture Hours (L) : 48 **Tutorial Hour (T) : 16**

Exam Marks: 75 **I.A. Marks : 25**

Exam Hours: 03

Course Outcomes

1. Explain the history of the internet and related internet concepts that are vital in understanding web development.
2. Discuss the insights of internet programming and implement complete application over the web.
3. Demonstrate the important HTML tags for designing static pages and separate design from content using Cascading Style sheet.
4. Utilize the concepts of JavaScript and Java
5. Use web application development software tools i.e., Ajax, PHP and XML etc. and identify the environments currently available on the market to design web sites.

Unit **L+T Hour**

Unit - I :Fundamentals:- **7+2=9 hours**

Internet, WWW, Web browsers and Web servers, URLs, MIME, HTTP, Security, Cyber laws.

Web Foundations**:**Evolution of the Web, Peek into the History of the Web, Internet Applications, Networks, TCP/IP, Higher Level Protocols, Important Components of the Web, Web search Engines, Application Servers.

Unit -II :Introduction to XHTM:- **7+2=9 hours**

Basic Syntax, Standard structure, Elements, Attributes, Images, Hypertext Links, Lists, Tables, Forms, Frames, Iframes, Symbols

Unit - III :Cascading Style sheets:- **7+2=9 hours**

Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

Unit -IV :The Basics of JavaScript:- **7+2=9 hours**

Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations and expressions, Screen output and keyboard input, Control

statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples.

Unit -V :JavaScript and HTML Documents:- 7+3=10 hours

The JavaScript execution environment, The Document Object Model (DOM), Elements access in JavaScript, Events and Event handling, Handling events from body elements, handling Event from Text Box and password elements, the DOM2 event model, the navigator object, DOM tree traversal and modification.

Unit -VI :Dynamic Documents with JavaScript:- 7+2=9 hours

Introduction, Positioning Elements, Moving Elements, Elements visibility, changing colors and fonts, dynamic content, stacking Elements, locating the mouse cursor, reacting to a mouse click, slow movement of elements, dragging and dropping Elements.

Unit -VII: Introduction to XML:- 6+3=9 hours

Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, displaying raw XML documents, displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.,

TEXT BOOK

4. 1. Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education (VTU 4thEdn.).
5. 2. M. Srinivasan: Web Technology Theory and Practice, Pearson Education,

REFERENCES

5. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education.
6. Chris Bates: Web Programming Building Internet Applications, Wiley India.Internet Technology and Web Design, Instructional Software Research and Development (ISRD) Group, Tata McGraw Hill.