



UNIVERSITY OF CALICUT

Abstract

General and Academic - Faculty of Science - Syllabus of MSc Computer Science Programme under CCSS PG Regulations 2019 (University Teaching Departments) with effect from 2019 Admission onwards-Implemented- Orders Issued.

G & A - IV - J

U.O.No. 10218/2019/Admn

Dated, Calicut University.P.O, 31.07.2019

*Read:-*1) U.O No.4500/2019/Admn dated 26.03.2019

2) Item No.1 of the minutes of the meeting of the Board of Studies in Computer Science & Application PG held on 10.06.2019

3) Item No. I.1 of the minutes of the meeting of Faculty of Science held on 27.06.2019

ORDER

The Regulations under Choice-based Credit Semester System for Post Graduate Programmes (CCSS-PG -2019) of all Teaching Departments / Schools of the University of Calicut w.e.f 2019 admissions has been implemented in the University of Calicut vide paper read first above.

The meeting of Board of Studies in Computer Science & Application PG held on 10.06.2019 has approved the Syllabus of MSc Computer Science Programme for Teaching Departments / Schools of the University of Calicut in tune with the new CCSS PG Regulations with effect from 2019 Admission onwards, vide paper read second above.

The Faculty of Science at its meeting held on 27.06.2019 has approved the minutes of the meeting of the Board of Studies in Computer Science & Application PG held on 10.06.2019, vide paper read third above.

Under these circumstances , considering the urgency, the Vice Chancellor has accorded sanction to implement the Scheme and Syllabus of M.S.c Computer Science Programme in accordance with the new CCSS PG Regulations 2019, in the University with effect from 2019 Admission onwards, subject to ratification by the Academic Council.

The Scheme and Syllabus of MSc Computer Science Programme for Teaching Departments / Schools of the University of Calicut in accordance with CCSS PG Regulations 2019, is therefore implemented in the University with effect from 2019 Admission onwards.

Orders are issued accordingly. (Syllabus appended).

Biju George K

Assistant Registrar

To

The HoD, Department of Computer Science/Co-ordinator CCSIT

Copy to: PS to VC/PA to PVC/ PA to Registrar/PA to CE/JCE I/JCE V/DoA/EX and EG Sections/GA I F/CHMK Library/Information Centres/SF/DF/FC

Forwarded / By Order

Section Officer

UNIVERSITY OF CALICUT
DEPARTMENT OF COMPUTER SCIENCE



Regulations, Scheme of Evaluation Course, Structure Syllabus for
MASTER OF SCIENCE (M.Sc.)

in

COMPUTER SCIENCE
(Choice Based Credit Semester System — CCSS
For the students admitted from the Academic Year 2019-2020 onwards)

Under the

FACULTY OF SCIENCE

June, 2019

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REGULATIONS

The existing regulations of Choice-based Credit Semester System (UO No. 4500/2019/Admn. Dated 26-03-2019) which are applicable for University Teaching Departments are also applicable for this programme with the following exceptions.

I Objectives: The course of the MSc (Computer Science) Programme is designed with the following objectives:

- To equip students to take up challenging research oriented responsibilities and courses for their higher studies/profession.
- To train and equip the students to meet the requirements of the Software Industry in the country and outside.
- To motivate and support the students to prepare and qualify challenging competitive examinations such as JRF/NET/JAM/GATE etc.

II Programme Structure:

- 1 Duration of the course shall be 2 years, divided into 4 semesters. The entire period of the four semester shall be divided for one core and one elective courses and for the Project Work.
- 2 The programme includes three types of courses, viz., Core courses (Code C), Elective Courses (Code E) and Audit Courses (Code A).
- 3 Selection and Eligibility for Admission is based on the existing University rules.
- 4 Evaluation of all semester theory papers will be on the basis of existing CCSS norms.
- 5 Conduct of Practical Examinations: Odd semester Practical Examinations will be conducted internally by the Department and Even Semester Examinations will be conducted by the Controller of Examination.
- 6 Core Courses: 'Core Course' means a course of a particular degree programme, which must be successfully completed by a student to receive the degree and which cannot be substituted by any other course. Core courses are offered by the Department conducting the programme.
- 7 Elective courses: 'Elective course' means a courses which can be substituted by equivalent course from the same or other Department/Schools and which must be successfully completed to receive the degree.

- 8 Audit Courses: There will be two Audit Courses with 2 credits each
- i. Ability Enhancement Course: A compulsory course which is mandatory for all programmes but its grade will be not be counted for the computation of SGPA or CGPA. This course is to get professional competency and exposure in the coarsened core area.
 - ii. Professional Competency Course: A compulsory course which is mandatory for all programmes but its grade will be not be counted for the computation of SGPA or CGPA. This course is to enhance the ability and skill in the coarsened core area.

These have to be done one each in the first two semesters. The credits will not be counted for evaluating the overall SGPA and CGPA. Concerned Department shall conduct examination for these courses and have to intimate /upload the results of the same to the University on the stipulated date during the III Semester. Students have to obtain only minimum pass requirements in the Audit Courses.

- 9 **Project Work and Viva:** The Project work should be carried out over the period of 16 weeks in the final semester in an Industry / R and D organization / Department/Institution. If the project is carried out in an Industry / R and D organization outside the campus, then a co-guide shall be selected from the Department/ Institution concerned. Every student should do the Project individually and no grouping is allowed. All the candidates are required to get the approval of their synopsis and the guide before commencement of the project from the Department / Institution and the matter may be intimated to the University at the beginning of the semester by the Department / Institution. The project will be reviewed periodically every month by the Department / Institutional. The continuous assessment marks (CA) will be based on the periodic progress and progress report.

At the end of the semester the candidate shall submit the Project report (two bound copies and one soft copy) duly approved by the guide, co-guide for End Semester Assessment. Evaluation for ESA should be conducted by a board of examiners appointed by the University. (Mark Distribution: Content 30% + Methodology 30% + Presentation 20 %, and Via- voce 20 %). If project work and the report are found to be not up to the expected standard, the examiners can ask the candidate to modify and resubmit the project report after incorporating the suggestions of the examiners. Such reports shall be resubmitted within the stipulated period suggested by the examiner(s).

UNIVERSITY OF CALICUT
Department of Computer Science
M.Sc. Computer Science
 Under CCSS (with effect from 2019 Admission)
COURSE STRUCTURE AND SCHEME OF EVALUATION

Semester 1

Sl.No.	Course Code	Course	Instructional Hrs/week		Exam Duration		Marks			Credit
			Lect/Lab	Tutorial	Theory	Practical	ESA	CA	Total	
1	CSC1C01	Discrete Mathematical Structures	3	1	3	—	80	20	100	4
2	CSC1C02	Advanced Data Structures and Algorithms	3	1	3	—	80	20	100	3
3	CS1CC03	Principles of Programming Methodology	3	1	3	—	80	20	100	4
4	CSC1C04	Theory of Computation	3	1	3	—	80	20	100	4
5	CSC1C05	Computer Organization and Architecture	3	1	3	—	80	20	100	4
6	CSC1C06	Practical 1	10	5	—	3	80	20	100	3
7	CSC1A01	Introduction to Research Methodology	—	—	3	—	—	100	100	2
Total			25	10	—	—	—	—	600	22

Semester 2

Sl.No.	Course Code	Course	Instructional Hrs/week		Exam Duration		Marks			Credit
			Lect/Lab	Tutorial	Theory	Practical	ESA	CA	Total	
1	CSC2C07	Design and Analysis of Algorithms	3	1	3	—	80	20	100	4
2	CSC2C08	Advanced Database Management System	3	1	3	—	80	20	100	4
3	CSC2C09	Operating System Concepts	3	1	3	—	80	20	100	4
4	CSC2C10	Object Oriented Programming with Java	3	1	3	—	80	20	100	3
5	CSC2E01-07	Elective 1	3	1	3	—	80	20	100	4
6	CSC2C11	Practical 2	10	5	—	3	80	20	100	3
7	CSC2A02	Term Paper	—	—	—	—	—	100	100	2
Total			25	10	—	—	—	—	600	22

Elective 1	Credit
CSC2E01- Artificial Intelligence	4
CSC2E02 - Information Theory and Coding	4
CSC2E03 - Computer Graphics	4
CSC2E04 - Advanced Microprocessor and Micro Controller	4
CSC2E05 - Numerical and Statistical Methods	4
CSC2E06 Distributed Computing	4
CSC2E07 Simulation and Modelling	4

Semester 3

Sl.No.	Course Code	Course	Instructional Hrs/week		Exam Duration		Marks			Credit
			Lect/Lab	Tutorial	Theory	Practical	ESA	CA	Total	
1	CSC3C12	Principles of Compiler Design	3	1	3	—	80	20	100	4
2	CSC3C13	Data Communication and Networking	3	1	3	—	80	20	100	4
3	CSC3C14	Web Technology	3	1	3	—	80	20	100	3
4	CSC3E08-CSC3E12	Elective 2	3	1	3	—	80	20	100	4
5	CSC3E13-CSC3E18	Elective 3	3	1	3	—	80	20	100	4
6	CSC3C15	Practical 3	10	5	—	3	80	20	100	3
	Total		25	10	—	—	—	—	600	22

Elective 2		Credit
CSC3E08 - Digital Image Processing		4
CSC3E09 - Wireless and Sensor Networks		4
CSC3E10 - Cryptography and Network Security		4
CSC3E11 - Remote Sensing and GIS		4
CSC3E12 - Digital Image Forensics		4
Elective 3		Credit
CSC3E13 - Soft Computing Techniques		4
CSC3E14 - Data Warehousing and Data Mining		4
CSC3E15 - Information Retrieval Systems		4
CSC3E16 - Data Analytics Using Python		4
CSC3E17 - Advanced Machine Learning		4
CSC3E18 - Advanced Java Programming		4

Semester 4

Sl.No.	Course Code	Course	Instructional Hrs/week		Exam Duration		Marks			Credit
			Lect/Lab	Tutorial	Theory	Practical	ESA	CA	Total	
1	CSC4C16	Software Engineering	3	1	3	—	80	20	100	4
2	CSC4E19-27	Elective 4	3	1	3	—	80	20	100	4
			Duration of the Project				Viva voce	CA	Total	
3	CS3C17	Project Work & dissertation	16 Weeks			400	300	100		8
	Total		6	2	—	—	—	—	600	16

Elective 4	Credit
CSC4E19 - Pattern Recognition	4
CSC4E20 - Natural Language Processing	4
CSC4E21 - Bio Informatics	4
CSC4E22 - Mobile Communication	4
CSC4E23 - Semantic Web Technology	4
CSC4E24 - Virtualization and Cloud Computing	4
CSC4E25 - Storage Area Network	4
CSC4E26 - Software Development for Portable Devices	4
CSC4E27 - Fundamentals of Big Data	4

UNIVERSITY OF CALICUT



Department of Computer Science
M.Sc. Computer Science Under CCSS (with effect from 2019 Admission)

SYLLABUS

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First Semester

CSC1C01: Discrete Mathematical Structures

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Propositional Logic: Statement Formulas and Truth Tables, Well Formed Formulas-Tautologies-Equivalence of Formulas-Duality Law-Tautological Implications-Normal Forms, Theory of Inference for the Statement Calculus. Predicate Calculus, Quantifiers, Free and Bound Variables, Inference Theory of the Predicate Calculus.

Unit II :

Set Theory-Sets and subsets-Set operations and their properties-Cartesian Products, Relations-Relation matrices- Properties of relations-Composition of relations, Equivalence relations and partitions-Partial Ordering.

Unit III :

Functions and Relations: Functions-Types of Functions, Composition of Functions and Inverse Functions. Relations -Relations and Their Properties, Functions as relations, Closure of Relations, Composition of relations, Equivalence Relations and Partitions. Partial Ordering, Hasse Diagram. The Pigeon hole Principle.

Unit IV :

Group Theory-Definition and Elementary Properties-Cyclic Groups- Homomorphism and Isomorphism-Subgroups-Cosets and Lagrange's Theorem, Rings and Fields-Definitions and examples of Rings, Integral Domains and Fields

Unit V :

Graph Theory-Paths and Cycles, Graph Isomorphism, Bipartite Graphs, Subgraphs, Representation of Graphs, Eulerian and Hamiltonian Properties of Paths-Trees-Spanning Trees, Cayley's theorem, Kruskal's Algorithm, Prim's Algorithm. Dijkstra's Algorithm to Find Shortest Path in Weighted Graphs.

References:

1. Trembley J.P. & Manohar R.P, Discrete Mathematical Structures with Application to Computer Science, Mc.Graw Hill, 2007
2. R.P.Grimaldi, Discrete and Combinatorial Mathematics: An applied Introduction, 3/e, Addison-Wesley, New Delhi, 1994
3. J.K.Truss, Discrete Mathematics for Computer Scientists, Addison Wesley, 1999
4. B.Kolman and R.C.Busby, Discrete Mathematical Structures for Computer Science, PHI, 1994
5. C.L.Liu. Elements of Discrete Mathematics, 2/e, McGraw Hill, 1985
6. John O. Clark , Derek A. Holton, A First Look at Graph Theory, world scientific publishing, 1995.

CSC1C02: Advanced Data Structures and Algorithms

Course Number: 2

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 3

Unit I :

Overview of Data Structures, Data Abstraction & Abstract data types. Arrays-Records-Representation. Data Structure operations: Traversing, Inserting and deleting, sorting and searching. Linear Search & Binary Search- Complexity.

Unit II :

Linear Data structures: Stack-operations and its implementations-Parsing arithmetic expressions, translating and evaluating; Recursion- characteristics of recursion-comparison of recursive and non-recursive algorithms, Queue- operations and its implementations-Circular queue-dequeue - priority queues, Linked Lists- Operations and implementations-Doubly Linked Lists and Circular lists-Sparse matrix representation.

Unit III :

Non-linear Data Structures: Trees-Tree traversals algorithms- Binary Trees-Threaded Binary Trees-Binary search Trees-Traversals and operations on BST - balanced trees-AVL, Red-Black Trees, Splay Tree, B-Tree, M-way Trees-Operations and their implementation.

Unit IV :

Hashing: Overview of hashing-Hash tables- hash functions and their computations-open addressing-Linear probing- quadratic probing-double hashing algorithms and their implementations-Separate chaining-Hashing efficiency.

Unit V :

Heap: Overview of heaps-Implementation and operations. Sorting techniques: Insertion sort- Selection sort- Shell sort- Bubble sort- Quick sort-Heap sort- Merge sort- External sort- Comparison of sorting algorithms. Graphs- representation of graphs-operations- traversals and their implementation- minimum spanning trees-shortest path problem-Efficiency of various graph algorithms.

References:

1. Alfred V.Aho, John E.Hopcroft and Jeffrey D.Ullman, Data structures and Algorithms,Pearson Education Asia,2002.
2. Horowitz E & Sahni S, Fundamentals of data structures, Computer Science press, 1978.
3. SartajSahni, Datastructures, Algorithms and Applications in Java, Second Edition, Universities Press(India) Pvt Ltd, 2005.
4. Robert Lafore, Datastructures and algorithms in Java, Second Edition, Sams Publishing,2003.
5. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction toAlgorithms,Third Edition, PHI,2010.
6. Seymour Lipschutz and GAV Pai, Data Structures, Indian Adapted Edition, Schaum's Outlines Series, TMH, 2006

CSC1C03: Principles of Programming Methodology

Course Number: 3

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Problem Solving-Flow Chart for Structured Programming-Program Charts-System Charts-Variables, data names, programming statements-Flow Chart Symbols-Terminal Symbols-I/O-Comments- Connectors-Process-Decision. Algorithm Design-Problem Solving Aspect- Top Down Design-Formal Conventions- Writing Algorithms- Fundamental Algorithms with flow chart. Program- Characteristics of a good program- Modular Approach- Programming style- Documentation and Program Maintenance- Compilers and Interpreters- Running and Debugging Programs- Syntax Errors-Run- Time Errors- Logical Errors- Concept of Structured Programming.

Unit II :

C Language preliminaries-C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants. Input-Output-getchar, putchar, scanf, printf, gets, puts, functions. Pre-processor directives. Operators and expressions-Arithmetic, unary, logical, bit-wise, assignment and conditional operators. Control statements-While, do-while, for statements, nested loops, if else, switch, break, Continue, and goto statements, comma operators. Storage types-Automatic, external, register and static variables.

Unit III :

Functions-Defining and accessing, passing arguments, Function prototypes, Recursion, Library functions, Static functions. Arrays-Defining and processing, Passing arrays to a function, Multi-dimensional arrays. Strings-Defining and operations on strings.

Unit IV :

Pointers-Declarations, Passing pointers to a function, Operations on pointers, Pointer Arithmetic, Pointers and arrays, Arrays of pointers function pointers. Structures-Defining and processing, Passing to a function, Unions, typedef, array of structure, and pointer to structure.

Unit V :

File structures-Definitions, concept of record, file operations: Storing, creating, retrieving, updating Sequential, relative, indexed and random access mode, Files with binary mode(Low level), performance of Sequential Files, Direct mapping techniques: Absolute, relative and indexed sequential files (ISAM) concept of index, levels of index, overflow handling. File Handling-File operation-creation, copy, delete, update- Text file, binary file.

References:

1. Martin M. Lipschutz and Seymour Lipschutz, Schaum's Outline of Theory and Problems of Data Processing.
2. Anil Bikas Chaudhuri, The Art Of Programming Through Flowcharts & Algorithms, Laxmi Publications, New Delhi.
3. Jean Paul Trembley and Pual G Sorenson, An Introduction to Data Structures with Applications, Tata McGraw Hill.

CSC1C04: Theory of Computation

Course Number: 4

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Preliminaries: Review of proof techniques-Mathematical induction - Basic concepts of languages automata and grammar-Alphabet, languages and grammars, productions and derivation. Regular languages: Regular expressions- Finite deterministic and non-deterministic automata-regular grammar. Equivalence between various models. Closure properties regular languages-DFA state minimization-Pumping lemma and proof for existence of non regular languages.

Unit II :

Context-Free Grammars (CFG)- Derivations- sentential forms- Parse tree- Ambiguity in grammars and Languages- Applications of CFG- Simplification of Context free Grammars- Normal forms: Chomsky Normal form (CNF) and Greibach Normal form (GNF).

Unit III :

Pushdown Automata (PDA)- Formal definition-Graphical notations - Language accepted by PDA- Deterministic and Non Deterministic PDA - Equivalence of PDAs and CFGs-Pumping lemma for CFLs, Closure properties of CFLs - Decision properties of CFL. Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Unit IV :

Turing Machines- Notation- Instantaneous Description- Transition Diagram- The language of a Turing Machine- Variants of TMs-Multitape TMs, Nondeterministic TMs- TMs with semi - infinite tapes, multistack machines - Universal Turing Machines- Equivalence of the various variants with the basic model - Church-Turing Thesis.

Unit V :

Computability- Closure properties of recursive and recursively enumerable language. Context Sensitive Language and LBA- Equivalence of

LBA and CSG-The Chomsky Hierarchy Un-decidability - Halting problem-reductions-Complexity: Complexity Classes - Class P - Class NP- NP complete and NP Hard problems.

References:

1. Linz: P. An Introduction to Formal Languages and Automata, Narosa, 1998.
2. Hopcroft J.E. and Ullman J.D., Introduction to Automata Theory Languages and Computation, Narosa, 1998.
3. H.R.Lewis and C.H.Papadimitriou, Elements of the Theory of Computation, Prentice Hall of India, 1996.
4. Martin J.C., Introduction to Languages and the Theory of Computation, Tata McTraw Hill, 1997.
5. J.E.Sagage, Models of Computation, exploring the power of Computing, Addison Wesley, 1998.
6. Michael Sipser : Introduction to theory of Computation , Cengage Learning, Indian Edition
7. D. S. Garey and G. Johnson, Computers and Intractability: A Guide to the Theory of NP-Completeness, Freeman, New York, 1979.

CSC1C05: Computer Organization and Architecture

Course Number: 5

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Digital Computers and Digital Systems, Number systems and Conversions, Digital Logic Circuits- Boolean Algebra & Map simplification, combinational circuits, flip flops, design of sequential circuits, Digital Components-Integrated Circuits, Decoders, Multiplexers, Registers, Shift Registers, Binary Counters, data representation - data types, complements, fixed-point representation, floating-point representation, other binary codes, error detection codes.

Unit II :

Computer Arithmetic: addition of positive numbers, design of fast adders, signed addition and subtraction, Arithmetic and Branching Conditions, Multiplication of positive numbers, signed number multiplication- Booth Algorithm, fast multiplication, division- restoring and non-restoring algorithms, floating point numbers and operations- single & double precision.

Unit III :

Basic computer organization-machine instructions- classification, function, addresses, size, addressing modes- instruction cycle - instruction sequencing. fundamental concepts- registers, register transfers, performing arithmetic or logic operations, memory read and write, execution of a complete instruction, branch instruction, Single bus, two bus, three bus organization, a complete processor- Control unit: - hardwired control, microprogrammed control, micro instructions-types.

Unit IV :

The Memory System: Some Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Virtual Memories, Memory Management Requirements, Secondary Storage, memory interleaving. Input / Output Organization -Accessing I/O devices- programmed I/O, interrupt I/O - interrupts - interrupt

processing- hardware interrupts-programmable interrupt controller-vectorized interrupts - interrupt nesting - daisy chaining- direct memory access (DMA)- DMA operations & DMA Controller, Introduction to I/O interfaces, I/O channels, IO Processors.

Unit V :

8085 microprocessor - Architecture: Block diagram-addressing modes-instruction set, Instruction cycle-timing diagrams - different machine cycles - fetch and execute operations - estimation of execution time. 8086 microprocessor - Architecture: Block diagram-Intel 8051 Micro controller-Architecture - basic instructions-basic assembly language programs-peripherals: interrupts, timers, parallel port, serial port.

References:

1. V C Hamacher, Computer Organization, Mc-Graw Hill International Edition, Fifth Edition.
2. Morris Mano, Digital logic and Computer design, Prentice Hall of India, 2004.
3. M Morris Mano, Computer System Architecture, Prentice Hall, Third Edition.
4. William Stallings, Computer Organization and Architecture, Fifth Edition.
5. Andrew S Tanenbaum, Structured Computer Education, Prentice Hall, Fourth Edition.
6. Floyd and Jain, Digital Fundamentals, Pearson Education, Eighth Edition.
7. Ramesh. S. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Wiley Eastern Ltd, New Delhi.

CSC1C06: Lab I - C Programming

Course Number: 6

Number of Credits: 3

Number of Contact Hours: 5 (10 Practical + 5 Tutorial)

Unit I C Programming:

Develop programs to implement the following:

1. HCF (Euclid's algorithm) and LCM of given numbers.
2. Find mean, median and mode of a given set of numbers
3. Conversion of numbers from binary to decimal, hexadecimal, octal and back.
4. Evaluation of functions like e^x , $\sin x$, $\cos x$ etc. for a given numerical precision using Taylor's series.
5. Testing whether a given number is prime.
6. String manipulation programs: sub-string search, deletion.
7. Lexicographic sorting of a given set of strings.
8. Generation of all permutations of the letters of a given string using recursion.
9. Programs to find the product of two matrices.
10. Inverse and determinant (using recursion) of a given matrix.

Unit II Data Structures and Algorithms:

Implement the following:

1. Singly linked list with operations to access data, add node and delete node.
2. Variations on linked lists.
3. Sparse matrix.
4. PUSH, POP operations of stack using Arrays/using linked lists.
5. Add, delete operations of a queue using Arrays.
6. Add, delete operations of a queue using linked lists.
7. Variations on queues.
8. Conversion of infix to postfix using stack operations.
9. Postfix Expression Evaluation using stack.

10. Towers of Hanoi Problem
11. Addition of two polynomials using linked list.
12. Binary tree using linked lists
13. Binary tree traversals.
14. Variations on tree structures
15. Graphs/Graph traversals
16. Shortest path algorithm
17. Sorting techniques/Search algorithms.

CSC1A01: Introduction to Research Methodology

Course Number: 7

Number of Credits: 2

Unit I :

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method - Understanding the language of research - Concept, Construct, Definition, Variable. Research Process.

Unit II :

Problem Identification & Formulation - Research Question - Investigation Question - Measurement Issues - Hypothesis - Qualities of a good Hypothesis - Null Hypothesis & Alternative Hypothesis. Hypothesis Testing - Logic & Importance.

Unit III :

Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Unit IV :

Data Analysis: Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages). Interpretation of Data and Paper Writing - Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Unit V :

Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.

References:

1. Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004.
2. Blumberg, Boris, Donald R. Cooper, and Pamela S. Schindler. Business research methods. Vol. 2. London: McGraw-Hill Higher Education, 2008.
3. Misra R.P, Research Methodology - A Hand Book, Concept publishing Company, New Delhi, 1988
4. Bell, Emma, Alan Bryman, and Bill Harley. Business research methods. Oxford university press, 2018.
5. <https://nptel.ac.in/courses/121106007/>

Second Semester

CSC2C07: Design and Analysis of Algorithms

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental data Structures. Analysis Framework, Asymptotic Notations and Basic efficiency classes, Mathematical analysis of Recursive and Non-recursive algorithms, Masters theorem. Brute Force Approaches: Introduction, Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.

Unit II :

Divide-and-Conquer: Mergesort, Quicksort, Binary Search, Strassen's Matrix Multiplication, Binary tree Traversals and related properties, median finding algorithm. Decrease-and-Conquer: Insertion Sort, Depth First and Breadth First Search, Topological sorting

Unit III :

Transform-and-Conquer: Introduction, Balanced Search Trees: AVL Trees, 2-3 Trees, Heaps and Heapsort. Greedy Method: The General Method, Huffman coding, Knapsack Problem, Job Sequencing with Deadlines, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths.

Unit IV :

Dynamic Programming: The General Method, Warshall's Algorithm,

Floyds Algorithm for the All-Pairs Shortest Paths Problem, 0/1 Knapsack, The Traveling Salesperson problem. Backtracking: n-Queens problem, Hamiltonian Circuit Problem, Subset Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.

Unit V :

Complexity: Complexity classes P, NP, Co-NP-Hard and NP-complete Problems Cooks theorem NP-completeness reductions for clique, vertex cover, subset sum, Hamiltonian cycle, TSP, Integer programming Approximation algorithms vertex cover, TSP, set covering and subset sum.

References:

1. Anany Levitin: Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education, 2007.
2. Thomas H Cormen, Charles E Leiserson, & Ronald L Rivest, Introduction to Algorithms, 2nd Ed. Prentice Hall of India Private Limited, New Delhi, 2001.
3. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran: Fundamentals of Computer Algorithms, 2nd Edition, Universities Press, 2007.
4. S. Basse, Computer Algorithms: Introduction to Design and Analysis, Addison Wesley, 1998.
5. U.Manber, Introduction to Algorithms: A creative approach, Addison Wesley, 1989
6. V.Aho, J.E. Hopcraft, J.D.Ullman, The design and Analysis of Computer Algorithms, Addison Wesley, 1974
7. Gilles Brassard & Paul Bratley, Fundamentals of Algorithmics, Prentice-Hall of India, 2007.
8. Goodman S E & Hedetniemi, Introduction to the Design & analysis of Algorithms, Mc- Graw Hill, 2002.

CSC2C08: Advanced Database Management System

Course Number: 2

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Database System Concepts, Purpose of Database Systems, Views of Data - Data Abstraction, Instances and Schemas, Data Independence, Data Models. Relational Data Model - Relational Model concepts, keys, Integrity constraints - Domain Constraints, Key Constraints, Entity Integrity Constraints , Referential Integrity Constraints. ER Data Model- Design Issues, Entity Relationship Diagram, Weak Entity Sets, Extended ER Features, Design of an ER Database Schema, Reduction of an ER Schema to Tables. Relational Algebra-Selection and Projection, Set operations, Renaming, Joins, Division. Relational Calculus.

Unit II :

Relational database design - Design Principles, Normalization, Normal Forms - 1NF, 2NF, 3NF, BCNF, 4NF & PJNF, Domain Key Normal Form. Transactions -concepts, states of Transactions, ACID properties. Schedules - serial schedules, concurrent schedules, Serializability, Concurrency control protocols - Locking-Two-Phase Locking, Deadlock, Granularity, Timestamp Ordering Protocol.

Unit III :

Relational Database Query Languages - Basics of QBE , SQL Data Definition Language(DDL), Data Manipulation Language(DML), Data Control Language(DCL) Commands, Basics of Query Processing. Data Definition in SQL - Data types, Creation, Insertion, Viewing, Updation, Deletion of tables, Renaming, Dropping of tables. Data Constraints - I/O constraints, Primary key, foreign key, unique key constraints, Database Manipulation in SQL - Select command, Logical operators, Range searching, Pattern matching, Grouping data from tables in SQL, GROUP BY, HAVING clauses, Joins. Views - Creation, Renaming the column of a view, DROP view.

Unit IV :

Program with SQL - Data types: Using set and select commands, Flow control constructs - if, if /else, while, goto. Global variables, Data types, Operators and Functions, Data Definition and Manipulation Statements, CodeBlocks, Stored Procedures- create, alter and drop, passing and returning data to stored procedures, using stored procedures within queries. Cursors - Working with cursors, Error Handling. User defined functions, implementing triggers.

Unit V :

Distributed Database systems- characteristics, architecture and challenges. Different approaches in database technologies - Object oriented and Object relational databases. Emerging trends in databases. Introduction to Big Data.

References:

1. AbrahamSilbersehatz, Henry F. Korth and S.Sudarshan, Database system concepts,6th Edition, Tata McGraw-Hill 2010.
2. Elmasri and Navathe, Fundamentals of Database systems, 5th Edition, Pearson, 2009.
3. CJ Date, Introduction to Database Systems, Addison Wesley.
4. VikramVaswani, MySQL The complete Reference,1st Edition, Tata McGraw-Hill, 2004.
5. Paul DuBois, MySQL Cookbook, 2nd Edition, O'Reilly Media, 2006

CSC2C09: Operating System Concepts

Course Number: 3

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

System software Overview: Operating system, I/O Manager, Assembler, Macro Processor Compiler and Interpreters, Linker, Loader. Fundamentals of OS: OS services and components, Different types of operating systems, multitasking, multiprogramming, time sharing, buffering, spooling.

Unit II :

Process & thread management: Concept of process and threads, process states, process management, context switching, interaction between processes and OS, multithreading. CPU Scheduling algorithms, Concurrency control: Concurrency and race conditions, mutual exclusion requirements , s/w and h/w solutions, semaphores, monitors, classical IPC problem and solutions , Dead locks -characterization , detection ,recovery, avoidance and prevention.

Unit III :

Memory management: Issues-Memory Allocation, Dynamic Relocation, various management strategies. Virtual memory, Paging: Issues and Algorithms. Segmentation: Typical implementations of paging and segmentation systems, Disk Scheduling. File Systems: File concept, File support, Access methods, Allocation methods, Directory systems, File Protection, Free Space management.

Unit IV :

Protection & security-Protection: Goals of protection, Domain of protection, Access matrix, Implementation of access matrix, Revocation of access rights .Security: the security problem, authentication, one-time passwords, program threats, System threats, Threat monitoring, Encryption. Case study of Microsoft Windows XP.

Unit V :

UNIX Operating System - UNIX Software architecture - Kernel, System calls, UNIX Command lines, Basic UNIX Commands, File System, Basics of UNIX Shell programming.

References:

1. D. M. Dhamdhare, Operating Systems, Tata Mc Graw Hill, 2nd Ed.
2. Silberschatz & Galvin, Operating System Concepts, Wiley, 7th Ed.,2000.
3. Gary J Nutt, Operating systems-A Modern Perspective, Addison Wesley,2000.
4. Flynn & Metioes, Understanding Operating System, Thomsan, 4th Ed.
5. Andrew Tanenbam, Albert S. Woodhull, Operating Systems Design & Implementation, Pearson.
6. Achyut S. Godbole, Operating Systems, Tata Mc Graw Hill 2nd Ed.
7. UNIX Operating System: The Development Tutorial via UNIX Kernel Services, YukunLiu, Yong Yue, LiweiGuo

CSC2C10: Object Oriented Programming with Java

Course Number: 4

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 3

Unit I :

Introduction to Object Oriented Programming, Comparison with other programming paradigms, Java Basics: Java Programming environment, Structure of a java program, Life cycle of a java program, Java Virtual Machine, Byte code, Features of Java, fundamental programming structures in Java: comments, Primitive Data Types ,variables, Keywords, literals, variables scope & declarations, Control structures, Operators - Casts and Conversions, Arrays. Simple programs.

Unit II :

Data abstraction and Encapsulation - Objects and Classes: Predefined Classes - Defining Classes- Static Fields and Methods - Method Parameters - Object Construction- Packages. Inheritance: Classes - Super classes - Subclasses - Object: The Cosmic Superclass - Generic Array Lists -Object Wrappers and Auto-boxing - Reflection - Enumeration Classes. Interfaces and Inner Classes, Polymorphism: Overloading - Overriding.

Unit III :

Introduction to GUI: AWT Architecture - Light-Weight vs Heavy-Weight, AWT Event Hierarchy & Event Handling - Using Top-Levels - components and containers - Introduction to Layouts. Deploying Applets and Applications: Applet Basics - The Applet HTML Tags and Attributes - Multimedia - The Applet Context - JAR Files - Application Packaging.

Unit IV :

Exceptions and Debugging: Dealing with Errors - Catching Exceptions - Using Exceptions, user defined Exceptions. Threads - Creating Threads, Runnable interface, Thread Class, Inter thread communication, Synchronization suspending, resuming and stopping threads. Multithreaded Programming. Streams and Files: The Complete Stream - ZIP File Streams - Use of Streams - Object Streams - File Management.

Unit V :

User Interface Components with Swing: Introduction to Layout Management - Text Input Choice Components - Menus - Sophisticated Layout Management - Dialog Boxes. Java library. Database Programming: JDBC - introduction, architecture, Drivers, connections, statements, resultset, Meta data and Query Execution. Sockets: Introduction to networking, InetAddress, url, socket, server sockets, Datagrams.

References:

1. Horstmann & Coronell, Core Java , Volume 1 and 2, 8th Ed., Pearson, 2008.
2. Herbert Schildt, Java2 The Complete Reference, Seventh Edition, Tata McGraw-Hill,2007.
3. Bruce Eckel, Thinking in Java, Prentice Hall, Fourth Edition, 2006.
4. Kathy Sierra and Bert Bates, Head first java, Second Edition, Orelly Media, 2005.
5. Y.Daniel Liang, Introduction to Java Programming, Eighth Edition, Pearson, 2011.
6. James. P. Cohoon, Jack. W. Davison, Programming in java 5.0, Tata McGraw Hill, 2006.
7. Thomas Wu, An introduction to Object Oriented Programming with Java, Tata McGraw Hill, 2006.
8. Bernard Van Haecke,JDBC: Java Database Connectivity, IDG Books India, 2000.
9. E Balaguruswamy, Programming in Java.

CSC2C11: Practical 2

Course Number: 5

Number of Contact Hours: 5 (10 Practical + 5 Tutorial)

Number of Credits: 3

Unit I Java Programming:

Develop programs to implement the following:

1. Classes, objects and methods.
2. Inheritance of different types.
3. Use of keywords super, abstract and final.
4. Method overloading and Method overriding
5. Packages and interfaces.
6. Exception handling
7. Use of static members in a class.
8. File operations.
9. Multithreaded Programming
10. Applets
11. String handling
12. AWT to work with text and graphics
13. Applications of Swing.

Unit II Advanced DBMS:

Implement the following:

1. DCL, DDL, DML, DQL statements in MySQL
2. Stored Procedures in MySQL
3. Cursors and Triggers
4. Transactional and Locking statements
5. Account Management statements

CSC2E01: ARTIFICIAL INTELLIGENCE

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction: Artificial Intelligence- problems, scope and applications, Problem space and search- Production system- characteristics- the predicate calculus, Inference rules, Structures and strategies for state space search, strategies for space search, using state space to represent reasoning with the predicate calculus.

Unit II :

Heuristics Search: Control and implementation of state space search, Generate and test, Hill climbing, Depth first search, Breadth first search, Best-first search, A*, Problem Reduction, AO*, Constraint Satisfaction, Means-ends analysis, Heuristic in games, Complexity issues.

Unit III :

Game Playing - The Minimax search procedure, adding Alpha-beta cut-offs, Additional refinement, Iterative deepening, Planning system and its components, Understanding, Understanding as constrained satisfaction.

Unit IV :

Knowledge representation issues, representation and mappings, Representing simple facts in logic, Representing instances and ISA relationships, Computable functions and Predicates, Resolution, conversion to clausal form, Unification algorithm, Natural deduction. Knowledge representation using rules, logic programming, forward versus backward reasoning, Symbolic reasoning under uncertainty- Nonmonotonic reasoning, Slot and filler structures: Semantic nets, frames, conceptual dependency, scripts.

Unit V :

Machine Learning - rote learning, learning by taking advice, learning in problem solving, learning from examples, Explanation based learning, Analogy, formal learning theory, Connectionist models- Hopfield networks, learning in neural networks, back propagation, applications of neural networks, Genetic algorithm, classifier systems and genetic programming, artificial life and society based learning.

References:

1. E. Rich, K. Knight and S.B.Nair, Artificial Intelligence, 3rd Edn. TMGH, New Delhi, 2009.
2. G.F. Luger and W.A Stubblefield, Artificial Intelligence - Structures and Strategies for complex problem solving, Addison-Wesley-1998.
3. P.H Winston - Artificial Intelligence, Addison-Wesley-1992.
4. Nils J. Nilsson ,Artificial Intelligence , A New Synthesis, Morgan Kauf 2000.
5. W.F. Clocksin and C.S. Mellish, Springer Verlag, Programming in Prolog 2003
6. Dan W.Patterson , Introduction to Artificial Intelligence and Expert Systems, Prentice Hall, 1990

CSC2E02: INFORMATION THEORY AND CODING

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Information Theory: Information and entropy, source encoding, Noiseless coding, Shannon's first fundamental theorem, Sources with finite memory: Markov sources, Discrete channel with discrete, Shannons second fundamental theorem on coding for memory less noisy channel, Discrete channel with continuous noise, continuous channel with continuous noise, Channel capacity theorem, Properties.

Unit II :

Waveform Coding Techniques: PCM Channel noise and error probability DPCM and DM Coding speech at low bit rates Prediction and adaptive filters. Base band shaping for Data transmission, PAM signals and their power spectra Nyquist criterion ISI and eye pattern Equalization

Unit III :

Error control coding: Galois fields, Vector spaces and metrics, Block codes, Binary Cyclic codes, Multiple error correcting codes, Majority - logic decoding, convolutional codes, Burst error correcting codes, ARQ, Performance of codes.

Unit IV :

Digital Modulation Techniques: Binary and M-ary modulation techniques, Coherent and non-coherent detection, Bit Vs symbol error probability and bandwidth efficiency. Bit error analysis, using orthogonal Signaling.

Unit V :

Discrete two dimensional linear processing: super position and Convolution, Finite area superposition and convolution, Circulant superposition and convolution, Unitary transforms, Generalized unitary transforms, Fourier transforms, Cosine, Sine & Hartely transforms, Hadamard, Har

walsh hadamard, Karhanen- Loeve transforms, Linear processing techniques: Transform domain processing, transformed domain superposition, Fast Fourier Transformation convolution, Fourier transform filtering.

References:

1. J. Dass. , S.K. Malik & P.K. Chatterjee, Principles of digital communication: 1991.
2. Vera Pless, Introduction to the theory of Error correcting codes: John Wiley & Sons, Inc. 1998
3. Robert G. Gallanger, Information Theory and Reliable Communication: Mc Graw Hill, 1992
4. Simon Haykin :Digital communications - John Willy & sons, 2003.

CSC2E03: COMPUTER GRAPHICS

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction, application and output devices for computer graphics: raster and random scan display, CRT, color CRT, flat panel, LCD, LED, DVST. Adapters; monochrome display adapter (MDA), CGA, hercules graphics card, enhanced graphics adapter, Professional graphics adapter, VGA, SVGA. Graphics software: GKS, PHIGS, OpenGL. Scan conversion: Points & lines, line drawing algorithms; DDA algorithm, Bresenham's line algorithm Circle generation algorithm Mid -Point Circle algorithm, Ellipse generating.

Unit II :

Filling, Clipping & Transformation (2D& 3D): Area scan conversion, seed fill algorithm ,scan line polygon fill algorithm ,Inside Outside test, Boundary fill algorithm ,Flood fill algorithm, Character generation. Anti-aliasing. Clipping operations, Cohen Sutherland line clipping, Liang Barsky line clipping, Nicholl Lee line clipping, polygon clipping, Sutherland Hodgeman & Weiler Atherton polygon clipping, Text clipping. Transformation: Geometric & coordinate transformation, Inverse transformation, Composite transformation, Translation, rotation, scaling, shearing, reflection.

Unit III :

Projection: 3D concepts & viewing pipeline, coordinate system, window to viewport coordinate Transformation, parallel & perspective projection, projection matrix, view volume. 3D object representation: wire-frame model, visible surface detection methods, depth comparison, Z-buffer algorithm, back face detection, BSP tree method, printer's algorithm, depth cueing.

Unit IV :

Curves & Fractals: curve representation, surfaces, designs, spline representation, Bezier curves, cubic spline, beta spline, B-spline curves. Fractal's geometry, fractal generation procedure, classification of fractal, fractal dimension, fractal construction methods.

Unit V :

Color & shading Models: Introduction, modelling light intensities and sources ,diffuse reflection, Lambert's cosine law, specular reflection, half-toning, dithering, color model - XYZ, RGB, YIQ, CMY & HSV, shading algorithm & model, illumination model, gouraud shading, phong shading. OpenGL programming: Introduction, primitives drawing, colouring, transformation, filling, curve.

References:

1. Donald Hearn and M. Pauline Baker, Computer Graphics, Prentice Hall, 1997
2. D.Hearn and M. P. Baker, Computer Graphics with Open GL, 3rd Ed., Prentice Hall, 2004.
3. FS Hill, JR, Computer Graphics using OpenG,L, Second Edition, Prentice Hall of India Private Ltd.-New Delhi, 2005
4. Dave, Mason Woo, Jackie, Tom Davis, Open GL Programming Guide, 6th Edition, Person

CSC2E04: ADVANCED MICRO PROCESSORS AND MICRO CONTROLLER

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

8085 microprocessor - Architecture: Block diagram-addressing modes-instruction set-basic programs- stacks and subroutines-interrupts-machine cycles-time delays.

Unit II :

8086 microprocessor - Architecture: Block diagram-real mode memory addressing-addressing modes: data addressing, program memory, addressing, stack memory addressing-instructions: data movement instructions, arithmetic logic instructions, program control instructions-basic programs-procedures.

Unit III :

Interrupts-types 8086 interrupts and interrupt responses-interrupt vector table-8259 PIC-interrupt applications: INT 09H and keyboard buffer-INT 21Hoperations for screen display and keyboard input- INT10Hand 16H operations for video and keyboard.

Unit IV :

Peripherals-memory interface-8255PPI-8254 PIT-8237 DMA controller-8279 keyboard and display controllers.

Unit V :

Intel 8051 Micro controller- Architecture-basic instructions-basic assembly language programs- peripherals: interrupts, timers, parallel port, serial port.

References:

1. Ramesh S.Gaonkar, Microprocessor architecture, programming and applications with the 8085,, PenRam International Edition.
2. Barry.B.Bray, The Intel microprocessors-architecture, Programming & interfacing,, PHI Edition.

3. Peter Abel, IBM PC assembly language & Programming, PHI Edition.
4. Muhammed Ali Mazidi, Janice GillisPie Mazidi, Rolin D.McKinlay, The 8051 micro controller and embedded systems,
5. Douglas V.Hall, Micro processors and interfacing, Programming and Hardware, TMH Edition.
6. Kenneth J.Ayala, The 8051 micro controller-Architecture, Programming and Applications, PRI Edition.

CSC2E05: NUMERICAL AND STATISTICAL METHODS

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Approximation and errors in computing - introduction, significant digits - inherent errors - numerical error - modeling errors - blunders - absolute and relative errors - conditioning and stability. Roots of non-linear equations - introduction - iterative methods - bisection - false position - Newton - Raphson's, Secant and Bairstow's methods.

Unit II :

Introduction solution of linear equations - Gauss elimination - Gauss-Jordan method - Jacobi Iteration method - Gauss-Seidal methods. Interpolation - linear interpolation - Newton's forward backward & divided difference interpolation methods - Lagrange's method.

Unit III :

Integration - trapezoidal rule, Simpson's 1/3, & 3/8 rules. Differential equations: Heunn's polygon, Range-Kutta fourth order, Milne-Simpson, Adams-Bashforth and Adams-Moulton methods.

Unit IV :

Classical definition of probability - statistical definition of probability - axiomatic approach to probability - addition and multiplication theorem on probability - compound and conditional probability - independence of events - Bayes theorem random variables - discrete and continues - pmf, pdf and distribution functions.

Unit V :

Introduction linear programming - mathematical formulation - graphical method of solution - simplex method - duality - dual simplex - transportation - assignment problems.

References:

1. E. Balagurusamy, Numerical Methods, 1st Edition, Tata Mcgraw Hill Education Private Limited, ISBN: 0074633112.

2. S.G. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons , ISBN: 9788180545283.
3. V.Rajaraman, Computer Oriented Numerical Methods, 3rd Edition, Prentice Hall Of India, ISBN: 81203078601993.
4. Satyendra Mittal and C. P. Sethi, Linear Programming, Pragati Prakashan.

CSC2E06: DISTRIBUTED COMPUTING

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Operating system fundamentals - distributed system concepts and architectures - major design issues - distributed computing environments (DCE).

Unit II :

Concurrent processes and programming - threads and processes - client server model time services language mechanisms for synchronization - concurrent programming languages.

Unit III :

Inter-process communication and coordination - message passing communication - request/reply communication - transaction communication - name and directory services - distributed mutual exclusion - leader election.

Unit IV :

Distributed process scheduling - static process scheduling, dynamic load sharing and balancing distributed process implementation.

Unit V :

Real-time scheduling - concepts of distributed file systems - distributed shared memory - distributed computer security

References:

1. Chow R. & Johnson T, Distributed Operating Systems and Algorithms, Addison Wesley.
2. Sinha P.K., Distributed Operating Systems Concepts and Design, PHI
3. Tanenbaum S. Distributed Operating Systems, Pearson Education.
4. Coulouris G, Dollimore J. & Kindberg T., Distributed Systems Concepts and Design, Addison Wesley

5. Singhal M. & Shivaratri, Advanced Concepts in Operating Systems, Distributed Databases And Multiprocessor Operating Systems, McGraw Hill.

CSC2E07: SIMULATION AND MODELING

Course Number: 6

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - systems and models - computer simulation and its applications -continuous system simulation - modeling continuous systems - simulation of continuous systems - discrete system simulation - methodology - event scheduling and process interaction approaches - random number generation.

Unit II :

Testing of randomness - generation of stochastic variates - random samples from continuous distributions - uniform distribution - exponential distribution m-Erlang distribution - gamma distribution - normal distribution - beta distribution - random samples from discrete distributions Bernoulli - discrete uniform -binomial - geometric and poisson.

Unit III :

Evaluation of simulation experiments - verification and validation of simulation experiments - statistical reliability in evaluating simulation experiments -confidence intervals for terminating simulation runs - simulation languages -programming considerations - general features of GPSS-SIM SCRIPT and SIMULA.

Unit IV :

Simulation of queueing systems - parameters of queue - formulation of queueing problems - generation of arrival pattern - generation of service patterns -Simulation of single server queues - simulation of multi-server queues -simulation of random queues.

Unit V :

Simulation of stochastic network - simulation of PERT network - definition of network diagrams forward pass computation - simulation of forward pass -backward pass computations - simulation of backward pass - determination of float and slack times determination of critical path - simulation of complete network - merits of simulation of stochastic networks.

References:

1. C. Deo N., System Simulation And Digital Computer, Prentice Hall of India.
2. Gordan G., System Simulation, Prentice Hall of India.
3. Law A.M. & Ketton W.D., Simulation Modelling and Analysis, McGraw Hill.

CSC2A02: Term Paper

Course Number: 7

Number of Credits: 2

A term paper is introduced in the second semester with the following objectives.

- To familiarize the student to the techniques of literature survey and to conduct a study/analysis result in a critical review of the recent research work/technology innovations related to Computer Science.
- To acquaint with the process of presenting the work through seminars and technical reports.

The student is expected to do an extensive literature survey and analysis in a research/innovations/technology area related to Computer Science, under the supervision of a faculty member from the Department. The student has to choose an area/topic for his/her work after due consultation and approval from the guide (students can refer articles from ACM/IEEE/INFLIBNET Journals/Conference Proceedings and/or equivalent documents, standard textbooks and web based material, approved by the supervisor)

The study should preferably result in a critical review of the recent research works/technology advancements/ innovations/ algorithms/theoretical contributions in the form of theorems and proofs/new methods of proof/new techniques or heuristics with analytical studies/implementations and analysis of results.

The student should give a seminar on his/her work, during the semester, and submit a technical report.

Evaluation: For the evaluation of the term paper, an evaluation committee is to be constituted. One faculty is to be designated as the Course Coordinator for this course. Committee is to be constituted by the Head of the Department (HOD) and (s)he shall be the Chairperson of the committee. In addition to the HOD, the Course Coordinator, the faculty guiding a particular student will also be a member of the committee. The Coordinator has to set the schedule for presentation and submission of the reports. While calculating the final score, 25% weight is to be given for the scores awarded by the guide to the student and the rest 75% weight is to be given for the average of the scores awarded to the student by remaining committee members.

A tentative list of the components for evaluation of Term Paper is as shown below. Evaluation committee can decide about the actual composition of the components and scores to be awarded for each component.

Components:

- Relevance of the Topic, Statement of Objectives, Correctness
- Quality of Literature Survey / Analysis of results
- Methodology / Tools adopted
- Quality of Implementation/Simulation /Testing
- Identification of Future Work
- Quality of the Term Paper Report
- Quality of Presentation
- Publications out of the Term Paper

Third Semester

CSC3C12-PRINCIPLES OF COMPILER DESIGN

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction to compiling : Compilers - Analysis of the source program - Phases of a compiler - Cousins of the Compiler - Grouping of Phases - Compiler construction tools - Lexical Analysis - Role of Lexical Analyzer - Input Buffering - Specification of Tokens.

Unit II :

Syntax analysis : Role of the parser - Writing Grammars - Context-Free Grammars - Top Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing - Operator Precedent Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser.

Unit III :

Intermediate code generation: Intermediate languages - Declarations - Assignment Statements - Boolean Expressions - Case Statements - Back patching - Procedure calls.

Unit IV :

Code generation: Issues in the design of code generator - The target machine - Runtime Storage management - Basic Blocks and Flow Graphs - Next-use Information - A simple Code generator - DAG representation of Basic Blocks - Peephole Optimization.

Unit V :

Code optimization and run time environments : Introduction - Principal Sources of Optimization - Optimization of basic Blocks - Introduction to Global Data Flow Analysis - Runtime Environments - Source Language issues - Storage Organization - Storage Allocation strategies - Access to non-local names - Parameter Passing.

References:

1. V Aho A, Ravi Sethi, D Ullman J, Compilers Principles, Techniques and Tools, 2nd Edition, Pearson Education Singapore Pte Ltd.
2. K. V. N. Sunitha, Compiler Construction, Pearson.
3. W Appel and Andrew, Modern Compiler Implementation in C, 1st Edition, Cambridge University Press.
4. Allen I Holub, Compiler Design in C, 1st Edition, PHI Learning Pvt Ltd.
5. Tremblay and Sorenson, The Theory and Practice of Compiler Writing, 1st Edition, BSP Books Pvt Ltd.
6. Torben Egidius Mogensen, Basics of Compiler Design, Department of Computer Science, University of Copenhagen (Online Edition).

CSC3C13-DATA COMMUNICATION AND NETWORKING

Course Number: 2

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Data and signals -Analog and Digital signals, Line configuration, Topology, Transmission mode, Guided and Unguided media, Parallel and Serial data transmission, Layered approaches-OSI and TCP/IP. Multiplexing. Transmission impairments-Distortion, Attenuation, Noise. Analog modulation- AM, PM, FM. Sampling theorem, Analog pulse modulation, Digital pulse modulation. ASK, FSK, PSK and PSK. Digital data transmission and Interface standards. DTE and DCE. Modems.

Unit II :

DataLinkLayers - ErrorDetection and Correction. DataLinkControl - lineDiscipline, flow control, error control .Data link Protocol-synchronous and asynchronous protocol, character oriented and Bit Oriented protocol. Multi Access Protocols- ALOHA and CSMA. Switching. Networking and Internetworking devices-Repeaters, Bridges, Routers and Gateways.

Unit III :

LANs: Project802-Ethernet, token bus, token ring. Bluetooth-architecture, layers, radio layer, baseband layers. L2CAP and upper layers. FDDI. MANs-IEEE802.6. SMDS. Network layer address and protocol- ARP, IP, ICMP, IGMP.IPv4 and IPv6.Subnetting.ISDNlayers and BISDN. X.25layers, packet layers protocol. Frame relay layers. ATM-design topology, protocol, architecture. Routing algorithms.

Unit IV :

SONET/SDH-Configuration, Layers, Frames. Transport Layer- Design Issues, Connection Management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP).Session layer. Presentation layer-Protocols, Compression, Translation. Application layer- Protocols, DNS, Telnet. www and HTTP.

Unit V :

Computer Network Security- Introduction, Need for security, Principles of Security, Types of Attacks. Symmetric and Public key algorithms. Authentication. Integrity. Key Distribution and Certification.

References:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, McGrawHill 2001
2. Andrew S. Tanenbaum, Computer Networks, Fourth Edition, Prentice-Hall, 2003
3. William Stallings, Data and Computer Communication, Eighth Edition, Prentice-Hall, 2007
4. J. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach Featuring Internet, Sixth Edition, Pearson Education.

CSC3C14 - WEB TECHNOLOGY

Course Number: 3

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 3

Unit I :

Introduction to Web programming - Introduction to SGML features - HTML, XHTML, DHTML, XML - HTML Vs XML - Creating XML documents - Parsing an XML document - Writing well formed documents - Organizing elements with namespaces - Defining elements in a DTD - Declaring elements and attributes in a DTD. Familiarization of HTML5 features and tag set.

Unit II :

Introduction to scripting - server side and client side scripting. CGI/Perl: Creating link to a CGI Script - Using a link to send data to a CGI Script - parsing data sent to a Perl CGI script - Using CGI script to process form data - Using scalar variables in Perl - Using variables in Perl - Using arithmetic operators in Perl - arrays, list, hashes, strings, pattern and regular expressions, text processing, subroutines - Associating a form with a script-

Unit III :

Java Server Pages - JSP scripting elements - Linking to external files - JSP declarations - JSP Expressions - JSP Scriptlets - Processing client requests- Accessing a database from JSP. Advantages of JSP comparing with other language.

Unit IV :

PHP: Advanced features of PHP, Defining PHP variables - variable types - operators - control flow constructs in PHP- Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions, GET and POST methods - Establishing connection with MySQL database - managing system data - parsing data between pages

Unit V :

Python: Introduction to Python language, Advantages of Python in comparison with other Languages, Data types, control structures, advanced data structures, I/O, defining classes, data collections, functions

and modules (math module), packages, exception handling, standard library, internet programming with python.

References:

1. Robert W. Sebesta, Programming with World Wide Web, 4th edition, Pearson Education, 2009.
2. XueBal et. al, The Web Warrior Guide to Web programming, Thomson Learning.
3. Chris Bates, Web Programming: Building Internet Applications, 3rd ed, Wiley Academic Catalog.
4. H.M. Deitel, P.J. Deitel and A.B. Goldberg, Internet and World Wide Web: How to Program, rd edition, Pearson Education.
5. Steven Holzner, PHP The complete Reference,1stEdition,McGraw-Hill, 2007.
6. Philip Hanna, JSP The complete Reference, 2nd Edition, McGraw-Hill, 2002.
7. Paul Barry, Head First Python, 1st Edition, O'Reilly Media, 2010
8. Scott Guelich, ShishirGundavaram and Gunther Birznieks, CGI Programming with Perl, 2ndEdition,O'Reilly Media, 2000.
9. How to Think Like a Computer Scientist: Learning with Python, Allen Downey , Jeffrey Elkner , Chris Meyers, <http://www.greenteapress.com/thinkpython/thinkpython.pdf>

CSC3E08-DIGITAL IMAGE PROCESSING

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - digital image representation - fundamental steps in image processing - elements of digital image processing systems - digital image fundamentals - elements of visual perception - a simple image model - sampling and quantization - basic relationship between pixels - image geometry

Unit II :

Image transforms - introduction to Fourier transform - discrete Fourier transform (DFT) - properties DFT- other separable image transforms - Walsh, Hadamard and Discrete Cosine transforms. Hotelling transform.

Unit III :

Image enhancement - basic grey level transformation - histogram equalization - image subtraction - Image averaging - spatial filtering - smoothing, sharpening filters - Laplacian filters. Enhancement in the frequency domain - frequency domain filters - smoothing, sharpening filters - homomorphic filtering.

Unit IV :

Image restoration - model of Image degradation/restoration process - noise models - inverse filtering - least mean square filtering - constrained least mean square filtering. Edge detection - thresholding - region based segmentation - Boundary representation

Unit V :

Image compression - fundamental concepts of image compression - compression models - information theoretic perspective. Lossless compression - Huffman coding - arithmetic coding - bit plane coding - run length coding. Lossy compression - transform coding - Image compression standards.

References:

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing - 3rd ed., Prentice Hall of India, New Delhi, 2008

2. B. Chanda and D.D. Majumder, Digital Image Processing and Analysis, PHI
3. A.K. Jain, Fundamentals of Digital Image Processing, PHI
4. W.K. Pratt, Digital Image Processing, John Wiley, 2006
5. M. Sonka, V. Hlavac and R. Boyle, Image Processing Analysis and Machine Vision, Brooks/colic, Thompson Learning, 1999.

CSC3E09 - WIRELESS AND SENSOR NETWORKS

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Over view of wireless sensor networks- Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

Unit II :

Architectures- Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Unit III :

Networking Sensors-Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

Unit IV :

Infrastructure Establishment-Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

Unit V :

Sensor Network Platforms and Tools - Sensor Node Hardware - Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

References:

1. Holger Karl and Andreas Willig, Protocols And Architectures for Wireless Sensor Networks, John Wiley, 2005.
2. Feng Zhao and Leonidas J. Guibas, Wireless Sensor Networks- An Information Processing Approach, Elsevier, 2007.

3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, Wireless Sensor Networks- Technology, Protocols, And Applications, John Wiley, 2007.
4. Anna Hac, Wireless Sensor Network Designs, John Wiley, 2003.

CSC3E10 - CRYPTOGRAPHY AND NETWORK SECURITY

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Computer security concepts - challenges - security attacks - security services - security mechanisms - a model for network security. Cryptography - symmetric encryption principles - cryptography - cryptanalysis - Feistel Cipher structure. Symmetric block encryption algorithms - DES - Triple DES - AES - random and pseudorandom numbers - stream cipher and RC4 - cipher block modes of operation.

Unit II :

Message authentication - approaches - MAC - one way Hash function - secure Hash functions - Message Authentication Codes. Public key cryptography principles - algorithms - digital Signatures.

Unit III :

Network security applications - symmetric key distributions using symmetric encryption - Kerberos version 4 - key distributions using asymmetric encryption - X.509 certificates -public key infrastructure - federated identity management.

Unit IV :

Transport level security - web security considerations - secure socket layer and transport layer security - SSL architecture - SSL record protocol - change cipher spec protocol - handshake protocol. Transport layer security - HTTPS - SSH. IP Security - overview - policy - encapsulating security payload - combining security associations - internet key exchange.

Unit V :

Intruders - intruders, intrusion detection, password management. Malicious software - types, viruses, countermeasures, worms, DDoS. Firewalls - need - characteristics, types, firewall basing, location and configuration - DMZ networks, VPN - distributed firewalls.

References:

1. William Stallings, Network Security Essentials Applications and Standards, 4th Edition, Pearson India, ISBN: 8131761754.
2. William Stallings, Cryptography and Network Security : Principles and Practice, 6th Edition, Pearson India, ISBN: 9332518777.
3. Atul Kahate, Cryptography and Network Security, 3rd Edition, Tata McGraw-Hill Publishing, ISBN: 9789332900929.
4. Eric Maiwald, Fundamental of Network Security, 1st Edition, Tata McGraw - Hill Education, 0071070931.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security: Private Communication in Public World, 2nd Edition, PHI Learning Pvt Ltd, ISBN: 8120322134.

CSC3E11-REMOTE SENSING AND GIS

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Fundamentals: Definition - scope - types and chronological development - ideal and real remote sensing system. Comparison of conventional survey, aerial remote sensing and satellite remote sensing - advantage and limitation of satellite remote sensing. EMR and Remote Sensing: Energy sources - electro magnetic radiation - spectral regions - energy interaction in the atmosphere - atmosphere window - energy interaction with earth surface features -spectral reflectance patterns for different region of EMR. Actors affecting remote sensing signatures. Platforms-data capture types and systems - data recording methods.

Unit II :

GIS and spatial data- Definition - maps spatial information - computer assisted mapping and analysis - components of GIS -people and GIS - maps and spatial data - thematic characteristics of spatial data ad GPS coordinate system- other sources of spatial data; census ad survey data, air photos, satellite images, field data. Data analysis operations in GIS, Terminologies measurements of lengths, perimeter and area in GIS - queries - reclassification buffering and neighborhood functions - integrated data.

Unit III :

Raster and vector overlay method: point-in-polygon and polygon and polygon-on- polygon problems of raster and vector overlays - spatial interpolation - GIS for surface analysis - network analysis: shortest path problem, location - allocation of resources - route tracking. Models of spatial processes: natural and scale analogue models - conceptual models - mathematical model - models of physical and environmental processes. Maps as output - alternative cartographic outputs - non-cartographic outputs - spatial multimedia - delivery mechanism - GIS and spatial decision supports -maps as decision tools.

Unit IV :

Remote sensing data: types - digital, analogue - fluvial land forms - - drainage pattern - erosional and depositional landforms - flood plain

mapping - coastal landforms - erosional and depositional features - glacial landforms.

Unit V :

Land use/land cover: Crop assessment, disease detection, forestry: types - species identification and diseases detection. Soils: soil mapping - soil moisture - soil erosion - reservoir station - soil salinity - soil conservation. Water resources: surface water resources - water quality monitoring and mapping - water pollution, identification of ground water potential recharge areas - integrated watershed development.

References:

1. Lillesand, TM John, Remote sensing and Image interpretation, Wiley.
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, An Introduction to Geographical Information Systems, Pearson Education, 2007

CSC3E12 - DIGITAL IMAGE FORENSICS

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :Background on Digital Images

Digital Camera Image Formation, Introduction and Hardware, Optical Imaging Path, Taking Lens, Antialiasing Filter, Infrared Cutoff Filter, Cover Glass, Sensor Optics, Image Sensor Operation and Artifacts, CCD Sensor Operation, CMOS Sensor Operation, Sensor Artifacts, Video Capture, Subsampling, Binning, Exposure Control, Processing and Storage, Nominal Image Processing Chain, Raw CFA Image, Camera Corrections, Stochastic Noise Reduction, Exposure and White Balance Correction, Adjusted CFA Image, Demosaicing, Interpolated RGB Image, Color Noise Reduction, Color Correction, Tone Scale and Gamma Correction, Edge Enhancement, Finished Image, Compression, Storage Formatting, Exif - JPEG, TIFF/EP, Post-Processing Enhancement Algorithms, Statistical Techniques, Wavelet-Based Compression, JP2 File Format

Unit II :Digital Image Formats

Searching and Extracting Digital Image Evidence, File Systems and Fragmentation, FAT and NTFS File System, File allocation, deletion and recovery, Fragmentation, Low Disk Space, Appending/Editing of Files, Wear - Leveling Algorithms in Next Generation Devices, File System Forced Fragmentation, File Carving, Carving Non-fragmented Files, Carving Bifragmented Files, Graph Theoretic Carving, Reassembly as Hamiltonian Path Problem, Reassembly as k-Vertex Disjoint Path Problem, Parallel Unique Path, Shortest Path First, SmartCarver, Pre-processing, Collation, Reassembly, Keyword or Dictionary-Based Techniques, Sequential Fragmentation Point Detection.

Unit III : Techniques Attributing an Image to Its Source

Image and Video Source Class Identification, Multimedia Forensics, Passive Forensics and Source Identification, Source Category Identification, Lens Distortion Features, Demosaicing Regularity, Other Statistical Features, Software Tools Identification, Forensics Learning Techniques, Feature Reduction Techniques, Classification Techniques, Fusion Techniques, Anti-Forensics and Countermeasures, Sensor Defects in Digital Image Forensic, Imaging Sensors and Their Defects, Sensor Fingerprint, Digital

Forensics Using Sensor Fingerprint, Fighting the Fingerprint - Copy Attack, Temporal Forensics, Source Attribution Based on Physical Defects in Light Path, Forensic Use of Sensor Dust, Forensic Use of Scratches in Scanners

Unit IV :Techniques Verifying the Integrity and Authenticity of Image Evidence

Techniques Verifying the Integrity and Authenticity of Image Evidence, Natural Image Statistics, Image Representation, Features Based on Regularities, Natural Versus Synthetic Using Image Features, Application to Digital Image Forensics, Photographic Versus Photorealistic, Generic Image Steganalysis, Live or Rebroadcast, Detecting Doctored Images, World, Lens, Sensor, Processing, Image, Discrimination of Computer Synthesized or Recaptured Images from Real Images, Visual Realism of Computer Graphics, Visual Realism of Recaptured Image, Statistics of Computer Graphics and Recaptured Images, Automatic Detection Using Computer, Pattern Recognition System and Design Issues, Evaluation Metric, Approaches for Photorealistic Computer Graphics Detection, Approaches for Recaptured Image Detection.

Unit V : Digital Image Forensics in Practice

Courtroom Considerations in Digital Image Forensics, Computer Forensics, Knowledge, Possession, Control, Expert Testimony, Discovery, Exhibits, Counter-Forensics, Image Generation, Practical Considerations, Epistemic Bounds, Image Models, Blurred Notion of Authenticity, Classification of Counter-Forensic Techniques, Robustness Versus Security, Integrated and Post-Processing Attacks, Targeted and Universal Attacks, Selected Targeted Attacks, Suppressing Traces of Image Processing, Adding Traces of Authentic Images, Relations to Steganography and Digital Watermarking, Countering Counter - Forensics: An Open Challenge

Text Book:

1. Digital Image Forensics- There is More to a Picture than Meets the Eye; 1st Edition, Husrev Taha Sencar and Nasir Memon , Springer, 2013

References:

1. Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes;2nd Edition, Albert Marcella Jr. and Doug Menendez, Auerbach Publications, 2007

2. Natural Image Statistics in Digital Image Forensics; 1st Edition, Siwei Lyu, VDM Verlag, 2008

CSC3E13 - SOFT COMPUTING TECHNIQUES

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2- category classification - minimum error rate classification - classifiers - discriminant functions - and decision surfaces - error probabilities and integrals - normal density - discriminant functions for normal density.

Unit II :

Introduction to Genetic Algorithm, Genetic Operators and Parameters, Genetic Algorithms in problem Solving, Theoretical Foundations of Genetic Algorithms, Implementation Issues - systems

Unit III :

Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Back-propagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets and applications of Neural Network.

Unit IV :

Introduction to Fuzzy Sets, Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering.

Unit V :

Advanced Topics: Support Vector Machines, Evolutionary computation (EC)- Evolutionary algorithms, Harmony search, Swarm intelligence.

References:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, Pearson Education, 2004.
2. M. Mitchell, An Introduction to Genetic Algorithms, Prentice-Hall, 1998.

3. D. E. Goldberg, Genetic Algorithms in Search, Optimization, and Machine Learning, Addison-Wesley, 1989.
4. S. V. Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, IEEE Press - PHI, 2004.
5. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications, PHI, 2003.

CSC3E14 - DATA WAREHOUSING AND DATA MINING

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Data warehouse - definition - operational database systems Vs data warehouses - multidimensional model - from tables and spreadsheets to Data Cubes - schemas for multidimensional databases - measures - concept hierarchies - OLAP operations in the multidimensional data model - data warehouse architecture.

Unit II :

Data mining - introduction - definition - data mining functionalities - major issues in data mining - data preprocessing - data cleaning - data integration and transformation - data reduction - data discretization and concept hierarchy generation. Association rule mining - efficient and scalable frequent item set mining methods - mining various kinds of association rules - association mining to correlation analysis - constraint-based association mining.

Unit III :

Classification and prediction - issues regarding classification and prediction - classification by decision tree introduction - Bayesian classification - rule based classification - classification by back propagation - support vector machines - associative classification - lazy learners - other classification methods - prediction - accuracy and error measures - evaluating the accuracy of a classifier or predictor - ensemble methods - model selection.

Unit IV :

Cluster analysis - types of data in cluster analysis - a categorization of major clustering methods - partitioning methods - hierarchical methods - density-based methods - grid-based methods - model-based clustering methods - clustering high dimensional data - constraint-based cluster analysis - outlier analysis.

Unit V :

Graph mining - mining object, spatial, multimedia, text and web data
- multidimensional analysis and descriptive mining of complex data objects - spatial data mining - multimedia data mining - text mining - mining the World Wide Web.

References:

1. Jain Pei, Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, 3rd Edition, Elsevier.
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining and OLAP, Computing Mcgraw-Hill.
3. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data mining Theory and Practice, 1st Edition, Prentice Hall of India.

CSC3E15 - INFORMATION RETRIEVAL SYSTEMS

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction: Information versus Data Retrieval, IR: Past, present, and future. Basic concepts: The retrieval process, logical view of documents. Modeling: A Taxonomy of IR models, ad-hoc retrieval and filtering. Classic IR models: Set theoretic, algebraic, probabilistic IR models, models for browsing.

Unit II :

Retrieval evaluation: Performance evaluation of IR: Recall and Precision, other measures, Reference Collections, such as TREC, CACM, and ISI data sets. Query Languages: Keyword based queries, single word queries, context queries, Boolean Queries, Query protocols, query operations.

Unit III :

Text and Multimedia Languages and properties, Metadata, Text formats, Markup languages, Multimedia data formats, Text Operations. Indexing and searching: Inverted files, Suffix trees, Suffix arrays, signature files, sequential searching, Pattern matching.

Unit IV :

Multimedia IR: Spatial access methods, Generic multimedia Indexing approach, Distance functions, feature extraction, Image features and distance functions. Searching the Web: Characterizing and measuring the Web.

Unit V :

Search Engines: Centralized and Distributed architectures, user Interfaces, Ranking, Crawling the Web, Web directories, Dynamic search and Software Agents. Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example - TREC results.

References:

1. Kowalski, Gerald, Mark T Maybury: Information Retrieval Systems: Theory and Implementation, Kluwer Academic Press, 1997.

2. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992.
3. Yates, Modern Information Retrieval, Pearson Education.
4. Robert Korfhage, Information Storage and Retrieval, John Wiley and Sons.

CSC3E16 - DATA ANALYTICS WITH PYTHON

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Overview of data science and analytics, Need of data science, Role and skills required for a data scientist, Technologies used in data analytics, Data analytics tools. Overview of artificial intelligence and machine learning. Division of machine learning tasks - supervised and unsupervised. Learning, predicting and classifying using machine learning.

Unit II :

Python: Introduction to Python language, Advantages of Python in comparison with other Languages, Characteristics of python, suitability of python in data manipulation and analysis, Data types, control structures, advanced data structures, I/O, defining classes, data collections, functions and modules, packages, exception handling and standard library in python. Computation capability of python. Powerfulness of libraries and tools of python in data manipulation, visualisation and data plotting like numpy, pandas, matplotlib, seaborn, scikit-learn.

Unit III :

Overview of machine learning algorithms, suitability of machine learning algorithms in data science problems and analytics, Application of machine learning in feature selection, Generalization of data using machine learning, Building predictive model by training with data and model evaluation, Need of dimensionality reduction of data.

Unit IV :

Regression analysis, techniques and its implementation using python, Regularisation techniques, Clustering, Cluster validation. Classification, algorithms for classification, Accuracy of classification techniques, Confusion matrix.

Unit V :

Formation of a data set, development of training data, testing data, and validation data, cross validation. Analysis of a problem and its relevant dataset - data analysis, modeling and evaluation of this case including the processes of Regression, clustering, feature selection, dimensionality reduction, classification, cross validation etc -implementation in Python.

References:

1. Jesus Rogel-Salazar, Data Science and Analytics with Python, CRC Press, 1st Edition, 2017.
2. Andreas C Muller, Sarah Guido, Introduction to machine learning with Python, O'Reilly, 1st edition, 2016.
3. Jake VanderPlas, Python Data Science Handbook - Essential Tools for Working with Data, O'Reilly, 1st edition, 2016.
4. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 1st Edition, 2015

CSC3E17 - ADVANCED MACHINE LEARNING

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :Introduction to Elementary Linear Algebra, Probability and Machine Learning

Introduction to Linear Algebra: Matrices, Vector spaces, Orthogonality, Determinants, Overview of Eigenvalues and Eigenvectors. Fundamentals of Probability:- Axioms of probability, Conditional probability, Random variables, Probability distributions and Density functions, Joint distribution and density function, Conditional distribution, Bayes' rule, Expectation and Variance. Distributions: Bernoulli, Binomial, Multinomial, Uniform, Normal, Chi-Square, t and F. Introduction to Machine Learning:- Concept of learning the task, inductive learning and hypothesis space, different machine learning approaches, types of learning; supervised, unsupervised and reinforcement, machine learning applications

Unit II :Supervised Learning

Learning a class from example, learning multiple classes and multi-labels, model selection and generalization, linear regression and feature selection, Bayesian learning, Decision Tree learning, classification tree and regression tree, multivariate methods for learning, multivariate classification and regression

Unit III : Unsupervised Learning

clustering; mixture densities, k-means clustering, expectation maximization algorithm, mixture latent variable models, Latent Dirichlet Allocation, spectral and hierarchical clustering, Dimensionality reduction; principal component allocation, linear discriminant analysis, canonical correlation analysis.

Unit IV : Reinforcement Learning and Design and Analysis of ML Experiments

Single state case: K-Armed Bandit, Elements of reinforcement learning, model-based learning, temporal difference learning, generalization, partially observable states. Setting a machine learning platform: training, validation and testing, over-fitting and under-fitting, different types

of error calculation. Cross-validation and resampling methods, Performance Analysis and accuracy measures: evaluation of machine learning algorithms, Binomial, Approximate Normal and t-tests

Unit V : Introduction to Artificial Neural Network and Deep Learning Concepts

Understanding brain, perceptron, Multi-Layer perceptron as universal approximator, the general architecture of an artificial neural network, feedforward and back-propagation, different linear and nonlinear activation functions for binary and multi-class and multi-label classification. Fundamentals of deep learning, Deep Feedforward Networks, Regularization for Deep Learning, Optimization for Training Deep Models, Introduction to Convolutional Networks, Sequence Modeling using Recurrent Nets, overview of LSTM and Bi-LSTM.

References:

1. Ethem Alpaydin, Introduction to Machine Learning- 3rd Edition, PHI.
2. Tom M. Mitchell, Machine Learning, McGraw-Hill, 1st Ed.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning), MIT Press, 2016.
4. Kuntal Ganguly, Learning Generative Adversarial Networks, Packt Publishing, 2017
5. Gilbert Strang, Linear algebra and its applications, Fourth Edition, Cengage Learning, 2006.

CSC3E18 - ADVANCED JAVA PROGRAMMING

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Java Database connectivity- JDBC Architecture- Drivers- Database connections- Statements-Result sets-Transactions metadata- stored procedures-error handling-BLOBs and CLOBs. JNDI- Architecture-context-initial context class-Object in a context -listing the children of a context-binding objects -accessing directory services-X.500 directories-Dir context interface- Attributes and attribute interface-creating directory entities and searching.

Unit II :

RMI -Architecture- Defining remote Objects-Creating stubs and skeletons -Seializable classes-Accessing Remote Objects-factory classes-Dynamically loaded classes-RMI activation-Registering remote objects-marshalling and unmarshalling.

Unit III :

CORBA -Architecture-Services-IDL-ORB-Naming service-Inter-ORB Communication-creating CORBA objects-simple server class-helper class-holder class-stubs and skeletons-registering with naming services- finding remote object-adding object to naming context-Using naming context. Different models for CORBA server/clients and their implementations.

Unit IV :

Java Servlets- Servlet life cycle- Servlet chaining-HTTP servlets-forms and interaction-POST-HEAD and other request-server-side includes-cookies-Session tracking-databases and non-HTML Content-Request dispatching-shared attributes-resource abstraction.

Unit V :

Enterprise Java Beans:-EJB roles-EJB Client-Object ?container-Transaction Management-implementing a Basic EJB Object-Implementing session Beans-Implementing Entity Beans-Deploying an enterprise Java Beans Object.

References:

1. David Flanagan, Jim Farley, William Crawford and Kris Magnusson , Java Enterprise in a nutshell- A desktop Quick reference, O'REILLY Media, 2003.
2. Stephen Ausbury and Scott R. Weiner, Developing Java Enterprise Applications, Wiley India, 2001.
3. Jaison Hunder and William Crawford, Java Servlet Programming, O'REILLY Media, 2002.
4. William Gross, Java RMI, 1st Edition, O'Reilly Media, 2001.
5. Gerald Brose, Vogel Andreas and Keith Dubby, Java Programming with CORBA, 3rd Edition, Wiley India Pvt Ltd, 2009.
6. Ed Roman and Scott Ambler, Mastering Enterprise Java Beans, 3rd Edition, Wiley, 2004.

CSC3C15- PRACTICAL 3

Course Number: 6

Contact Hours per Week: 15 (10 Practical + 5 Tutorial)

Number of Credits: 3

Web Technology:

1. Create webpages using HTML, HTML5 including text, lists, Images and Videos, hyperlinks, tables and menus .
2. Design a data entry form using DHTML including java script validation.
3. Design a web page using XHTML including text, lists, data tables and anchor links.
4. Write an XML file describing some entity attributes. Write a document type definition(DTD) to validate the above XML file. Display the XML file contents in a coloured tabular format with suitable headings.
5. Programs to demonstrate the usage of regular expressions in perl.
6. Database programming with perl
7. Programming and web development using CGI-Perl.
8. Create a webpage using JSP and JDBC including operations of data storage and retrieval from database tables.
9. Develop dynamic database driven sites with PHP and MySQL.
10. Programming and web development using Python.

Fourth Semester

CSC4C16 - SOFTWARE ENGINEERING

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Software Process Models: Software Process, Generic Process Model - Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Component Based Development, Aspect-Oriented Software Development, Formal Methods. Agile Process Models - Extreme Programming (XP), Adaptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering.

Unit II :

Software Requirements: Functional and Non-Functional Requirements, Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling, Software Requirement and Specification (SRS) Document.

Unit III :

Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity. Information Hiding, Functional Independence, Cohesion and Coupling, Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Unit IV :

Software Quality: McCall's Quality Factors, ISO 9126 Quality Factors, Overview of -Quality Control-Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM). Estimation

and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations. Constructive Cost Model (COCOMO).

Unit V :

Software Testing: Verification and Validation, Error, Fault, Bug and Failure, Unit and Integration Testing, White-box and Black-box Testing, Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing. Regression Testing, Performance Testing, Stress Testing, Re-engineering, Reverse Engineering.

References:

1. Pressman R.S, Software Engineering, a practitioner's approach-seventh edition, McGraw Hill
2. Ian Somerville, Software Engineering, Pearson Education Asia.
3. Jalote P, An Integrated Approach to Software Engineering, Narosa
4. Mall R, Fundamentals of Software Engineering, Prentice Hall India

CSC4E19 - PATTERN RECOGNITION

Course Number: 2

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - introduction to statistical - syntactic and descriptive approaches - features and feature extraction - learning - Bayes Decision theory - introduction - continuous case - 2- category classification - minimum error rate classification - classifiers - discriminant functions - and decision surfaces - error probabilities and integrals - normal density - discriminant functions for normal density.

Unit II :

Parameter estimation and supervised learning - maximum likelihood estimation - the Bayes classifier - learning the mean of a normal density - general Bayesian learning - nonparametric technic - density estimation - parzen windows - k-nearest neighbour estimation - estimation of posterior probabilities - nearest-neighbour rule - k-nearest neighbour rule.

Unit III :

Linear discriminant functions - linear discriminant functions and decision surfaces - generalized linear discriminant functions - 2-category linearly separable case - non-separable behaviour -linear programming algorithms, support vector machines- multilayer neural networks - feed forward operation and classification, back propagation algorithm, error surface, back propagation as feature mapping.

Unit IV :

Syntactic methods - stochastic search- Boltzmann learning - Nonmetric methods- decision trees-CART - other tree methods, grammatical methods, grammatical inference.

Unit V :

Unsupervised learning and clustering - mixture densities and identifiability, maximum likelihood estimates, applications to normal mixtures, unsupervised Bayesian learning, data description and clustering.

References:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, Second edition, 2006
2. Gonzalez R.C. and Thomson M.G., Syntactic Pattern Recognition - An Introduction, Addison Wesley.
3. Fu K.S., Syntactic Pattern Recognition And Applications, Prentice Hall, Eaglewood cliffs
4. Rajan Shinghal, Pattern Recognition: Techniques and Applications, Oxford University Press, 2008.

CSC4E20 - NATURAL LANGUAGE PROCESSING

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - Models -and Algorithms - The Turing Test -Regular Expressions Basic Regular Expression Patterns -Finite State Automata - Regular Languages and FSAs - Morphology - Inflectional Morphology - Derivational Morphology -Finite-State Morphological Parsing - Combining an FST Lexicon and Rules -Porter Stemmer.

Unit II :

N-grams Models of Syntax - Counting Words - Unsmoothed N-grams - Smoothing- Backoff -Deleted Interpolation - Entropy - English Word Classes - Tagsets for English - Part of Speech Tagging -Rule-Based Part of Speech Tagging - Stochastic Part of Speech Tagging - Transformation-Based Tagging.

Unit III :

Context Free Grammars for English Syntax- Context-Free Rules and Trees - Sentence- Level Constructions - Agreement - Sub Categorization - Parsing - Top-down - Earley Parsing - Feature Structures - Probabilistic Context-Free Grammars.

Unit IV :

Representing Meaning - Meaning Structure of Language - First Order Predicate Calculus-Representing Linguistically Relevant Concepts -Syntax-Driven Semantic Analysis - Semantic Attachments - Syntax-Driven Analyzer - Robust Analysis - Lexemes and Their Senses - Internal Structure - Word Sense Disambiguation -Information Retrieval.

Unit V :

Discourse -Reference Resolution - Text Coherence -Discourse Structure - Dialog and Conversational Agents - Dialog Acts - Interpretation - Coherence - Conversational Agents - Language Generation - Architecture - Surface Realizations - Discourse Planning - Machine Translation - Transfer Metaphor - Interlingua - Statistical Approaches.

References:

1. D.Jurafsky and J. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition,2nd Edition, Prentice Hall, 2008.
2. C. Manning and H. Schutze, Foundations of Statistical Natural Language Processing ”, MIT Press, 1999.
3. James Allen. Natural Language Understanding, Addison Wesley, 1994.

CSC4E21 - BIO INFORMATICS

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Cells-Prokaryotes and Eukaryotes-DNA double helix- central dogma - RNA, Amino acids, Proteins -string representations- different levels of protein structures-DNA cloning- A brief introduction to different mappings techniques of genomes- genome sequencing methods-DNA micro arrays - Human Genome Project-A glossary of biological terms.

Unit II :

Scope of bioinformatics-Genomics and Proteomics- Problems in bioinformatics - sequence alignment, phylogeny, gene finding, microarray analysis, Homology and evolutionary relationships; Homology analysis and function of an entire gene or of segments within it, secondary structure prediction, protein structure prediction, comparative genomics and drug design.

Unit III :

Data management, Data life cycle, An introduction to the major resources at NCBI, EBI and ExPASy - Nucleic acid sequence databases: GenBank, EMBL, DDBJ - Protein sequence databases: SWISS-PROT, TrEMBL, PIR-PSD - Genome Databases at NCBI, EBI, TIGR, SANGER - How to access these databases and to make use of the tools available. Various file formats for bio-molecular sequences like genbank and fasta, the concept of profiles- The derived databases- Prosite, Pfam, PRINTS, CATH, SCOP.

Unit IV :

Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, paralogues. Scoring matrices: basic concept of a scoring matrix, PAM and BLOSUM matrices, differences between distance and similarity matrix, Pairwise sequence alignments: basic concepts of sequence alignment, Needleman and Wunchsh, Smith and Waterman algorithms for pairwise alignments, BLAST and FASTA and their versions, Multiple sequence alignments (MSA): the need for MSA, basic

concepts of various approaches for MSA (e.g. progressive, hierarchical etc.), Algorithm of CLUSTALW.

Unit V :

Phylogeny: Basic concepts of phylogeny; molecular evolution; Definition and description of phylogenetic trees, Phylogenetic analysis algorithms - Maximum Parsimony, UPGMA and Neighbour-Joining, Gene Finding: The six reading frames-Computational gene finding in prokaryotes and eukaryotes Basic signals - start and stop codons, promoters etc- important coding measures- Regular expressions- Introduction to Hidden Markov models- Introduction to genomic signal processing Molecular visualization: Visualization of protein structures using Rasmol or Rastop

References:

1. Hooman H. Rashidi and Lukas K.Buehler, Bioinformatics Basics. Applications in Biological Science and Medicine, CAC Press 2000.
2. Dan Gusfield, Algorithms on Strings Trees and Sequences, Cambridge University Press 1997.
3. P. Baldi. S. Brunak, Bioinformatics: A Machine Learning Approach, MIT Press, 1988.
4. Harshawardhan P.Bal, Bioinformatics - Principles and Applications - Tata McGraw Hill

CSC4E22 - MOBILE COMMUNICATION

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction, wireless transmission - frequencies for radio transmission - signal propagation - multiplexing - modulation - spread spectrum - cellular systems - medium access control - specialized MAC - SDMA - FDMA - TDMA - classical and slotted aloha - CSMA - collision avoidance - polling - CDMA - comparison of S/T/F/CDMA.

Unit II :

Telecommunication systems - GSM-mobile services - system architecture - radio interface - protocols - localization and calling - handover - security - new data services - satellite systems- routing- localization - handover- broadcast systems - digital audio and video broadcasting.

Unit III :

Wireless LAN-Infra red Vs radio transmission -infra structure and adhoc networks-IEEE 802.11, hyperlan- Bluetooth -IEEE 802.15

Unit IV :

Mobile network layer - mobile IP - IP packet delivery - registration - tunneling and encapsulation - optimizations - reverse tunneling - dynamic host configuration protocol-Mobile ad-hoc networks, Transport Layer-TCP-Indirect TCP-Snooping TCP-Mobile TCP- retransmission-recovery-transaction oriented TACP

Unit V :

WAP-Design and principles of operations, WAP architecture, Overview-WAP model, components-WAE, overview-WWW model-WAE model-WTA architecture, Wireless session protocol specifications-Wireless transaction protocol specification-security specification- Wireless datagram protocol-wireless control message protocol specification.

References:

1. Schiller J., Mobile Communications, Addison Wesley, 2/e, Pearson Education, 2009.

2. Gray.S.Rogers,John Edwards, An Introduction to Wireless Technology, Pearson Education
3. Singhal et.al S., The Wireless Application Protocol, Addison Wesley
4. C. Siva Ram Murthy, WDM Optical Networks: Concepts, Design, and Algorithms, Pearson Education.
5. Yi-Bang Lin and Imrich Chlamtac, Wireless and Mobile Architectures, Wiley Student Edition, 2008.
6. William Stallings, Wireless Communications and Networks, Prentice Hall, 2004
7. Vijay K.Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers / Elsevier, 2009.

CSC4E23 - SEMANTIC WEB TECHNOLOGY

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Components - types - ontological commitments - ontological categories - philosophical background - knowledge representation ontologies - top level ontologies - linguistic ontologies - domain ontologies - semantic web - need - foundation - layers - architecture.

Unit II :

Languages for semantic web and ontologies - web documents in XML - RDF - schema - web resource description using RDF - RDF properties - topic maps and RDF - overview - syntax structure - semantics - pragmatics - traditional ontology languages - LOOM - OKBC - OCML - Flogic Ontology Markup Languages - SHOE - OIL - AML - OIL - OWL.

Unit III :

Ontology learning for semantic web - taxonomy for ontology learning - layered approach - phases of ontology learning - importing and processing ontologies and documents - ontology learning algorithms - evaluation.

Unit IV :

Ontology management and tools - overview - need for management - development process - target ontology - ontology mapping - skills management system - ontological class - constraints - issues. Evolution - development of tools and tool suites - ontology merge tools - ontology based annotation tools.

Unit V :

Applications - web services - semantic web services - case study for specific domain - security issues - current trends.

References:

1. Asuncion Gomez-Perez, Oscar Corcho and Mariano Fernandez-Lopez, *Ontological Engineering: with examples from the areas of Knowledge Management, e-Commerce and the Semantic Web*, 1st Edition, Springer.

2. Grigoris Antoniou and Frank van Harmelen, A Semantic Web Primer, The MIT Press
3. Liyand, Introduction to the Semantic Web and Semantic Web Services, Chapman.
4. Alexander Maedche, Ontology Learning for the Semantic Web, Springer, 2002nd Edition,
5. John Davies, Dieter Fensel and Frank Van Harmelen, Towards the Semantic Web: Ontology - Driven Knowledge Management, 1st Edition, Wiley.
6. Dieter Fensel, Wolfgang Wahlster, Henry Lieberman and James Hendler, Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential, The MITPress.

CSC4E24 - VIRTUALIZATION AND CLOUD COMPUTING

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction - evolution of cloud computing - system models for distributed and cloud computing - NIST cloud computing reference architecture - Infrastructure as a Service (IaaS) - resource virtualization - Platform as a Service (PaaS) - cloud platform and management - Software as a Service (SaaS) - available service providers.

Unit II :

Virtualization - basics of virtualization - types of virtualization - implementation levels of virtualization - virtualization structures - tools and mechanisms - virtualization of CPU, memory, I/O devices - desktop virtualization - server virtualization - Linux KVM, Xen, Qemu, LXC, OpenVZ.

Unit III :

Cloud infrastructure - FOSS cloud software environments - Eucalyptus, Open Nebula, OpenStack - OpenStack architecture - compute, object storage, image service, identity, dashboard, networking, block storage, metering, basic cloud orchestration and service definition.

Unit IV :

Programming model - parallel and distributed programming paradigms - Mapreduce, twister and iterative Mapreduce - mapping applications - programming support - Apache Hadoop - HDFS, Hadoop I/O, Hadoop configuration, MapReduce on Hadoop.

Unit V :

Security in the cloud - security overview - cloud security challenges - software-as-a-service security - security governance - risk management - security monitoring - security architecture design - data security - application security - virtual machine security - Qubes - desktop security through Virtualization.

References:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing (From Parallel Processing to the Internet of Things), Elsevier Science..
2. John W. Rittinghouse and James F. Ransome, Cloud Computing: Implementation, Management, and Security, 1st Edition, CRC Press.
3. Toby Velte, Robert Elsenpeter and Anthony Velte, Cloud Computing, A Practical Approach, TMH.
4. George Reese, Cloud Application Architectures, 1st Edition, Shroff /O'Reilly.
5. Ravi Nair and Jim Smith, Virtual Machines: Versatile Platforms for Systems and Processes, 1st Edition, Elsevier Science / Morgan Kaufmann,
6. Katarina Stanoevska - Slabeva, Thomas Wozniak, Santi Ristol, Grid and Cloud Computing - A Business Perspective on Technology and Applications, Springer.
7. Open stack Operations Guide, <http://docs.openstack.org/ops/>.
8. Tom White, Hadoop: The Definitive Guide, O'Reilly Media.

CSC4E25 - STORAGE AREA NETWORK

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Basic networking concepts and topologies - OSI reference model, common network devices, network topologies, MAC standards - need for storage networks - storage devices - techniques evolution - benefits of SANs - SAN components and building blocks - fibre channel basics - fibre channel topologies, fibre channel layers, classes of service SAN topologies.

Unit II :

SAN fundamentals - SAN operating systems software and hardware types of SAN technology - technology and configuration, high scalability and flexibility standards - storage management challenges - networked storage implementation challenges - storage subsystems for video services.

Unit III :

Storage networking architecture storage in storage networking - challenges, cost and performance network in storage networking - fibre channel, emerging SAN interconnect technologies - basic software, advanced software, backup software implementation strategies.

Unit IV :

Storage network management in-band management out-of-band management -SNMPHTTP - TELNET storage network management issues - storage resource management - storage management, storage, systems and enterprise management integration.

Unit V :

Designing and building a SAN - design considerations - business requirements - physical layout, placement, storage, pooling, data availability, connectivity, scalability, migration, manageability, fault tolerance and resilience - prevention of congestion - routability - backup and restoration - SAN security and iSCSI technology - basic security guidelines - implementing SAN security - backup and restoration in iSCSI technology - future of SANS.

References:

1. Meeta Gupta, Storage Area Network Fundamentals, Cisco Press.
2. John R. Vacca, The Essential Guide to Storage Area Networks, 1st Edition, Prentice Hall,
3. Richard Barker and Paul Massiglia, Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs, Wiley India Pvt Ltd.
4. Tom Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, 2nd Edition, Addison Wesley Professional.
5. Robert Spalding, Storage Networks: The Complete Reference, 1st Edition, Tata McGraw-Hill Education.
6. Christopher Poelke and Alex Nikitin, Storage Area Networks for Dummies, 2nd Edition,
7. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka and Nils Haustein, Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, Wiley India Pvt Ltd.

CSC4E26 - SOFTWARE DEVELOPMENT FOR PORTABLE DEVICES

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction to Mobile Web (HTML 5) - Semantic Elements - Structural Elements - Basic formatting tags - heading, paragraph, underline break, bold, italic, underline, superscript, subscript, font and image. Different attributes like align, color, bgcolor, font face, border, size. Navigation Links using anchor tag - internal, external, mail and image links. Lists - ordered, unordered and definition, table tag, HTML5 form controls - form, input types - color, date, datetime, datetime-local, email, month, number, range, search, tel, time, url, week, text, password, textarea, button, checkbox, radio button, select box, hidden controls, calendar, date, time, email, url, search. Datalist, keygen, output - Introduction to CSS3.

Unit II :

jQuery - introduction - Adding jQuery to web pages - downloading - accessing from CDNs - jQuery syntax - jQuery selectors - event methods - ready(), click(), dblclick(), mouseenter(), mouseleave(), mousedown(), mouseup(), hover(), focus(), blur() - effects - hide, show, fading, sliding, animation - callback functions - chaining - methods for changing and manipulating HTML elements and attributes - adding new elements/content - append(), prepend(), after(), before() - removing elements - remove(), empty() - manipulating CSS3 - dimensions of elements and browser window - traversing - ancestors, descendants, siblings.

Unit III :

Introduction to Android and smart phones, Android architecture and virtual machine, mobile technology terminologies, setting up the environment, setting up emulators, Android fundamentals - activities and applications activity life cycles, activity stacks, activity states. Introduction to manifest, resources and R.java, assets, values - strings.xml - form widgets, views, layouts and drawable resources - XML layouts, linear layouts, relative layouts, table layouts, Android widgets, UI XML

specifications events, bundles and intents - explicit intents implicit intents event broadcasting with intents event reception with broadcast receivers, adapters and data binding.

Unit IV :

Files, content providers and databases - saving and loading files, SQLite databases - Android database design - exposing access to a data source through a content provider content provider registration native content providers, Android Debug Bridge (adb) tool, Linkify.

Unit V :

Adapters and widgets, notifications, custom components threads running on UI thread, Worker thread handlers and runnable AsyncTask (in detail), playing audio and video, recording audio and video, using the camera to take and process pictures. Networking and location based services - live folders, using sdcards - reading and writing, XML parsing - JSON parsing - including external libraries in applications, Map-based activities, Maps via intent and Map activity GPS, location based services configuration, geocoding, accessing phone services (Call, SMS, MMS), network connectivity services, using Wifi and Bluetooth action bar tabs and custom views on action bars.

References:

1. Terry Felke-Morris, Web Development and Design Foundations with HTML5, Addison-Wesley.
2. Html 5 Black Book: Covers CSS3, Javascript, XML, XHTML, Ajax, PHP and JQuery, Kogent Learning Solutions Inc.
3. Kessler, Programming HTML 5 Applications, O'Reilly Media.
4. Robin Nixon, Html5 For Ios And Android: Beginner Guide, McGraw-Hill Edu.India Pvt .Ltd,.
5. Lauren Darcey and Shane Conder, Android Wireless Application Development : Android Essentials (Volume 1), 3rd Edition, Pearson Education.
6. Zigurd Mednieks, Rick Rogers, Lombardo John and Blake Meike, Android Application Development, 1st Edition, O'Reilly Meida,
7. Reto Meier, Professional Android 2 Application Development, 1st Edition, Wiley India Pvt Ltd,

CSC4E27- FUNDAMENTALS OF BIG DATA

Course Number: 1

Contact Hours per Week: 4 (3 Lecture + 1 Tutorial)

Number of Credits: 4

Unit I :

Introduction to Big Data - definition and importance of Big Data - four dimensions of Big Data - volume, velocity, variety, veracity - importance of big data - structured data, unstructured data - the role of a CMS in big data management - integrating data types into a big data environment - distributed computing and Big Data. Big Data stack - layer 0,1 and 2 - Big Data management - operational databases - relational databases - non relational databases - NoSQL - key-value pair databases - document databases - columnar databases - graph databases - spatial databases.

Unit II :

Big Data analysis - basic analytics - operationalized analytics - modifying business intelligence products to handle Big Data - Big Data analytics examples - Analytics solutions - text analytics - exploring unstructured data - understanding text analytics - analysis and extraction techniques - the extracted information - text analytics tools for Big Data - custom applications for Big Data analysis - R Environment - Google Prediction API - Characteristics of a Big Data Analysis Framework.

Unit III :

NoSQL databases - types - Advantages over Relational Databases - MongoDB - introduction - MongoDB philosophy - the data model - designing the database - collections - documents - data types - the -id Field - indexes - viewing available databases and collections - opening a database - inserting data - querying for data - retrieving documents - aggregation commands - grouping results - conditional operators - specifying an array of matches - applying criteria for search - \$slice - \$size - \$exists - \$type - \$elemMatch - \$not (meta-operator) - update() - save() - \$inc - \$set - \$unset - \$push - \$pushAll - \$addToSet - removing elements from an array - atomic operations - modifying and returning a document atomically - renaming a collection - removing data - referencing a database - implementing index-related functions - min() and max().

Unit IV :

Hadoop - history - components - HDFS - MapReduce Basics - origins of MapReduce - map function - reduce function - putting them together - Hadoop common components - application development in Hadoop - Pig and Pig Latin - Load - Transform - Dump and Store - Hive - Jaql - getting our data into Hadoop - basic copy data - Flume - Zookeeper - HBase - Oozie - Lucene - Avro.

Unit V :

Understanding MapReduce - key/value pairs - the Hadoop Java API for MapReduce - the Mapper class - the Reducer class - the Driver class - writing simple MapReduce programs - Hadoop-provided mapper and reducer implementations - Hadoop-specific data types - the Writable and WritableComparable interfaces - wrapper classes - Input/output - InputFormat and RecordReader - OutputFormat and RecordWriter. Implementing WordCount using streaming - analyzing a large dataset - summarizing the UFO data - summarizing the shape data - a relational view on data with Hive - creating a table for the UFO data - inserting the UFO data - redefining the table with the correct column separator - creating a table from an existing file - SQL views.

References:

1. Hurwitz, Alan Nugent, Fern Halper and Marcia Kaufman, Big Data for Dummies.
2. Eelco Plugge, Peter Membrey and Tim Hawkins, The Definitive Guide to MongoDB: The NOSQL Database for Cloud and Desktop Computing, 1st Edition, Apress,
3. Chris Elaton, Derk Deroos, Tom Deutsch, George Lapis and Pual Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, 1st Edition, Garry Turkington, Hadoop Beginner's Guide, Packt Publishing Ltd,

General Pattern of Question Paper
Core and Elective courses in M.Sc. Computer Science Programme
Under CCSS (with effect from 2019 Admission)

Code:

Reg. No:

Name:

1st/2nd/3rd/4th Semester M.Sc. Computer Science Degree
Examination 2019
CCSS M.Sc. Programme

Course Code : (eg: CS1C02) Course : (Eg: Advanced Data Structures
and Algorithms)

Time: 3 Hours

Total Marks: 80

Answer five full questions; Each Question carries 16 marks.

Question Numbers:1 to 8

Total Marks = 5 x 16 = 80 Marks

NOTE: Minimum one question from each of the five modules. Remaining three questions can be from any module. There should not be more than two questions from the same module.