



Ramakrishna Mission Residential College (Autonomous)

Vivekananda Centre for Research

Ramakrishna Mission Ashrama

(A Branch Centre of Ramakrishna Mission, Belur Math, Howrah-711202)

Narendrapur, Kolkata - 700 103, West Bengal, India

A Scientific Industrial Research Organisation, Recognised by DST, Govt. of India

College with Potential for Excellence (CPE), Re-accredited by NAAC - 'A' (CGPA 3.56 out of 4)

Department of Computer Science

Notice

Date: 16.07.2018

The next meeting of Board of Studies (BOS) of the Department of Computer Science will be held on 30.07.2018 at 11 A.M. in Departmental Teachers' Room. All the members are requested to attend the meeting.

Agenda:

1. To prepare the list of Paper Setter, Moderator for theory Papers for B.Sc. Odd Semester.
2. To prepare the list External Examiner for Practical Papers for B.Sc. Odd Semester.
3. To design the CBCS three year syllabus structure for B.Sc. Computer Science Programme.
4. To design the detailed syllabus for SEM – I and SEM – II for B.Sc. Computer Science Programme.
5. To design CBCS syllabus for M.Sc. Computer Science Programme.

BOARD OF STUDIES

Date: 30/7/18.

MEMBER PRESENT:

1. Lakshmi Sanyal 30/7/18
2. Devdatta Sin 30/7/18
3. ~~Dr. K. K. Sanyal~~ 30/7/18
4. Pratik 30/7/18
5. Sgiri 30/7/18
6. Md Firoj Ali 30/7/18
7. Saptarshi Naskar 30/7/18

MINUTES:

1. Copies of resolution adopted at the board of studies held on 10.3.2018 were circulated among the members present at the meeting.
2. New syllabus for CBCS system are designed for SEM-I to SEM-VI and detailed syllabus for SEM-I and SEM-II are proposed for B.Sc. Computer Science programme. After discussion revisions & new courses were approved. (as attached)
3. Syllabus for M.Sc. Course in Computer Science is designed for CBCS system, to introduce the programme from 2018-2019 session.
4. Separate panels for paper setter, moderators, reviewers and external examiners for practical examination are prepared for SEM-I, SEM-II & SEM-V UG course and moderators for SEM-I PG course for the session JULY, 2018 to DECEMBER, 2018.

Lakshmi Sanyal
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Ramakrishna Mission Residential College

(Autonomous)

Narendrapur, Kolkata – 700103



Department of Computer Science

Syllabi for Courses offered by the Department
at Under Graduate Level

Under **CBCS**

2018

Programme Name: BSc with Honours in Computer Science

Programme Code: BSHCOM

Computer Science (Honours)

Objective: After graduation, the Computer Science graduates would be able to implement fundamental domain knowledge of core courses for developing effective computing solutions by incorporating creativity and logical reasoning. The students can deliver professional services with updated technologies in computer science based career. They develop leadership skills and incorporate ethics, team work with effective communication & time management in the profession. They can also conduct research among computing professionals as per market needs.

Computer Science (Generic elective)

Objective: This course is designed for the students who take Computer Science as an elective subject along with their chosen honours subject. Some of these honours subjects like Physics/Chemistry/Statistics/Mathematics/Economics specifically require specific computer knowledge back-up, which is far from the rudimentary knowledge of core computer science. Hence this course is designed to cater a common minimum requirement of the above-mentioned disciplines.

Ability Enhancement Compulsory Course (AECC)

1. Compulsory language to be taken in 1st Year.
 - a. Subject: English
 - i. Marks: 50
 - ii. Credit: 2
 - iii. Written Test at the Mid & End Semester
 - c. Subject: Bengali
 - i. Marks: 50
 - ii. Credit: 2
 - iii. Written Test at the Mid & End Semester
2. Environmental Studies
 - i. Marks in Theory : 75
 - ii. Credit: 3
 - iii. Written Test at the Mid & End Semester
 - iv. Marks in Project : 25
 - v. Credit: 1

vi. Each Student will be required to submit a Project Report at the end of Second Semester of First Year. The Project will be an original work which may be related to the Honours Subject of the students but must be some aspect of the environmental studies. However, students may involve his own habitat while doing his Project. In the month of February students should talk to either their teacher of the Environmental Studies or the teachers of their own subject to choose the Project area. The length of the Project Report should be not less than 1500 words but not more than 3000. It may be hand written or typed. The Project must be submitted by 31st May. Students should submit their Project Report Head of the Department and must obtain a Project Completion Certificate from the HoD.

Course Structure: Semester-wise distribution of Courses

Semester	Course Code	Course Name	Credits
1	HCEN1AE01S	To be given by college centrally	2
	HCOM1CC01L	Computer Fundamentals & C Programming	6
	HCOM1CC02L	Digital Electronics & Computer Organization	6
	HCOM1GE01L	See GE 1 *	6
		Total	20
2	HENV2AE02S	To be given by college centrally	2
	HCOM2CC03L	Data Structure	6
	HCOM2CC04L	Microprocessor	6
	HCOM2GE01L	See GE 1 *	6
		Total	20
3	HCOM3CC05L	Numerical methods & Graph Theory	6
	HCOM3CC06L	Operating Systems	6
	HCOM3CC07L	Object Oriented Modelling and Programming in Java	6
	HXXX3SE01S	To be given by college centrally	2
	HCOM4GE02L	See GE 2 *	6
		Total	26
4	HCOM4CC08L	Database Management System	6
	HCOM4CC09L	Design and Analysis of algorithm	6
	HCOM4CC10N	Discrete Mathematics & Theory of Computation	6
	HVED4SE02S	To be given by college centrally	2
	HCOM4GE02L	See GE 2 *	6
		Total	26
5	HCOM5CC11L	Software Engineering	6
	HCOM5CC12L	Data Communication and Networking	6
	DSE	See DSE 1	6
	DSE	See DSE 2	6
		Total	24
6	HCOM6CC13L	Artificial Intelligence	6
	HCOM6CC14L	Computer Graphics	6
	DSE	See DSE3	6
	DSE	See DSE4	6
		Total	24
		Grand Total	140

Choices for Discipline Specific Electives (DSE)*

DSE1 (For Semester 5)		DSE2 (For Semester 5)	
Course Code	Course Name	Course Code	Course Name
HCOM5DS11L	Digital Image Processing	HCOM5DS21L	R Programming
HCOM5DS12L	Cryptography and Network Security	HCOM5DS22L	Python programming
DSE3 (For Semester 6)		DSE4 (For Semester 6)	
Course Code	Course Name	Course Code	Course Name
HCOM5DS31L	Soft Computing	HCOM5DS41L	Optimization Techniques
HCOM5DS32L	Data Science	HCOM6DS42J	Project Work

*A student has to opt for any one of the courses available/given by the department in a specific year under each category.

CC 1	Paper-HCOM1CC01LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM1CC01LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand the concepts of computer basics & programming.
2. Understand the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
3. Write, compile and debug programs in C language and use different data types for writing the programs.
4. Design programs connecting decision structures, loops and functions.
5. Explain the difference between call by value and call by address.
6. Understand the dynamic behaviour of memory by the use of pointers.
7. Use different data structures and create / manipulate basic data files and developing applications for real world problems.

Paper-HCOM1CC01LTH

Computer Fundamentals and C Programming [60L]

Group – A

(Computer Fundamentals)

Introduction: Motivation for development of computer & its historical background, Characteristics of computer, Generation of computer & their relative advantages and disadvantages, application of computers. [2L]

Classification of computers: according to task performed (General purpose and special purpose), according to logic (Analog, digital, Hybrid), according to size (Super computer, main frame, mini and micro computer), Personal computer, workstation, Portable computers (laptop, notebook, handheld computer, PDAs). [2L]

Components of digital computers and functions of each unit: CPU (ALU & CU), memory, Input and output device, block diagram of a digital computer, Hardware and software: Purpose of H/W & S/W. Classification of S/W (System S/W, Application S/W), Firmware. [2L]

Problem solving using computers: Algorithm and its properties, simple algorithms as examples, flowchart, decision table, comparative study of machine level language, assembly language, high level language. [4L]

Number system: base or radix, Decimal, binary, octal and hexadecimal number system, Algorithm for conversion from any base to any base (for both Integral and floating point data),

Arithmetic operation: addition, subtraction, multiplication and division of binary, octal and hexadecimal number, Signed number representation: signed magnitude, diminished radix complement [(R-1)'s complement] and radix complement [R's complement], relative advantages and disadvantages, addition and subtraction using complement representation, Fixed and floating point representation: Fixed point number and its disadvantages, Floating point number and scientific representation (mantissa and exponent), Biased exponent and its advantages, IEEE 754 floating point representation. [6L]

Computer codes: advantages of codes, Weighted & non-weighted code, BCD code (BCD representation of decimal numbers, conversion of BCD to binary, addition and subtraction of BCD numbers), Unit distance code, Reflected code, Gray code (Binary code to gray code and vice-versa), ASCII code, Error detecting and correcting code (Parity code, Block parity, checksum, CRC, Hamming code). [4L]

Group – B

(Programming using C)

Introduction: Basic Structure; Character Set; Keywords, Identifiers, Constants, Variables; Data Types and Sizes, Type Casting, Floating Point Domain Error. [2L]

Operators and Expressions: Arithmetic, Relational, Logical, Assignment, Bitwise, Increment, Decrement, Ternary Operators and Expressions; Precedence and Association of Operators. [2L]

Instruction: Type Declaration, I/O (Formatted and Unformatted) And Control Instruction (If-Else, Else-If, Switch-Case, For Loop, While Loop, Do-While Loop, Break, Continue, Goto). [8L]

Functions: Declaration, Definition, Return; Storage Class (Auto, Static, Register, External); Scopes Rules; Header Files; Variables Number of Arguments; Recursion; Call by Value, Call by Address. [4L]

C Preprocessor: Macros; Difference with Function; Include-if, elif, undef, pragma Directives. [2L]

Arrays: One Dimensional and Two Dimensional Arrays; Memory Representation, Initialization, Bound Checking; Insertion and Deletion of Elements; Searching (Linear, Binary), Sorting (Bubble, Insertion, Selection); Passing Array to Function; Multidimensional Arrays; Matrix Implementation. [4L]

Pointers: &,* Operators; Pointer and Addresses; Pointer Expressions; Pointers as Function Arguments; Pointers and Arrays; Pointer Arithmetic; Character Pointers and Functions; Function Returning Pointers; Dynamic Allocation; Pointer to a Function. [4L]

Strings: One and Two Dimensional; Fixed Length and Variable Length Strings; Problem Solving like Text Processing; Conversion to other Types etc.; Strings and Pointers, Command Line Arguments. [4L]

Structure and Unions: Structure Types, Variables; Initialization; Array of Structures; Structures and Functions; Pointers and Structures; Self-Referential Structures; typedef, Unions, Enumerated Data Types. [4L]

Input and Output: Standard I/O, Streams; printf, scanf etc., Console I/O Functions; Disk I/O functions Like fopen, fclose, fseek, ftell etc.; Text and Binary Files, Random Access; Files and Structures., Text and Binary Files. [4L]

Bitwise Operations: One's Complement, >>, <<, &, |, XOR Operators; Bit Printing Of Variables, Hexadecimal Notations. [2L]

Paper-HCOM1CC01LPR

Computer Fundamentals and C Programming Lab [40L]

Group – A: Word processing, Spreadsheet, Presentation S/W tools. [10L]

Introduction to MS Word and users utilities, Exploring Templates & Formation of documents, Table Handling, Mail merge and Print process.

Spread sheet, Work book Window, Formatting cells/Worksheet, Working with formula, function and charts, Filtering data and printing a presentation.

Introduction to M.S Power point, Creating Templates-Fonts and color editing, Adding Multimedia effects, Consolidating using Ms power point.

Group – B: Problem solving using C Language [30L]

Introduction to computer programming, use of editors, compilation, debugging, Basic C programs, String Manipulation, File Management, Control and loops, Programs using if conditions; switch case, loops, arrays, functions, files, command line arguments, string manipulations.

Text/Reference Books:

1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. Programming with C, Byron S. Gottfried, McGraw Hill.
4. The C Programming Language, Kernighan and Dennis, PHI.
5. The Complete reference C, Herbert Schildt, McGraw Hill.
6. Let Us C, Kanitkar, BPB Publication.
7. Programming in ANSI C, Balaguruswamy, McGraw Hill.

Question Pattern for End Semester Examination

(CC 1)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 4 questions each carrying 2 marks from Group – A have to be given.
- 4 questions each carrying 2 marks from Group – B have to be given.

Section-II

2 questions each carrying 8 marks from Group – A have to be given.

Section-III

6 questions each carrying 8 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 1 from each of the section.

SEMESTER – 1		
CC 2	Paper-HCOM1CC02LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM1CC02LPR	Credits : 2

	Full Marks :30
Number of classes required : 60+40	
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance	

Outcomes : This course will enable students to:

1. Acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. Perform the analysis and design of various digital electronic circuits.
3. Conceptualize the basics of organizational and architectural issues of a digital computer.
4. Analyze performance issues in processor and memory design of a digital computer.
5. Understand various data transfer techniques in digital computer.

Paper-HCOM1CC02LTH

Digital Electronics& Computer Organization [60L]

Group – A

(Digital Logic)

Basic logic gates and their properties: Introduction (Functional behaviour of logic gates, truth table, timing diagram), Logic gates (AND, OR, NOT, NAND, NOR, EX-OR, EXNOR), Active levels of logic signal. [2L]

Boolean Switching Algebra: Introduction, postulates of Boolean algebra, differences from normal algebra, Theorems of Boolean algebra, Boolean function (Maxterm, Minterm, Canonical form, Standard form, conversion between standard and canonical form, Number of Boolean Functions), Karnaugh Map minimization (Upto Four Variable) [6L]

Implementation of Combinational logic: Two level and Multilevel implementation using basic gates, Universal logic gates (NAND & NOR), Two and Multilevel implementation using universal gates. [2L]

Combinational logic: Adders, Subtractor, Parallel Adder and its disadvantage, Carry Look Ahead Adder, BCD Adder, Code Converter, Comparator, Decoder, Demultiplexer, Encoder, Priority Encoder, Multiplexer. [10L]

Sequential circuit: Latch: RS, D, JK, T, Latch conversion, Flip-flop: RS, D, JK, T, Master slave, Edge trigger, Counter: Asynchronous, Synchronous, Register: SISO, SIPO, PISO, PIPO, Universal shift register. [10L]

Group – B

(Computer Organization)

Basic computer organization: Accumulator based CPU, CPU registers, IAS computer, Von Neumann computer. [2L]

Instruction: Machine instruction, Assembly language instruction, micro instruction, Instruction Cycle, Instruction Format, 0, 1, 2, 3-address instruction, instruction types, instruction set completeness, Addressing modes. [4L]

Stack organization: Implementation of Stack using Shift register, Application of stack in Organization. [2L]

Memory: Types of Memory (RAM, ROM, DRAM, SRAM, SAM), characteristic of memory, Memory organization: Linear, 2D, Memory expansion (Horizontal, vertical and mixed). Associative memory: Design and application, concept of Virtual memory, Cache memory: Concept of locality of reference, cache memory organization, Hit & miss, Write back & Write through Cache, Mapping (Direct, Associative and Setassociative mapping). [8L]

Bus Organization: Bus structure, I/O interfacing, tri-state logic, Address decoding (Absolute & Partial), Memory mapped I/O & I/O mapped I/O, Data transfer (Programmed I/O, Interrupt initiated I/O, DMA), Bus contention and bus arbitration. [4L]

ALU Design: Functions of ALU, Bit sliced ALU, Implementation of Arithmetic operations (Fixed point data [Addition, subtraction, multiplication and division algorithm for signed number represented in signed magnitude and 2's complement]). [6L]

CU Design: Hardwired and Micro-programmed CU design and their relative advantages & disadvantages, Horizontal and vertical microinstruction, parallelism in Microinstruction. [4L]

Paper-HCOM1CC02LPR

Digital Logic & Computer Organization Lab [40L]

Group – A: Combinational and Sequential circuit implementation using ICs [30L]

Verification of functional behaviour of different logic gates AND, OR, NOT, NAND, NOR, EX-OR, EXNOR

Two and multilevel implementation of Boolean Functions using universal gates

Implementation of different combinational circuits Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Adder, BCD Adder, Code Converter, Comparator, Decoder, Demultiplexer, Encoder, Priority Encoder, Multiplexer using ICs.

Implementation of different sequential circuits Latches, Flip-flops Asynchronous and Synchronous Counter, Register, Universal shift register using ICs

Group – B: Computer Organization lab using simulation S/W [10L]

Implementation of RAM, Linear and 2D Memory organization, Memory expansion (Horizontal, vertical and mixed), Associative memory, Cache memory, Arithmetic and Logical operations using simulation Software.

Text/Reference Books

1. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
2. Digital Systems - Principle & Applications, Tocci&Widmer, EEE.
3. Digital Logic & State Machine Design, Comer, Oxford.
4. Digital Principle & Applications, Malvino& Leach, McGraw Hill.
5. Digital Design, Mano, PHI.
6. Digital Integrated Electronics- H.Taub&D.Shilling, McGraw Hill.
7. Digital Circuits and Design, Salivahan, Vikas
8. Computer System Architecture, Morries Mano, Pearson.
9. Computer Organization & Architecture, Williams Stallings, Pearson.
10. Computer Organization, Hamacher, Vranesic and Zaky, McGraw Hill.
11. Computer Architecture and Organization, Govindrajalu, Tata McGraw Hill.
12. Computer Architecture and Organization, J P Hayes, Tata McGraw Hill.
13. Structured Computer Organization, Andrew S. Tanenbaum, Austin, 6th edition,

Question Pattern for End Semester Examination

(CC 2)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 4 questions each carrying 2 marks from Group – A have to be given.
- 4 questions each carrying 2 marks from Group – B have to be given.

Section-II

4 questions each carrying 8 marks from Group – A have to be given.

Section-III

4 questions each carrying 8 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 2 from each of the section.

SEMESTER – 2		
CC 3	Paper-HCOM1CC03LTH	Credits : 4 Full Marks : 50+20*

	Paper-HCOM1CC03LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Impart the basic concepts of data structures and algorithms.
2. Understand concepts about searching and sorting techniques.
3. Understand basic concepts about stacks, queues, lists and trees.
4. Understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
5. Gain ability to analyze algorithms and algorithm correctness.

Paper-HCOM1CC03LTH

Data Structure [60L]

Introduction: Algorithm and its properties. Asymptotic notation (O , Ω , θ). Definition and Concepts of Linear and Non Linear Data Structures. [2L]

Arrays: Types, Memory Representations; Address Translations, Two Dimensional Arrays, Row Major and Column Major Forms; Sparse Matrix Representations and Address Translation. [4L]

Linked List: Single, Double, Circular & Header Linked List; Operations Like Insertion, Deletion, Searching, Sorting, Inversion, Splitting, Merging Etc. ; Polynomial Representation, Addition, Multiplication. [10L]

Stacks And Queues : Concepts Of Stack And Queue; Insertion and Deletion of Elements; Array and Linked Representation; Prefix, Infix And Postfix Notation; Postfix Expression Evaluation, Infix To Postfix; Circular Queue Insertion and Deletion; Dqueue Insertion and Deletion; Priority Queue Implementation using Array or Linked List; Queue Using Circular Linked List; Stack Using Queues; Queue Using Stacks. [10L]

Recursion: Divide and Conquer; Direct and Indirect recursion; Use of System Stack, Recursion Tree; Elimination of Recursion using Stack, Tail Recursion, Recursion Vs. Iteration. [3L]

Searching: Algorithm of Sequential and Binary Search Techniques; Complexity Analysis. [2L]

Trees: Concepts of Different Types of Binary Trees; Quantitative Properties; Depth, Internal And External Nodes, Minimum And Maximum Path Length; Syntax Trees; Concepts Of Heap; Traversal of Binary Trees (In-Order, Preorder, Post-Order) Both Recursive And Non Recursive; Array and Linked Representation of Binary Trees; BST Insertion and Deletion

Algorithm; Threaded Binary Trees: Insertion, traversal Algorithm, AVL tree, Extended Binary Tree. [15L]

Sorting: Algorithm and Complexity Analysis of Bubble, Selection, Insertion, Quick, Merge, Radix, Heap Sorting Techniques; Concepts of External Sorting. [10L]

Hashing: Concepts, Advantages and Disadvantages; Different Hash Functions; Collision and Resolution Techniques – Open Addressing (Linear & Quadratic Probing, Rehashing), Chaining And Coalesced Chaining; Dynamic Hashing and Extendible Hashing; Perfect Hash Function; Applications (Symbol Table). [4L]

Paper-HCOM1CC03LPR

Data Structure Lab [40L]

Implementation of algorithms of Data Structure Using C [40L]

Implementation of Single, Double, Circular Linked List (Operations like Insertion, Deletion, Searching, Sorting, Inversion, Splitting, Merging, RepresentationPolynomial, Addition and Multiplication of polynomial.

Implementation of Stack and Queue using array and linked list, Postfix Expression Evaluation, Infix To Postfix conversion, Circular Queue, Dqueue and Priority Queue Implementation using Array or Linked List.

Implementation of Sequential and Binary Search Techniques.

Implementation of Binary Trees; Traversal of Binary Trees (In-Order, Preorder, Post-Order) Both Recursive and Non-Recursive, BST, Threaded Binary Trees.

Implementation of Bubble, Selection, Insertion, Quick, Merge, Radix, Heap Sorting Techniques.

Implementation of Linear Probing, Chaining.

Text/ Reference Books:

- 1) Fundamentals of Data Structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Pr.
- 2) Data Structures: A Pseudo code Approach with C, Richard F. Gilberg and Behrouz A. Forouzan, Cengage Learning
- 3) Data Structures In C, Noel Kalicharan, CreateSpace Independent Publishing Platform.
- 4) Adam Drozdek, Data Structures and algorithm in C, Cengage Learning.

Question Pattern for End Semester Examination

(CC 3)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

CC 4	Paper-HCOM1CC04LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM1CC04LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand basic architecture of 8 bit microprocessors.
2. Understand interfacing of 8 bit microprocessor with memory and peripheral chips involving system design.
3. Understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessors.
4. Understand RISC and CISC based microprocessors.
5. Write programs to run on 8085 microprocessor based systems.

Paper-HCOM1CC04LTH

Microprocessor [60L]

Introduction: Microprocessor and microcontroller, Organization of microprocessor based system, Application of Microprocessor. [2L]

Microprocessor Architecture: Registers, Address bus, data bus, control bus, Multiplexing and demultiplexing of Address-data bus, Function of different pins of 8085A, 8085A Microprocessor functional block diagram, Timing diagram (Opcode fetch, Memory read, Memory write, I/O read, I/O write) [10L]

Interfacing Of Memory and I/O: Address decoding (Absolute & Partial decoding), Concept of Memory mapped I/O and I/O mapped I/O. [8L]

Instruction set of 8085A: Instruction format, opcode format, data format, addressing modes, Instruction Types (Data transfer, arithmetic, logical, branch operation), Counter and delay routine, Delay calculation, Stack operation (PUSH, POP), Subroutine call, Conditional CALL and RETURN, Restart instruction. Simple programs as example [20L]

Interrupt: 8085A Interrupt process, S/W and H/W interrupts, Vectored and non-vectored Interrupt, RIM and SIM instruction, DMA. [10L]

8255A programmable Peripheral interface: Block diagram, control word, I/O and BSR mode, Normal I/O mode, Handshaking I/O mode, Bidirectional mode, Illustration using LED, SSD and Matrix keyboard Interfacing. [10L]

Paper-HCOM1CC04LPR

Microprocessor Lab [40L]

Programming using 8085Microprocessor [40L]

Implementation of different Assembly Language Programs using Data transfer, arithmetic, logical, branch instruction using 8085 Microprocessor Kit.

Implementation of delay routine and calculation of delay time produced by delay routine.

Implementation of Program using Stack operation (PUSH, POP) and Subroutine call.

Text/Reference books:

1. Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989 by Ramesh S. Gaonkar.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications, 1980.
3. An introduction to micro computers Vol. 2 – some real Microprocessor – Galgotia Book Source, New Delhi by Adam Osborne and J. Kane.
4. Advanced Microprocessors by Ray and Bhurchandi - TMH.
5. Intel Corp. Micro Controller Handbook – Intel Publications, 1994.
6. Microprocessors and Interfacing by Douglas V. Hall, McGraw Hill International
7. Assembly Language Programming the IBM PC by Alan R. Miller, SubexInc, 1987.

Question Pattern for End Semester Examination

(CC 4)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

CC 5	Paper-HCOM3CC05LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM3CC05LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

Numerical Methods

1. Provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.
2. Deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration, solution of differential equation, boundary value problems, solution of matrix problems.
3. Facilitate numerical computing.

Graph Theory

1. Explain basic concepts in combinatorial graph theory.
2. Define how graphs serve as models for many standard problems discuss the concept of graph, tree, Euler graph, cut set and combinatorics.
3. Realize the applications of graphs in science, business and industry.

Paper - HCOM3CC05LTH

Numerical Methods and Graph Theory [60L]

Group – A

(Numerical Methods)

Errors: Concepts; Types of errors. [2]

System of Linear Equations: Properties of Set of Linear Equations -Linearly dependent and independent, Rank, Singularity of coefficient matrix; Ill condition matrix, Gaussian Elimination, Gauss-Jordon Elimination; iteration method and its convergence condition and testing; Gauss-Jacobi and Gauss-Seidal iteration algorithm and its applications. [6]

Non-linear equation: Iterative methods and different types of convergence; divergence and its test condition; Bisection algorithm; Regular-Falsi method, Secant and Newton-Raphson method; Problems and its graphical significance. [6]

Solution of differential equations: Euler method; Taylor method; Runge-Kutta second and fourth order method for solving differential equations. [4]

Interpolation: Newton forward and backward interpolation; Lagrange interpolation. [4]

Curve fitting: Linear, Quadratic fitting. [4]

Integration: Mathematical foundation for Trapezoidal and Simpson's 1/3 rules and its composite forms. [4]

Group – B

(Graph Theory)

Introduction: Definition of linear graph, self loop, Parallel edges, simple graph, multigraph, Pseudo graph, directed graph, Application of graph, Finite and Infinite graph, Incidence and degree, Indegree and outdegree of directed graph and their relation, Isolated vertex, Pendant vertex and Null graph. [4]

Walk, Path & Circuit: Isomorphic Graph, Subgraph (Edge and Vertex disjoint), Walk, path circuit and their differences, Connected & Disconnected Graph, Components, Operation On Graphs (Union, Intersection, Ring sum, Decomposition, Deletion of edge and vertex, Fusion, Euler Graph, Arbitrarily Traceable Graph, Hamiltonian paths and circuit, Complete graph, Bipartite graph, complete bipartite graph. [6]

Tree: Definition of tree, Distance, Eccentricity, Center, Radius and diameter, rooted tree, Binary tree and its properties, Spanning tree, Breadth First Search and Depth First Search, Minimum spanning tree, Algorithm for finding Minimum Spanning Tree (Prim's and Kruskal). [10]

Shortest Path Problem: Dijkstra Algorithm, Traveling Salesman Problem, Floyd and Warshall algorithm. [6]

Representation of Graph: Adjacency matrix and adjacency list, Incidence matrix, Path matrix, Circuit matrix, their relative advantage & disadvantages. [4]

Paper - HCOM3CC05LPR

Numerical Methods and Graph Theory Lab [40L]

Group – A: Numerical Problem Solving using C Language [20L]

Implementation of Gaussian Elimination, Gauss-Jordan Elimination, Gauss-Jacobi and Gauss-Seidal iteration for solving of Linear Equation.

Implementation of Bisection method, Regular-Falsi method, Secant method and Newton-Raphson method for solving of Non Linear Equation.

Implementation of Euler method, Taylor method; Runge-Kutta second and fourth order method for solving differential equations.

Implementation of Newton forward and backward interpolation and Lagrange interpolation.

Implementation of Linear, Quadratic fitting.

Implementation of composite Trapezoidal and Simpson's rules.

Group – B: Implementation of algorithms of Graph Theory using C Language [20L]

Implementation of Breadth First Search and Depth First Search for graph traversal.

Implementation of Prim's and Kruskal's Algorithm for finding Minimum Spanning Tree.

Implementation of Dijkstra Algorithm, Floyd and Warshall algorithm for finding Shortest Path.

Text/ Reference Books:

1. C.L. Liu & Mahapatra, Elements of Discrete mathematics, 2nd Sub Edition 1985, Tata McGraw Hill.
2. Rosen, Discrete Mathematics and Its Applications, Sixth Edition 2006.
3. T.H. Cormen, C.E. Leiserson, R. L. Rivest, Introduction to algorithms, Prentice Hall on India, (3rd edition 2009).
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms 1988 John Wiley Publication.
5. J. L. Hein, Discrete Structures, Logic, and Computability, Jones and Bartlett Publishers, 3rd Edition, 2009.
6. D.J. Hunter, Essentials of Discrete Mathematics, Jones and Bartlett Publishers, 2008.
7. Numerical Analysis and Computational Procedures by Mollah; New Central Book.
8. Computer Oriented Numerical Methods, 3rd Edition, V Rajaraman, PHI
9. Graph Theory With Applications To Engineering And Computer Science by Narsingh Deo, PHI.
10. Graph Theory by J.A. Bondy and U.S.R. Murty, Springer.
11. Introduction to Graph Theory by D B West, 2nd edition, Pearson Education

Question Pattern for End Semester Examination

(CC 5)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 4 questions each carrying 2 marks from Group – A have to be given.
- 4 questions each carrying 2 marks from Group – B have to be given.

Section-II

4 questions each carrying 8 marks from Group – A have to be given.

Section-III

4 questions each carrying 8 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 2 from each of the section.

SEMESTER – 3		
CC 6	Paper-HCOM3CC06LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM3CC06LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Learn the fundamentals of Operating Systems.
2. Learn the mechanisms of OS to handle processes and threads and their communication.
3. Learn the mechanisms involved in memory management in contemporary OS.
4. Gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
5. Know the components and management aspects of concurrency management.
6. Learn programmatically to implement simple OS mechanisms.

Paper - HCOM3CC06LTH

Operating System [60L]

Introduction: Concepts of System S/W and Application S/W, Concept of Compiler, Interpreter, Assembler (One Pass and Two Pass Concepts), Loader, Linker. [4]

Operating System Fundamentals: Concepts of Batch, Multiprogramming, TimeSharing, Multiprocessing, Multithreading, Distributed, Real Time, Handheld Systems; I/O and CPU Protection Methods; Concepts of Process. [6]

Processor Scheduling : Basic Concepts; Preemptive And Non-Preemptive Scheduling; Scheduling Criteria; FCFS, SJF, SRTF, Priority, Round Robin, Multilevel Feedback Queue Scheduling Algorithms; Gantt Chart Representation of Scheduling, Calculation of Waiting and Turnaround Time. [10]

Concurrent Processes: Concurrent Processes; Precedence Graphs, Fork and Join Notation; Critical Section Problem; Two Process Software Solution (Peterson Algorithm); Multi-Process Solution (Bakery Algorithm); Semaphores; Critical Section Problem and Semaphores: Busy Waiting, Deadlock, Starvation, Mutex, Monitors; Classical Problem Of Synchronization (Bounded Buffer, Reader Writer, Dining Philosopher) and Semaphore Solution; Critical Regions. [10]

Deadlocks: System Model, Necessary Conditions; Resource Allocation Graph; Deadlock Prevention; Deadlock Avoidance, Safe State, Resource Allocation Graph Algorithm, Banker's Algorithm; Deadlock Detection; Recovery from Deadlock. [6]

Memory Management: Concepts Address Binding; Logical and Physical AddressSpace; Overlays, Swapping; Contiguous Memory Allocation Concepts, Fragmentationand Compaction; Basic Method of Paging and H/W Support, Memory Protection,Structure of Page Table, Shared Pages; Segmentation, Segmentation with Paging. [8]

Virtual Memory: Concepts of Virtual Memory; Demand Paging; Page ReplacementBasic Schemes: FIFO, Optimal, LRU Page Replacement Techniques, Belady's Anomaly;LRU Approximation, Global And Local Allocation Of Frames; Thrashing; Working SetModel; Prepaging; Page Size; Inverted Page Table. [8]

Disk Scheduling: Concepts of Seek Time and Latency; FCFS, SSTF, SCAN, LookAlgorithms; Concept of RAID, SAN. [4]

File System: File Attributes; Operations and Types; File Access Methods (Sequential,Direct, Index Sequential); Directory Structure (Single Level, Two Level, Tree and Acyclic Graph Structured). [4]

Paper - HCOM3CC06LPR

Operating System Lab [40L]

Group – A: Implementation of algorithms of Operating System using C Programming [20L]

Implementation of FCFS, SJF, SRTF, Priority, Round Robin algorithm.

Implement Fork(), exec(),wait() system calls PetersonAlgorithm); Multi-Process Solution; Bakery Algorithm; Classical Problem Of Synchronization (Bounded Buffer, Reader Writer, DiningPhilosopher)

Implementation ofDeadlockPrevention; Resource Allocation Graph Algorithm, Banker's Algorithm; Deadlock Detection;

Implementation of Fragmentation, Page Replacement Basic Schemes: FIFO, Optimal, LRU Page Replacement Techniques,

Implementation FCFS, SSTF, SCAN, Look Algorithms.

Group – B: Shell Programming [20L]

Unix Components/Architecture,General features of Unix commands/ command structure. Command arguments and options, Understanding of some basic commands

The vi editor, Wild cards and file name generation. Removing the special meanings of wild cards, Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee, Command substitution, Basic and Extended regular expressions, The grep, egrep,

Shell programming, Command line arguments, if, while, for and case control statements, set and shift commands and handling positional parameters, File inodes and the inode structure. File links – hard and soft links, Filters,

Mechanism of process creation, Parent and child process, The ps command with its options. Executing a command at a specified point of time: at command, Executing a command periodically: cron command and the crontab file, Signals, The nice and nohup commands. Background processes, The bg and fg command, The kill command.

Text/Reference books:

1. Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
2. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
3. Milenkovie M., "Operating System: Concept & Design", McGraw Hill.
4. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
5. Dietel H. N., "An Introduction to Operating Systems", Addison Wesley.

Question Pattern for End Semester Examination

(CC 6)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 3		
CC 7	Paper-HCOM3CC07LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM3CC07LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand the object oriented concepts for designing object oriented models.
2. Understand the use of UML (Unified Modelling Language) for object oriented analysis and design.
3. Understand the issues for implementing object oriented designs or models.
4. Understand the concept of different patterns for constructing software architectures through object oriented models.
5. Know the structure and model of the Java programming language.
6. Use the Java programming language for various programming technologies.
7. Develop software in the Java programming language.
8. Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements.
9. Propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.
10. Choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems.

Paper - HCOM3CC07LTH

Object Oriented Modelling and Programming in Java[60L]

Introduction: Basis of Object model; Abstraction; Encapsulation; Modularity; Benefits of object models. Object and class; State; Behaviour; Relationships among objects; Link and associations; Generalization, inheritance, polymorphism; N-ary associations; Aggregations. Meta-class; Abstract class; Multiple Inheritance; Metadata; [5L]

Fundamentals of Object-Oriented design in UML: Static and dynamic models, UML diagrams: Class diagram, Object diagram, State diagram, interaction diagram: collaboration diagram, sequence diagram, use case diagram, activity diagram [10L]

Introduction to Java Java Architecture and Features, Understanding the semantic and syntax differences between C++ and Java, Compiling and Executing a Java Program, Variables, Constants, Keywords Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Comments, Doing Basic Program Output, Decision Making Constructs (conditional statements and loops) and Nesting, Java Methods (Defining, Scope, Passing and

Returning Arguments, Type Conversion and Type and Checking, Built-in Java Class Methods) [5L]

Arrays, Strings and I/O Creating & Using Arrays (One Dimension and Multi-dimensional), Referencing Arrays Dynamically, Java Strings: The Java String class, Creating & Using String Objects, Manipulating Strings, String Immutability & Equality, Passing Strings To & From Methods, String Buffer Classes. Simple I/O using System. out and the Scanner class, Byte and Character streams, Reading/Writing from console and files. [10L]

Object-Oriented Programming Overview Principles of Object-Oriented Programming, Defining & Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables & Methods, Objects as parameters, final classes, Object class, Garbage Collection. [5L]

Inheritance, Interfaces, Packages, Enumerations, Auto boxing and Metadata Inheritance: (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending interfaces and packages, Package and Class Visibility, Using Standard Java Packages (util, lang, io, net), Wrapper Classes, Autoboxing/Unboxing, Enumerations and Metadata. [10L]

Exception Handling, Threading Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. [8L]

Applets and Event Handling Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener Interfaces, Adapter and Inner Classes, Design and Implementation of GUIs using the AWT controls. [7L]

Paper - HCOM3CC07LPR

JavaLab [40L]

Problem Solving using JAVA [40L]

Compiling and Executing a Java Program, Doing basic program output of Data types, variable, expressions, operators, and control structures, Implementation of class and object, Implementation of Constructor and overloading.

Creating & Using Arrays (One Dimension and Multi-dimensional). Implementation of basic String handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, Implementation of I/O operations – keyboard input using BufferedReader & Scanner classes.

Implementation of Single Level, Multilevel, Method Overriding and Dynamic Method Dispatch. Write programs on interfaces. Write programs on packages.

Implementation of try, catch, throw, throws and finally, Creating own exceptions, Implementation of Multithreading, Synchronization, Inter Thread communication and deadlock.

Basics of applet programming, applet life cycle, Implementation of event handling and listener, Creation of buttons and text fields.

Text/Reference books:

1. Ken Arnold, James Gosling, David Holmes, "The Java Programming Language", 4th Edition, 2005.
2. James Gosling, Bill Joy, Guy L Steele Jr, Gilad Bracha, Alex Buckley "The Java Language Specification, Java SE 8 Edition (Java Series)", Published by Addison Wesley, 2014.
3. Joshua Bloch, "Effective Java" 2nd Edition, Publisher: Addison-Wesley, 2008.
4. Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 1 ,9th Edition, Printice Hall.2012
5. Cay S. Horstmann, Gary Cornell, "Core Java 2 Volume 2 - Advanced Features)", 9th Edition, Printice Hall.2013
6. Bruce Eckel, "Thinking in Java", 3rd Edition, PHI, 2002.
7. E. Balaguruswamy, "Programming with Java", 4th Edition, McGraw Hill.2009.
8. Paul Deitel, Harvey Deitel, "Java: How to Program", 10th Edition, Prentice Hall, 2011.
9. "Head First Java", Orielly Media Inc. 2nd Edition, 2005.
10. David J. Eck, "Introduction to Programming Using Java", Published by CreateSpace Independent Publishing Platform, 2009.
11. John R. Hubbard, "Programming with JAVA", Schaum's Series, 2nd Edition, 2004.

Question Pattern for End Semester Examination

(CC 7)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 4		
CC 8	Paper-HCOM3CC08LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM3CC08LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Describe the fundamental elements of relational database management systems.
2. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
3. Design ER-models to represent simple database application scenarios .
4. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
5. Improve the database design by normalization.
6. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

Paper - HCOM3CC08LTH

Database Management System [60L]

Introduction: Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas And Instances; Database Languages; Database Users, DBA; Data Dictionary; Functional Components of DBMS. [5]

ER Model: Entity, Attributes and Relationship; Structural Constraints; Keys; ER Diagram of Some Example Database; Weak Entity Set; Symbolic Conventions; Specialization and Generalization; Constraints of Specialization and Generalization; Aggregation. [10]

Relational Model: Basic Concepts of Relational Model; Domain Constraints, Referential Integrity, Assertions, Triggers, Relational Algebra; Tuple Relational Calculus; Domain Relational Calculus. [15]

Relational Database Design: Problems of Un-Normalized Database; Functional Dependencies, Derivation Rules, Closure Of FD Set, Membership Of A Dependency, Canonical Cover; Decomposition to 1NF, 2NF, 3NF and BCNF Using FD; Lossless Join Decomposition Algorithm; Dependency Preservation. [10]

SQL: Basic Structure, Data Definition, Constraints and Schema Changes; Basic SQL Queries (Selection, Insertion, Deletion, Update); Order by Clause; Complex Queries, Aggregate

Function and Group by Clause; Nested Sub Queries; Correlated Sub Queries; Views (Insert-Able and Updatable), Joined Relations; Set Comparisons (All, Some); etc. [10]

Record Storage and File Organization: Fixed Length and Variable Length Records; Concepts of Disk Blocks; Spanned and Un-Spanned Organization of Records; Primary File Organizations and Access Structures Concepts; Unordered, Sequential, Hashed; Concepts of Primary and Secondary Index; Dense and Sparse Index; Index Sequential Files; Multilevel Indices. [10]

Paper - HCOM3CC08LPR

Database Management System Lab [40L]

Group – A: SQL Queries [20L]

Introduction to SQL Queries, Retrieving Data, Updating Data, Inserting Data, Deleting Data, Sorting and Filtering Data, Advanced Filtering, Summarizing Data, Grouping Data, Subqueries, Joining Tables, Managing Tables, Views.

Group – B: Front End Design [20L]

Any front-end design tool to develop applications as a stand-alone or web based application.

Text/Reference books:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing Company.
3. Jain: Advanced Database Management System CyberTech
4. Date C. J., “Introduction to Database Management”, Vol. I, II, III, Addison Wesley.
5. Ullman JD., “Principles of Database Systems”, Galgottia Publication.

Question Pattern for End Semester Examination

(CC 8)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 4		
CC 9	Paper-HCOM3CC09LTH	Credits : 4 Full Marks : 50+20*
	Paper-HCOM3CC09LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Analyze the performance of algorithms.
2. Choose appropriate algorithm design techniques for solving problems.
3. Understand how the choice of data structures and the algorithm design methods impact the performance of programs.
4. Clear up troubles the usage of set of rules design methods including the grasping approach, divide and overcome, dynamic programming, backtracking.
5. Understand the variations among tractable and intractable problems.
6. Introduce P and NP classes.

Paper -HCOM3CC09LTH

Design and Analysis of Algorithm [60L]

Introduction: Order notations, induction, floor and ceiling functions, pigeon-hole principle, recurrence relations. [5L]

Algorithm design techniques:

Greedy algorithms: Introduction, Huffman code, Dijkstra algorithm, Spanning tree and minimum spanning tree (Kruskal and Prims algorithm), knapsack Problem. [10L]

Divide and conquer algorithms: Introduction, Merge sort, Quick sort, Binary search, Multiplication of Large Integers, Strassen's Matrix Multiplication, Closest-Pair and Convex-Hull Problems. [10L]

Dynamic programming: Introduction, Longest common subsequence, Warshall's and Floyd's Algorithm, knapsack Problem, Chained matrix multiplication. [8L]

Backtracking Algorithms: N queens problem. [2L]

Branch and Bound Technique: Introduction, Assignment Problem, Traveling salesman problem. [5L]

Algorithms on arrays: Selection and median-finding, counting, string matching (Rabin-Karp and Knuth-Morris-Pratt algorithms). [6L]

Maximum flow Network: Introduction, Residual network, Ford-Fulkerson algorithm.[4L]

Randomized algorithms: Monte Carlo and Las Vegas algorithms. [5L]

NP-completeness: Classes P and NP, reduction, NP-completeness, Examples of NP-complete problems. [5L]

Paper -HCOM3CC09LPR

Design and Analysis of Algorithm Lab [40L]

Implementation of Greedy algorithms like Huffman code, Dijkstra algorithm, Minimum spanning tree (Kruskal and Prim's algorithm), Fractional Knapsack Problems.

Implementation of Divide and conquer algorithms like Merge sort, Quick sort, Binary search, Multiplication of Large Integers, Strassen's Matrix Multiplication, Closest-Pair and Convex-Hull Problems.

Implementation of Dynamic programming like Longest common subsequence, Warshall's and Floyd's Algorithm, 0/1 Knapsack Problems.

Implementation of median-finding, string matching (Rabin-Karp and Knuth-Morris-Pratt algorithms).

Text/Reference books:

1. T.H. Cormen et al - Introduction to Algorithms, PHI
2. E. Horowitz, S. Sahani - Fundamentals of Computer Algorithms – Galgotia
3. Bratley et al - Fundamentals of Algorithms, PHI
4. Goodman: Introduction to Design and Analysis of Algorithms, TMH

Question Pattern for End Semester Examination

(CC 9)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 4		
CC 10	Paper - HCOM4CC10NTH	Credits : 5 Full Marks : 65+20*
	Paper - HCOM4CC10NTU	Credits : 1 Full Marks :15
Number of classes required : 75+25		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

Discrete Mathematics

1. Write an argument using logical notation and determine if the argument is or is not valid.
2. Demonstrate the ability to write and evaluate a proof or outline the basic structure of and give examples of each proof technique described.
3. Understand the basic principles of sets and operations in sets.
4. Prove basic set equalities.
5. Apply counting principles to determine probabilities.
6. Demonstrate an understanding of relations and functions and be able to determine their properties.

Theory of Computation

1. Construct finite state machines and the equivalent regular expressions.
2. Prove the equivalence of languages described by finite state machines and regular expressions.
3. Construct pushdown automata and the equivalent context free grammars.
4. Prove the equivalence of languages described by pushdown automata and context free grammars.
5. Construct Turing machines.

Paper -HCOM4CC10NTH

Discrete Mathematics and Theory of Computation [75L]

Group – A

Discrete Mathematics

Induction: First and second (Strong) principle of Induction with examples. [2L]

Sets: Definition, Universal set, subset, Power set, Operations on Set (Union, Intersection, Complement, Cartesian product, Computer representation of Sets. Principle of Inclusion and Exclusion: Proof, some simple problems, Application of PIE (To determine the number of solution in integers of an equation with constraint, to find number of primes of a positive number). [5L]

Relation: Introduction, functions as relation, relation on set, properties of relation, combining relation, n-ary relation, database and relation – an application, Equivalence relation & equivalence classes. [8L]

Counting Theory: Multiplication Rule, Proof and simple problems on Order sample with repetition, Order sample without repetition, unordered sample without repetition, unordered sample with repetition. [7L]

Recurrence Relation: Definition, Modeling with recurrence relation (Tower of Hanoi and similar simple problems), Solving Recurrence relation (Linear Homogeneous & Inhomogeneous with constant coefficient), Divide and conquer algorithm and Recurrence relation (Illustration with binary search, merge sort, quick sort and similar simple problems). [8L]

Generating Function: Definition, Generating function to solve recurrence relation. [5L]

Group – B

Theory of Computation

Introduction: Synchronous & Asynchronous Sequential Circuit, Storage Element, Melay and Moore Machines, Design Technique of State Machine. [3L]

Finite State Model: Synchronous Sequential Machine; State Successor in Sequential Machine; Capabilities and Limitations of FSM; State Equivalence and Machine Minimization. [4L]

Theory of Automata: Definition of Automation; Description of Finite Automation; Transition System; Properties of Transition Function; NDFA, DFA, Conversion from NDFA to DFA, Minimization of States (Equivalence Partition); Conversion From Moore to Mealy machine and Vice Versa. [7L]

Formal Languages: Basic Definition of Grammar and Languages; Examples; Chomsky Classification of Languages; Languages and their Relations; Operation on Languages; Language and Automata. [7L]

Regular Set and Regular Grammar: Regular Expression; Finite Automata and Regular Expression; Regular Grammars and Regular Languages; Pumping Lemma for Regular Sets, Application of Pumping Lemma, Closure Properties of Regular Languages. [10L]

Context-Free Languages: Basics of CFL; Sentential Forms; Derivation Trees; Ambiguity in CFG, Pushdown Automata: Basic Definition; Language Acceptance by PDA; Deterministic PDA. [5L]

Turing Machine: Turing Machine Model; Representation of Turing Machine; Language Acceptability by TM; Design of TM; Nondeterministic TM; Universal TM. [4L]

Paper -HCOM4CC10NTU

Discrete Mathematics and Theory of Computation Tutorial [25L]

Group – A: Tutorial of Discrete Mathematics [10L]

Group – B: Tutorial of Theory of Computation [15L]

Text/Reference books:

1. Liu C. L., “Introduction to combinatorial mathematics”, McGraw Hill
2. Mott J. L., Kandel A. and Baker T. P., “Discrete mathematics for Computer Scientists and Mathematicians”, PH
3. Rosen—Discrete Mathematics, 2nd Edition, TMH
4. Robert J. McElice, Robert B. Ash & Carol Ash, “Introduction to discrete Mathematics”, Tata McGraw Hill.
5. Lipschutz—2000 Solved Problems in Discrete Mathematics, TMH
6. Hopcroft JE. and Ullman JD., “Introduction to Automata Theory, Languages & Computation”, Narosa.
7. K.L.P Mishra & N. Chandrasekharan – “Theory of Computer Science”, PHI
8. Ash & Ash – “Discrete Mathematics”, TMH
9. Kohavi ZVI, “Switching & Finite Automata”, 2nd Edn., Tata McGraw Hill.
10. Linz Peter, “An Introduction to Formal Languages and Automata”, Narosa

Question Pattern for End Semester Examination

(CC 10)

Section-I (Objective type)

- 5 questions each carrying 3 marks have to be answered.
- 4 questions each carrying 3 marks from Group – A have to be given.
- 4 questions each carrying 3 marks from Group – B have to be given.

Section-II

3 questions each carrying 10 marks from Group – A have to be given.

Section-III

5 questions each carrying 10 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 2 from each of the section.

SEMESTER – 5		
CC 11	Paper – HCOM5CC11LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM5CC11LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand the nature of software development and software life cycle process models, agile software development, SCRUM and other agile practices.
2. Explain methods of capturing, specifying, visualizing and analyzing software requirements.
3. Understand concepts and principles of software design and user-centric approach and principles of effective user interfaces.
4. Know basics of testing and understanding concept of software quality assurance and software configuration management process.
5. Understand need of project management and project management life cycle.
6. Understand project scheduling concept and risk management associated to various type of projects.

Paper -HCOM5CC11LTH

Software Engineering [60L]

Introduction: S/W engineering discipline – evolution and impact, Program Vs S/W, Emergence of S/W engineering (Introduction to Control based design, Data structure oriented design, data flow oriented design, object oriented design). [5L]

S/W life cycle: Usefulness, Life cycle Model (Classical water fall model, Iterative waterfall model, prototype model, spiral model, comparisons). [5L]

S/W Requirement Specification: Need, Components and characteristic of SRS, SRS document for Simple problems. [10L]

Software Project: Planning a Software Project. Effort Estimation: (COCOMO and Function Points Model), Project Scheduling, Staffing and Personnel Planning, Software Configuration Management Plan, Quality Assurance Plans, Project Monitoring Plans, Risk Management. [10L]

S/W design: Cohesion & Coupling, S/W design Approach (Function oriented approach [DFD, Structure chart, Transformation of DFD into Structure chart], Object oriented approach [UML diagram, Use case model, class diagram, Interaction diagram]). [10L]

Coding: Coding standards, Code review (Code walk through, Code Inspection, Clean room testing). [5L]

Testing: Unit Testing (Driver and Stub Module, Black box testing [Equivalence class Partitioning and Boundary value analysis], White box testing [Statement coverage, Edge/branch coverage, condition coverage, path coverage], Integration Testing (Big bang, Top down, Bottom up, Mixed approach). [10L]

Maintenance: Characteristics, Types (corrective, adaptive and perfective), S/W maintenance process model (Reverse engineering cycle followed by forward engineering model). [5L]

Paper – HCOM5CC11LPR

Software Engineering Lab [40L]

Mini Project illustrating requirement specification, DFD, ER diagram, Data dictionary, Use Case diagram, Project management, Architecture and Component level design, testing by Software tools. [40L]

Text/Reference books:

1. Pankaj Jalote – An Integrated Approach to Software Engineering, NAROSA.
2. Sommerville, Ian – Software Engineering, Pearson Education
3. R. G. Pressman – Software Engineering, TMH
4. Ghezzi, Software Engineering, PHI

Question Pattern for End Semester Examination

(CC 11)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 5		
CC 12	Paper – HCOM5CC12LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM5CC12LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Independently understand basic computer network technology.
2. Understand and explain Data Communications System and its components.
3. Identify the different types of network topologies and protocols.
4. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
5. Identify the different types of network devices and their functions within a network
6. Understand and building the skills of subnetting and routing mechanisms.
7. Familiar with the basic protocols of computer networks, and how they can be used to assist in network design and implementation

Paper – HCOM5CC12LTH

Data Communication and Computer Network[60L]

Data Communication: Components, Data Representation; Direction of Data Flow; Types of Connections; Categories of Networks: LAN, MAN and WAN; Concepts of Centralized and Distributed Networks; Concepts of Protocols, OSI and TCP/IP Models. [8L]

Signals: Analog and Digital; Periodic and aperiodic Signals; Time Frequency Domains, Composite Signals; Concepts Of Frequency, Bandwidth , Bit Rate, Baud Rate, Channel Capacity; Nyquist & Shannon's Theorem; Attenuation, Distortion and Noise, concept of modulation. [5L]

Multiplexing: FDM (Multiplexing and Demultiplexing Process, Applications), TDM (Time Slot and Frames, Interleaving, Bit Padding, Applications),WDM. [8L]

Transmission Media: Guided Media (Twisted Pair, Co-Axial Cable, Fiber Optical Cable); Unguided Media (Radio Waves, Microwaves, Infrared, Satellite Communication); NIC. [5L]

Switching: Circuit, Packet and Message Switching; Comparisons. [4L]

Data Link Layer: Error Detection and Correction (Parity, Checksum, CRC, Humming Code); MAC Layer; Stop-And-Wait ARQ, Sliding Window Protocol, Selective Repeat ARQ, HDLC Protocol; ALOHA (Pure And Slotted), CMA/CD Protocol, Polling; Token Passing; CDMA; Ethernet, Token Bus, Token Ring, ATM. [10L]

Network Layer: IP Addressing and Classes of IP Address; Subnet; Static and dynamic routing; ARP; IP; ICMP; unicast and multicast routing protocols; [8L]

Transport layer: process-to-process delivery; UDP; TCP; Congestion control protocols. [4L]

Connecting Devices: Repeaters, Hub, Bridges, Switch, Router and Gateway. [3L]

Application Layer: client server model; FTP, HTTP, SMTP, Telnet etc protocols; Servers and Clients; Ports; DNS; Accounts, ISP; Email: Account, Sending, Receiving, Mailing List, IRC, Voice and Video Conferencing, WWW, Browsers. [5L]

Paper – HCOM5CC12LPR
Data Communication and Computer Network lab [40L]

Networking programming using suitable software. [40L]

Experiments using interprocess communication and Network communication, synchronization & IPC using semaphore, pipe & messages.

Programs for FTP and socket based chat.

Implementation of File Transfer – Communication through serial port – Communication through TCP/IP port

Efficient error checking algorithms

Remote Procedure Call, Remote Method Invocation.

Text/Reference books:

1. B. A. Forouzan – “Data Communications and Networking (3rd Ed.) “ – TMH
2. A. S. Tanenbaum – “Computer Networks (4th Ed.)” – Pearson Education/PHI
3. W. Stallings – “Data and Computer Communications (5th Ed.)” – PHI/ Pearson Education
4. Lathi B. P., “Communication Systems”, John Wiley

Question Pattern for End Semester Examination

(CC 12)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 6		
CC 13	Paper – HCOM6CC13LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM6CC13LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
2. Apply these techniques in applications which involve perception, reasoning and learning.
3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
4. Acquire the knowledge of real world Knowledge representation.
5. Analyze and design a real world problem for implementation and understand the dynamic behaviour of a system.
6. Use different machine learning techniques to design AI machine and enveloping applications for real world problem.

Paper – HCOM6CC13LTH

Artificial Intelligence [60L]

Introduction: AI applications, AI techniques, AI Problems. Importance of AI [2L]

State Space search: State Space Graphs, Implicit and explicit graphs, Production Systems, formulating the state-space; *Uninformed search:* breadth first search, depth first search; Uniform cost algorithm; *Informed search:* Generate-and-test, Hill Climbing, Best First Search, Problem Reduction, Constraint Satisfaction , Mean-Ends Analysis ;Analysis and comparison of search algorithms. [10L]

Knowledge Representation: Representations and Mappings, Knowledge representation method- Propositional Logic, Predicate logic, Representing Simple facts in Logic, Representing Instances and Isa relationships, Computable Functions and Predicates, Resolution- Forward and backward chaining. [10L]

Slot and Filler Structures: Semantic Networks, Frames, Conceptual Dependencies, Scripts [8L]

Game Playing: Two agent games, AND/OR graphs, Minimax procedure, and game trees, Alpha – Betapruning procedure, learning evaluation functions. [6L]

Uncertainty: different types of uncertainty - degree of belief and degree of truth, various probability constructs - prior probability, conditional probability, probability axioms, probability distributions, and joint probability distributions, Bayes' rule, other approaches to modeling uncertainty, Dempster-Shafer theory, fuzzy sets/logic. [10L]

Expert Systems: Concepts of Expert system systems; examples of expert systems. [4L]

Logic Programming: Introduction to programming in logic. Declarative and Procedural Meaning, Data Objects, Lists, Operators, Controlled Backtracking. [10L]

Paper – HCOM6CC13LPR Artificial Intelligence Lab [40L]

Problem solving of Artificial Intelligence using Software [40L]

Implementation of breadth first search, depth first search, Representations of Knowledge, Representing Simple facts in Logic, Minimax procedure, game trees, Alpha – Beta pruning procedure, learning, uncertainty,

Introduction to programming in logic: Data Objects, Lists, Operators, Controlled Backtracking.

Text/Reference:

1. Elaine Rich and Kevin Knight: Artificial Intelligence, TMH
2. Dan W. Patterson: Introduction to Artificial Intelligence and Expert Systems, PHI
3. S. Russel and P. Norvig, "Artificial Intelligence, A modern Approach"
4. Computational Intelligence, Eberhart, Elsevier, ISBN 9788131217832
5. Artificial Intelligence: A New Synthesis, Nilsson, Elsevier, ISBN 9788181471901

Question Pattern for End Semester Examination

(CC 13)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 6		
CC 14	Paper – HCOM6CC14LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM6CC14LPR	Credits : 2 Full Marks :30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations.
2. Familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
3. Design, development and testing of modeling, rendering, shading and animation.

Paper – HCOM6CC14LTH

Computer Graphics [60L]

Vector Space: vector, vector space and its properties, vector subspace, linear combination of vectors, linear span, complementary subspace, linear dependence and independence, bases and dimension, coordinates, dimension of a sub space. [10L]

Introduction: VDU; Raster Scan and Random Scan Displays; Video Controller, Display Processor. [5L]

Output Primitives: Points and Lines, Line Drawing Algorithms (Bresenham, DDA); Circle Generating Algorithms (Properties Of Circle, Midpoint Circle Algorithm);Midpoint Ellipse Algorithms, Other Curves, Scan Line Polygon Fill Algorithms; Inside-Outside Test; Scan Line Fill of Curved Boundary Areas; Boundary fill Algorithms, Flood Fill Algorithm; Anti-Aliasing. [10L]

2D Geometric Transformations: Translation, Rotation , Scaling; Matrix Representation, Homogeneous Coordinates; Composite Transformation(General Pivot Point Rotation, General Fixed Point Scaling, General Scaling Directions); Reflection, Shear; Transformations Between Coordinates Systems. [10L]

2D Viewing: The Viewing Pipeline; Viewing Coordinate Reference Frame; Window-To-View port Coordinate Transformation; Point and Line Clipping, Cohen Sutherland Line Clipping Algorithm; Polygon Clipping; Text Clipping.3D concepts: Three-Dimensional Object Representations – Three-Dimensional Geometric and Modeling Transformations – Three-Dimensional Viewing – Color models–Animation. [10L]

Multimedia systems design: An Introduction – Multimedia applications – Multimedia System Architecture – Evolving technologies for Multimedia – Defining objects for Multimedia systems – Multimedia Data interface standards – Multimedia Databases. [5L]

Multimedia file handling: Compression & Decompression – Data & File Format standards – Multimedia I/O technologies - Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval Technologies. [5L]

Hypermedia: Multimedia Authoring & User Interface – Hypermedia messaging -Mobile Messaging – Hypermedia message component – Creating Hypermedia message –Integrated multimedia message standards – Integrated Document management. [5L]

Paper – HCOM6CC14LPR

Computer Graphics Lab [40L]

Implementation of graphics algorithms using Programming Language [40L]

Implementation of Line Drawing Algorithms (Bresenham, DDA); Circle Generating Algorithms (Midpoint Circle Algorithm); Midpoint Ellipse Algorithms, Polygon Fill Algorithms; Boundary fill Algorithms, Flood Fill Algorithm.

Implementation of Translation, Rotation, Scaling; Composite Transformation, Reflection, Shear.

Implementation of Cohen Sutherland Line Clipping Algorithm; Polygon Clipping.

Books and References

1. Hughes, Van Dam, et al. Computer Graphics Principles and Practice 3e, Pearson, 2014
2. P Shirley, Fundamentals of Computer Graphics, 2e, AK Peters, 2005 1 of 3
3. Hearn and Baker Computer Graphics with OpenGL, 3e, Prentice Hall, 2004.
4. Foley and Van Dam, Fundamentals of Interactive Computer Graphics
5. Moller and Haines, Real-time Rendering, AK Peters,

Question Pattern for End Semester Examination

(CC 14)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

Discipline Specific Electives (DSE)

SEMESTER – 5		
DSE 1	Paper – HCOM5DS11LTH	Credits : 4 Full Marks : 50+20*=70
	Paper – HCOM5DS11LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

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

Paper – HCOM5DS11LTH

Digital Image Processing [60L]

Introduction: Introduction of Image Processing with its applications, Components of Image processing system, Image Formation model. Image Sampling and Quantization - Spatial and Gray-Level Resolution; Some Basic Relationships Between Pixels -Neighbors, Adjacency, Connectivity, Regions, and Boundaries, Distance Measures, Image Operations on a Pixel Basis; Linear and Nonlinear Operations. [8L]

Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations - Negatives, Log, Power-Law; Histogram Processing - Histogram Equalization, Histogram Matching (Specification); Enhancement Using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering, Smoothing Spatial Filters; Sharpening Spatial Filters - Use of First and Second Derivatives for Enhancement [10L]

Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain - One-Dimensional Fourier Transform and its Inverse, Two-Dimensional DFT and its Inverse, Filtering in the Frequency Domain, Smoothing and Frequency-Domain Filters; Sharpening and Frequency Domain Filters; The Fast Fourier Transform; [10L]

Color Image Processing: Color Fundamentals, Color Models - RGB, CMY, HSI; Pseudocolor Image Processing – Intensity Slicing, Gray Level to Color Transformations; Basics of Full-Color Image Processing. [4L]

Morphological Image Processing : Some Basic Concepts from Set Theory, Logic Operations Involving Binary Images, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms - Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening; Extensions to Gray-Scale Images.[10L]

Image Segmentation: Detection of Discontinuities - Point Detection, Line Detection, Edge Detection, Edge Linking and Boundary Detection - Local Processing, Global Processing via the Hough Transform, Thresholding - , Basic Global Thresholding, Basic Adaptive Thresholding, Optimal Global and Adaptive Thresholding, Local Thresholding; Region-Based Segmentation - Region Growing, Region Splitting and Merging. [10L]

Image Compression: Introduction, Lossy Compression techniques and Loss less image compression techniques, Huffman coding, Run Length Encoding, JPEG, Block Truncation compression. [8L]

Paper – HCOM5DS11LPR

Digital Image ProcessingLab [40L]

Implementation of Image processing algorithms using Programming Language and software tools. [40]

Image read, write, saving;Loading Video from WebCam/File, Drawing and Writing on Images, Basic Image Operations, Add Images and Threshold, Blending Images, Bitwise Operator, TrackBar, Object Detection using HSV Color space, Basic Thresholding, Histogram, Basic Geometric Transformation, Perspective Transformation, Affine Transformation, Adaptive Thresholding, Image Smoothing, Morphological Transformation, Edge Detection Operators;Find and Draw contours, Template Matching, Hough lines transform, Corner Detection, Image Pyramid (Blending and Reconstruction),Feature Detection (SIFT,SURF,ORB), Feature Matching, Mouse Events, Histogram and Back Projection, Object Tracking with Mean Shift, Object Tracking with Camshift, Optical-flow-with-lucas-kanade-method, Background Subtraction, k-NN Classification, Object Tracking using Homography, Fourier Transform, Wavelets, Face Detection Using Haar cascade classifier.

DrawingLine, Scatter plot, Box plots etc ;Display of one of multiple images, Histograms, Creating subplots, Adding title to axes and plot; figure size, legends; Showing and Saving plots, use of Seaborn.

Bit plane slicing, Image negative, Local Binary Pattern, Histogram equalization, Convolution, Edge detection: : Sobel, Prewitt, Laplacian, Canny, Marr-Hildreth; Otsu and other thresholding, Contours, Morphological operators: erosion, dilation, opening ,closing, Hit and Miss transform, Thinning, Thickening, Watershed algorithm; Frequency domain

transform: DFT,DCT,DWT; Multi resolution analysis (MRA), Huffman coding, Run length encoding, JPEG. Basic steganography: LSB, PVD,DWT etc.

Text and Reference Books:

1. Gonzalez, R. C. and Woods, R. E. [2002/2008], Digital Image Processing, 2nd/3rd ed., Prentice Hall.
2. Sonka, M., Hlavac, V., Boyle, R. [1999]. Image Processing, Analysis and Machine Vision (2nd edition), PWS Publishing, or (3rd edition) Thompson Engineering, 2007
3. Gonzalez, R. C., Woods, R. E., and Eddins, S. L. [2009]. Digital Image Processing Using MATLAB, 2nd ed., Gatesmark Publishing, Knoxville, TN.
4. Anil K. Jain [2001], Fundamentals of digital image processing (2nd Edition), Prentice-Hall, NJ
5. Willian K. Pratt [2001], Digital Image Processing (3rd Edition), , John Wiley & Sons, NY
6. Burger, Willhelm and Burge, Mark J. [2008]. Digital Image Processing: An Algorithmic Introduction Using Java, Springer
7. Digital Image Analysis (With CD-ROM), Kropatsch, Springer, ISBN 978038795066
8. Digital Image Processing, 6e (With CD), Jähne, Springer, ISBN:978-3-540-24035-8 2

Question Pattern for End Semester Examination

(DSE1)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

OR

SEMESTER – 5		
DSE 1	Paper – HCOM5DS12LTH	Credits : 4 Full Marks : 50+20*=70
	Paper – HCOM5DS12LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Understand basics of Cryptography and Network Security.
2. Secure a message over insecure channel by various means.
3. Learn about how to maintain the Confidentiality, Integrity and Availability of a data.
4. Understand various protocols for network security to protect against the threats in the networks.

Paper – HCOM5DS12LTH

Cryptography and Network Security [60L]

Introduction: Introduction to Cryptography, Security Threats, Vulnerability, Types of attacks, Security approaches, Principles of Security, Security services and mechanism, Conventional Encryption Model, CIA model. [5L]

Mathematical Background: Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem. [10L]

Cryptography Concepts: Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size. [10L]

Symmetric Key Algorithm: Introduction, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm, AES (Advanced Encryption Standard). [10L]

Asymmetric Key Algorithm: Introduction, RSA algorithm, Rabin cryptosystem, Elgamal cryptosystem, Elliptic curve cryptosystem, Digital Signature, Basic concepts of Message Digest and Hash Function. [15L]

Internet Security Protocols & User Authentication: Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication. [5]

Network Security: TCP/IP, Firewall, IP Security, VPN. [5]

Paper – HCOM5DS12LPR

Cryptography and Network Security Lab [40L]

Implementation of different Substitution and Transposition Techniques.

Implementation of different modules in DES(Data Encryption Standard), IDEA(International Data Encryption Algorithm), RC5(Rivest Cipher 5) and AES (Advanced Encryption Standard).

Implementation of RSA algorithm, Rabin cryptosystem, Elgamal cryptosystem.

Implementation of different modules in Digital Signature, Message Digest and Hash Function using Programming Language.

Books & References

1. “Cryptography and Network Security”, William Stallings, 2nd Edition, Pearson Education Asia
2. “Network Security private communication in a public world”, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. Cryptography and Network Security - B.A.Forouzan, McGraw-Hill publications.
5. “Network Security Essentials: Applications and Standards” by William Stallings, Pearson
6. “Designing Network Security”, MerikeKaeo, 2nd Edition, Pearson Books

Question Pattern for End Semester Examination

(DSE1)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 5		
DSE 2	Paper – HCOM5DS21LTH	Credits : 4 Full Marks : 50+20*=70
	Paper –HCOM5DS21LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Use R-Studio to write and run R code
2. Write syntactically correct R expressions that involve variables, variable assignment, operators and functions
3. Identify basic R data types (character, double, integer and logical)
4. Identify basic R data structures relevant to modern data analysis (atomic vectors and data frames)
5. Import data into R
6. Apply the basic verbs of data transformation (filtering, selecting, mutating, renaming and arranging)
7. Create statistical graphics with ggplot2
8. Find and read documentation for R packages and functions.

Paper – HCOM5DS21LTH

Programming in R

Basics of R: Variables, Data Types, Vectors, Calling Functions, Function Documentation, Missing Data ,Data frames, Lists, Matrices,Arrays.[5L]

Reading Data into R: Reading CSVs, Excel Data, Reading from Databases, Data from Other Statistical Tools, R Binary Files, Data Included with R, Extract Data from Web Sites [5L]

Statistical Graphics: Base Graphics, ggplot2 [3L]

Writing R Functions:Function Arguments, Return Values, do.call[5L]

Program Control Statements: if and else,switch, if-else, Compound Tests, for Loops, while Loops, Controlling Loops [5L]

Data Reshaping: cbind and rbind, Joins, reshape2 [5L]

Manipulating Strings: paste, sprintf, Extracting Text, Regular Expressions [2L]

Probability Distributions: Normal Distribution, Binomial Distribution, Poisson Distribution, Other Distributions [5L]

Basic Statistics: Summary Statistics, Correlation and Covariance, T-Tests, ANOVA [5L]

Linear Models: Simple Linear Regression, Multiple Regression, Generalized Linear Models, Logistic Regression, Poisson Regression, Other Generalized Linear Models, Survival Analysis [5L]

Nonlinear Models: Nonlinear Least Squares, Splines, Generalized Additive Models, Decision Trees, Random Forests [5L]

Time Series and Autocorrelation: Autoregressive Moving Average, VAR, GARCH [5L]

Clustering: K-means, PAM, 3 Hierarchical Clustering [5L]

Paper – HCOM5DS21LPR

R programming Lab

Problem solving using R programming [40]

Basic programs over Arithmetic Operators, Relational Operators, Relational Operators, Relational Operators, Miscellaneous Operators, Implementing if, if...else, switch and different loops(repeat, while, for). Program using built in functions and user defined functions.

Different string manipulation programs, Vector and list manipulation programs, Different programs of Matrices, arrays, factors, Handling of Data frames, packages, data reshaping, Files and Charts

Implementation of mean, median & mode; linear regression, multiple regression, logistic regression; normal distribution, binomial distribution and poisson regression analysis of covariance.

Books and References:

1. R for Everyone Advanced Analytics and Graphics Jared P. Lander
2. William N. Venables and David M. Smith, An Introduction to R. 2nd Edition. Network Theory Limited. 2009
3. Norman Matloff, The Art of R Programming - A Tour of Statistical Software Design, No Starch Press. 2011

Question Pattern for End Semester Examination

(DSE2)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

OR

SEMESTER – 5		
DSE 2	Paper – HCOM5DS22LTH	Credits : 4 Full Marks : 50+20*=70
	Paper – HCOM5DS22LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Acquire programming skills in core Python.
2. Acquire Object Oriented Skills in Python.
3. Develop the skill of designing Graphical user Interfaces in Python
4. Develop the ability to write database applications in Python.

Paper – HCOM5DS21LTH

Python programming [60L]

Understanding Python: Variables, basic operators, Understanding python blocks. [2]

Data types: Declaring and using Numeric data types: int, float, complex, Using string data type and string operations, Defining list and list slicing, Use of Tuple data type. [5]

Flow Control: Conditional blocks using if, else and elif, Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block. [5]

Function, Module and Packages: Organizing python codes using functions, Organizing python projects into modules, Importing own module as well as external modules, Understanding Packages, Powerful Lambda function in python, Programming using functions, modules and external packages. [8]

String, List and dictionary: Building blocks of python programs, Understanding string in build methods, List manipulation using in build methods, Dictionary manipulation, Programming using string, list and dictionary in build functions. [5]

File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations. [5]

Object oriented Programming: Concept of class, object and instances, Constructor class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using OOps support. [10]

Regular Expression: Powerful pattern matching and searching, Power of pattern searching using regex in python, Real time parsing of networking or system data using regex, Password, email, url validation using regular expression, Pattern finding programs using regular expression. [5]

Exception Handling: Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling. [5]

Database Interaction: SQL Database connection using python, Creating and searching tables, Reading and storing config information on database, Programming using database connections. [5]

Multithreading: Understanding threads, Forking threads, Synchronizing the threads, Programming using multithreading. [5]

Paper – HCOM5DS21LPR

Python programming [40L]

Problem Solving using Python Programming. [40]

Boos & References

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
3. Core Python Programming (2nd Edition) by Wesley J. Chun

Question Pattern for End Semester Examination

(DSE2)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 6		
DSE 3	Paper – HCOM6DS31LTH	Credits : 4 Full Marks : 50+20*=70
	Paper – HCOM6DS31LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
2. Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
3. Understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations.
4. Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.
5. Reveal different applications of these models to solve engineering and other problems.

Paper – HCOM5DS31LTH
Soft computing [60L]

Introduction:What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. [5L]

Neural Networks:What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons , Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.[15L]

Fuzzy Systems:Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.[15L]

Genetic Algorithm:History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.GA based Back propagation Networks:GA based Weight Determination, K - factor determination in Columns.[15L]

Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems. [5L]

Fuzzy Back propagation Networks: LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks. [5L]

Paper – HCOM6DS31LPR

Soft computing Lab [40L]

Problem solving using soft computing techniques.

Books & references

1. S.Rajasekaran, G. A. Vijayalakshami, PHI.
2. Genetic Algorithms: Search and Optimization, E. Goldberg.
3. Neuro-Fuzzy Systems, Chin Teng Lin, C. S. George Lee, PHI.
4. Build_Neural_Network_With_MS_Excel_sample by Joe choong

Question Pattern for End Semester Examination

(DSE3)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

OR

SEMESTER – 6		
DSE 3	Paper – HCOM6DS32LTH	Credits : 4 Full Marks : 50+20*=70
	Paper – HCOM5DS32LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Know basic notions and definitions in data analysis, machine learning.
2. Know standard methods of data analysis and information retrieval
3. Formulate the problem of knowledge extraction as combinations of data filtration, analysis and exploration methods.
4. Translate a real-world problem into mathematical terms.
5. Possess main definitions of subject field.
6. Possess main software and development tools of data scientist.
7. Learn to develop complex analytical reasoning.

Paper – HCOM5DS32LTH

Data Science [60L]

Probability and Statistics: Combinatorial probability, Independence of events, Conditional probabilities. [2L]

Random variables, densities, Expectation, Variance and moments, Standard univariate distributions, Independence of random variables. [6L]

Introduction to Statistics with examples of its use, Draw random samples, Descriptive statistics, Graphical statistics: Histogram, scatter diagram, Pie diagram, estimates sample moments, sample mean, sample standard deviation. [8L]

Sampling distributions based on normal populations - t, chi-square and F distribution. [4L]

Testing of Hypothesis: one sample and two sample tests based on t, chi-square and F distributions. - Error probabilities, statistical power of test, p-values, log-likelihood ratio test. [8L]

Machine Learning:

Unsupervised Learning, Basic Concept , K-means Clustering, K-Nearest Neighbours. [5L]

Supervised Learning: Linear Regression, Polynomial Regression, Logistic Regression, Naïve Bayes, Bayes Theorem. Decision Trees, Random Forests, Perceptrons, Gradient Descent, Multi-Layered Perceptrons (MLP), Support Vector Machines. [10L]

Train-test, F1 Score, Accuracy, Confusion Matrix, Precision, Principal Component Analysis, Dimensionality Reduction. [5L]

Data Visualization: Basic principles; ideas and tools for data visualization. [2L]

Introduction Deep learning: Basic concept of Deep Learning, Difference from Machine Learning. Convolutional Neural Networks: Architectures, convolution layers. Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. [10L]

Paper – HCOM6DS32LPR

Data Science Lab [40L]

Problem solving of using different data sets and algorithms.

Books & References

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from the Frontline. O'Reilly. 2014.
2. 1. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press. 2014. (free online)
3. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. ISBN 0262018020. 2013.
4. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Elements of Statistical Learning, Second Edition. ISBN 0387952845. 2009. (free online)
5. Avrim Blum, John Hopcroft and Ravindran Kannan. Foundations of Data Science.

Question Pattern for End Semester Examination

(DSE3)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

SEMESTER – 6		
DSE 4	Paper – HCOM5DS41LTH	Credits : 4 Full Marks : 50+20*=70
	Paper –HCOM5DS41LPR	Credits : 2 Full Marks : 30
Number of classes required : 60+40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Describe clearly a problem, identify its parts and analyze the individual functions.
2. Perform feasibility study for solving an optimization problem
3. Perform mathematical translation of the verbal formulation of an optimization problem.
4. Design algorithms, the repetitive use of which will lead reliably to finding an approximate solution
5. Evaluate and measure the performance of an algorithm.
6. Discover study and solve optimization problems.
7. Understand optimization techniques using algorithms.
8. Investigate, study, develop, organize and promote innovative solutions for various applications.

Paper – HCOM6DS41LTH

Optimization Techniques [60L]

Introduction: Origin and development of operation research, Nature and characteristic features, models in O.R., application of O.R. [4L]

Linear Programming Problem: Introduction, mathematical formulation of the problem and graphical solution method. [5L]

Simplex Method: Introduction, computational procedure, artificial variable, problem of degeneracy, application of simplex method. [8L]

Duality: Concept, formulation of primal – dual, duality and simplex method, Dual Simplex method. [5L]

Transportation Problem: Introduction, mathematical formulation, finding initial basic feasible solution, optimality, degeneracy, unbalanced transportation problem. [6L]

Assignment Problem: Introduction, mathematical formulation and solution. [5L]

Inventory Model: Introduction to inventory control, deterministic inventory model, EOQ model with quantity discount. [8L]

Queuing Models: Concepts relating to queuing systems, basic elements of queuing model, role of Poisson & exponential distribution, concepts of birth and death process. [6L]

Network Scheduling: Introduction, Critical Path Method (CPM), PERT calculation. [8L]

Information Theory: Introduction, Entropy and its properties, joint and conditional entropies, Mutual information, Encoding. [5L]

Paper – HCOM6DS41LPR

Optimization Techniques lab [40L]

Implementation of Graphical solution of Linear Programming problems and Simplex Method. [16L]

Implementation of Transportation Problem, Assignment Problem. [12L]

Implementation of network models. [12L]

Boosk & References:

1. J K Sharma, Operations Research Theory and Applications, MacMillan India Ltd.
2. N D Vohra, Quantitative Techniques in management, Tata McGraw Hill.
3. Handy A Taha, Operations Research – An Introduction, Prentice Hall of India, New Delhi.
4. Wagner H M, Principles of Operations Research: With Applications to Management Decisions, Prentice-Hall of India, New Delhi.
5. Hillier F S and Lieberman G J, Operations Research, Holden Day Inc., San Francisco.
6. Payne T A, Quantitative Techniques for Management: A Practical Approach, Reston Publishing Co. Inc., Virginia.
7. Wilkes F M, Baum P and Smith G D, Management Science: An introduction, John Wiley and Sons, Santa Barbara.

Question Pattern for End Semester Examination

(DSE4)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered.
- 8 questions each carrying 2 marks have to be given.

Section-II

8 questions each carrying 8 marks have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II.

OR

SEMESTER – 6		
DSE 4	Paper – HCOM6DS42J	Credits : 6 Full Marks : 80+20*=100
Number of classes required : --		
*15 Marks are reserved for Internal Assessment (one Presentation is to be taken in Mid Semester) & 5 marks for Attendance.		

Outcomes : This course will enable students to:

1. Identify a suitable problem to be solved computationally and reflectively analyze proposed solutions to the identified computing problem.
2. Design and develop solutions to the problem and analyze results.
3. Prepare a thesis and defend the thesis on the work done.
4. Augment the knowledge base in the chosen area of computing, adhering to ethical practices at every stage.

Paper-HCOM6DS42J

PROJECT WORK

The students are expected to demonstrate the core competency in the development of enhancements to the knowledge base in the area of interest in computing. The secondary competencies include the management of time bound projects involving research, analysis of problem complexities, design and development of effective solutions and communication of the project's progress, adhering to ethical practices at every stage. This stage of the project evaluates the state of maturity of these competencies. The students are expected to present two reports at intermediate stages, as well as prepare and defend a thesis on their research work. The students should take a new research-oriented project in consultation with the assigned project supervisor.

Question Pattern for End Semester Examination

(DSE4)

A) Literature Review and Problem Formulation: 30 marks

B) Report Writing: 30 marks

C) Presentation: 10 marks

D) Viva-Voce: 10 marks

SEMESTER – 1 / SEMESTER – 2		
GE 1	Paper – HCOM1GE01LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM1GE01LPR	Credits : 2 Full Marks : 30
Number of classes required : 60 + 40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Introduces the concepts of computer basics & programming.
2. Understand the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
3. Write, compile and debug programs and use different techniques for problem solving in computer.
4. Acquire programming skills in core Python.
5. Acquire Object Oriented Skills in Python.
6. Develop the skill of designing Graphical user Interfaces in Python.
7. Develop the ability to write database applications in Python.

Paper – HCOM1GE01LTH

Problem Solving Using Computer [60L]

Group – A

(Computer Fundamentals)

Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers. [2L]

Basic Computer Organization: Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices. [2L]

Introduction to Programming Languages: Machine Language, Assembly Language, High Level Language. [1L]

Software: Systems and Application s/w, System Software: Classifications- Operating Systems (OS); Translators – Compilers and Interpreters, Pre-processors, Assemblers, Loaders, Linkers. [8L]

Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation, Function oriented and Object Oriented Paradigm: Basic characteristics, Definition, Brief comparison. [6L]

Techniques of Problem Solving: Flowcharting, decision table, algorithms, Pseudo codes. [6L]

Group – B

(Programming using Python)

Overview of Programming: Structure of a Python Program, Elements of Python [3L]

Introduction to Python: Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator). [8L]

Creating Python Programs: Input and Output Statements, Control statements (Looping-while Loop, for Loop, Loop Control, Conditional Statement- if...else, Difference between break, continue and pass). [8L]

Structures: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments. [8L]

Introduction to Advanced Python: Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming. [8L]

Paper – HCOM1GE01LPR

Problem Solving Using Computer Lab [40L]

Group – A: Word processing, Spreadsheet, Presentation S/W tools. [10L]

Introduction to MS Word and users utilities, Exploring Templates & Formation of documents, Table Handling, Mail merge and Print process
Spread sheet, Work book Window, Formatting cells/Worksheet, Working with formula, function and charts, Filtering data and printing a presentation
Introduction to M.S Power point, Creating Templates-Fonts and color editing, Adding Multimedia effects, Consolidating using Ms power point.

Group – B: Programming using Python. [30L]

Problem solving using python programming

Text/ Reference Books:

1. P. K. Sinha & Priti Sinha, “Computer Fundamentals”, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. John V. Guttag, “Introduction to Computation and Programming Using Python”, MIT Press
4. Allen Downey, “Think Python: How to Think Like a Computer Scientist”, O’Reilly
5. Mark Lutz, “Learning Python, 5th Edition”, O’Reilly
6. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Question Pattern for End Semester Examination

(GE 1)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 4 questions each carrying 2 marks from Group – A have to be given.
- 4 questions each carrying 2 marks from Group – B have to be given.

Section-II

2 questions each carrying 8 marks from Group – A have to be given.

Section-III

6 questions each carrying 8 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 1 from each of the section.

SEMESTER – 3 / SEMESTER – 4		
GE 2	Paper – HCOM1GE02LTH	Credits : 4 Full Marks : 50+20*
	Paper – HCOM1GE02LPR	Credits : 2 Full Marks : 30
Number of classes required : 60 + 40		
*15 Marks are reserved for Internal Assessment (to be taken from the mid-semester exam) & 5 marks for Attendance		

Outcomes : This course will enable students to:

1. Describe the fundamental elements of relational database management systems.
2. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
3. Design ER-models to represent simple database application scenarios.
4. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
5. Improve the database design by normalization.
6. Understand basic computer network technology.
7. Understand and explain Data Communications System and its components.
8. Identify the different types of network topologies and protocols.
9. Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
10. Identify the different types of network devices and their functions within a network
11. Understand and building the skills of subnetting and routing mechanisms.

Paper – HCOM1GE02LTH

DBMS and Computer Network [60L]

Group – A

(DBMS)

Introduction: Drawbacks of Legacy System; Advantages of DBMS; Layered Architecture of Database, Data Independence; Data Models; Schemas and Instances; Database Languages. [6L]

ER Model: Entity, Attributes and Relationship; Structural Constraints; Keys; ER Diagram of Some Example Database; Weak Entity Set; Symbolic Conventions; Specialization and Generalization. [6L]

Relational Model: Basic Concepts of Relational Model; Relational Algebra. [6L]

SQL: DDL, DML, Queries. [7L]

Integrity Constraints: Domain Constraints, Entity and Referential Integrity. [2L]

Relational Database Design: Problems of Un-Normalized Database; Functional Dependencies, Derivation Rules, Decomposition to 1NF, 2NF, 3NF, BCNF Using FD; Lossless Join Decomposition Algorithm; Dependency preservation. [8L]

Group – B

(Computer Network)

Introduction: Components, Uses, Application, LAN, MAN, WAN; Topology. [4L]

Network Software: Layered, Interface, Protocol, Connection Less and Connection Oriented Service, ISO-OSI and TCP/IP model, Functionalities of each layer. [4L]

Data and Signals: Periodic & Non-periodic signals, Bandwidth, Bit Rate, Baud Rate, Bit Length, and Composite Signal. [2L]

Transmission Media: Transmission Spectrum, Guided (Twisted Pair, Coaxial, Optical Fiber) and Unguided (Radio Wave, Microwave, Infrared, and Satellite Communication: Geostationary, Low Orbit and VSAT). [5L]

Multiplexing: FDM, TDM, WDM. [2L]

Internet: Bridges, Routers, Modem, DNS, URL, ISDN, WWW, Browser, IP Address, E-mail: Architecture and services. [8L]

Paper – HCOM1GE02LPR

DBMS and Web Design Lab [40L]

Group – A: SQL. [20L]

Introduction to SQL Queries, Retrieving Data, Updating Data, Inserting Data, Deleting Data, Sorting and Filtering Data, Advanced Filtering, Summarizing Data, Grouping Data, Subqueries, Joining Tables, Managing Tables, Views.

Group – B: Web Design using S/W. [20L]

HTML Programming: Head, Body, Colors, Attributes, Lists, Relative Links, Images, Tables, Form

CSS: Creating Style Sheet, Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements, objects and functions, Working with Lists and Table.

PHP and MySQL: Basic Syntax, Defining variable and constant, Php Data type, Operator and Expression, Decisions and loop, Function, Array, Handling Html Form with Php, Working with file and Directories, Session and Cookies, Database Connectivity with MySql.

Text/ Reference Books:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishnan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. Data Communication and Networking, B.A. Forouzan, TMH.
5. Data and Computer Communication, W. Stallings, Pearson Education.
6. Computer Network, Tanenbaum, Pearson Education.

Question Pattern for End Semester Examination

(GE2)

Section-I (Objective type)

- 5 questions each carrying 2 marks have to be answered
- 4 questions each carrying 2 marks from Group – A have to be given.
- 4 questions each carrying 2 marks from Group – B have to be given.

Section-II

4 questions each carrying 8 marks from Group – A have to be given.

Section-III

4 questions each carrying 8 marks from Group – B have to be given.

Section-I is compulsory. Answer any 5 questions from Section-II and Section-III taking at least 2 from each of the section.