MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
Syllabus of B. Sc. In Computer Science
(Effective for 2021-2022 Admission Session)
Choice Based Credit System
140 Credit (3-Year UG)

CBCS – MAKAUT UG Degree: B. Sc. - Computer Science (Hons) 140 Credit

Subject Type	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI
CC	C1, C2	C3, C4	C5, C6,C7	C8,C9,C10	C11,C12	C13,C14
DSE					DSE1, DSE2	DSE3, DSE4
GE	GE1	GE2	GE3	GE4	Capstone Project Evaluation	
AECC	AECC 1	AECC 2				
SEC			SEC 1	SEC 2		
	4 (20)	4 (20)	5 (26)	5(26)	4 (24)	4 (24)

Teaching-Learning-Assessment as per Bloom's Taxonomy fitment

Levels	L1: REMEMBER	L2: UNDERSTAND	L3: APPLY	L4: ANALYZE	L5: EVALUATE	L6: CREATE
Courses – T&L and Assessment Levels						
SEM 1	▓	▓	▓			
SEM 2	▓	▓	▓			
SEM 3	▓	▓	▓	▓		
SEM 4	▓	▓	▓	▓		
SEM 5	▓	▓	▓	▓	▓	
SEM 6		▓	▓	▓	▓	▓
MOOCs						
BEGINNER	▓	▓				
BASIC	▓	▓	▓			
INTERMEDIATE	▓	▓	▓	▓		
ADVANCED		▓	▓	▓	▓	

CC: **Core Course**
AECC: **Ability Enhancement Compulsory Courses**
GE: **Generic Elective Course**
DSE: **Discipline Specific Elective Course**
SEC: **Skill Enhancement Course**

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Curriculum Structure

1st Semester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC1-T	CS 101	Programming Fundamental – using C Language	4	4			yes			
	CC1-P	CS 191	Programming using C	2		2		yes			
	CC2-T	CS 102	Digital Electronics	4	4				yes		
	CC2-P	CS 192	Digital Electronics Lab	2		2		yes			
GE	GE1		Any one from Basket – 1 to 5	6					yes		
AECC	AECC 1	CS(HU-101)	Soft Skills (English Communication)	2	2				yes		
Semester Credits				**20**							

2nd Semester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC3-T	CS 201	Data Structures	4	4				yes		
	CC3-P	CS 291	Data Structures Lab	2		2		yes			
	CC4-T	CS 202	Computer Organization	4	4			yes			
	CC4-P	CS 292	Computer Organization Lab.	2		2		yes			
GE	GE2		Any one from Basket – 1 to 5	6					yes		
AECC	AECC 2	CS(HU-201)	Quantitative Aptitude and Logical Reasoning	2	2				yes		
Semester Credits				**20**							

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3rdSemester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC5-T	CS 301	Object Oriented Programming using JAVA	4	4			yes			
	CC5-P	CS 391	OOP using Java	2		2		yes			
	CC6-T	CS 302	Design and Analysis of Algorithm	4	4					yes	
	CC6-P	CS 392	Design and Analysis of Algorithm Lab	2		2		yes			
	CC7-T	CS 303	Database Management Systems	4	4					yes	
	CC7-P	CS 393	Database Management Systems Laboratory	2		2		yes			
GE	GE3		Any one from Basket – 1 to 5	6					yes		
SEC	SEC-1	CS 304	A. Web Design (HTML, CSS, Javascript)	2	2					Yes	
			B. Python								
Semester Credits				**26**							

*SEC: Any one (A or B)

4th Semester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC8-T	CS 401	Operating Systems	4	4			yes			
	CC8-P	CS 491	Operating Systems Lab.	2		2		yes			
	CC9-T	CS 402	Data Communication and Computer Networks	4	4					yes	
	CC9-P	CS 492	Data Communication and Computer Networks Lab	2		2		yes			
	CC10-T	CS 403	Software Engineering	4	4				Yes		
	CC10-P	CS 493	Software Project Management Lab	2		2		Yes			
DSE	Not Required in SEM-IV as per guide lines										
GE	GE4		Any one from Basket – 1 to 5	6					yes		
SEC	SEC-2	CS 404	A. Android Development	2	2				yes		
			B. Web Server Programming						yes		
Semester Credits				**26**							

*SEC: Any one (A or B)

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5th Semester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC11-T	CS 501	Artificial Intelligence	4	4				yes		
	CC11-P	CS 591	Artificial Intelligence Lab	2		2		yes			
	CC12-T	CS 502	Multimedia and Its Applications	4	4					yes	
	CC12-P	CS 592	Multimedia Laboratory	2		2		yes			
DSE	DSE-1	A	DSE 503A	Cloud Computing	4	4					Yes	
			DSE 593A	Cloud Computing Lab.	2		2				Yes	
		B	DSE 503B	Cryptography and Information Security	4	4					Yes	
			DSE 593B	Cryptography and Information Security Lab.	2		2		Yes			
		C	DSE 503C	Advanced Java Programming	4	4					Yes	
			DSE 593C	Advanced Java Programming Lab.	2		2				Yes	
	DSE-2	DSE 581		Minor Project on Industrial Training	6							
Semester Credits				24							

- DSE-1 (A or B or C)

6th Semester

Subject Type		Course Code	Course Name	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
					L	P	T	Offline	Online	Blended	
CC	CC13-T	CS 601	Machine Learning	4	4				Yes		
	CC13-P	CS 691	Machine Learning Lab.	2		2		Yes			
	CC14-T	CS 602	Web Technology	4	4					yes	
	CC14-P	CS 692	Web Technology Lab	2		2		Yes			
DSE	DSE-3	DSE 603A	E-Commerce	4	4						
		DSE 693A	E-Commerce Lab	2		2					
		DSE 603B	Sensor Network and IoT	4	4					Yes	
		DSE 693B	Sensor Network and IoT Lab.	2		2		Yes			
	DSE-4	CS 681	Major Project	6						Yes	
Semester Credits				24							

- DSE-3 (A or B)

Paper Name: Programming Fundamentals – using C Language/ Programming using C Lab
Code: CS 101 / CS 191
Contact: 4L+ 2P
Credits: 4 + 2
Allotted Hrs: 60

Course Objectives:
1. To analyze a new problem
2. Learn to design algorithm for the problem
3. Logical implementation of problems
4. Implement steps of algorithms through programming in C
5. Learn basic input and output method through high level programming
6. Conditional statement management
7. Loop concepts
8. Learn function management
9. Input and output through files

Module 1: Introduction to Principles of programming
Introduction to Programming , Programing Domain : Scientific Application , Business Applications,   Artificial Intelligence, Systems Programming , Web Software Categories of Programming Languages: Machine Level Languages, Assembly Level Languages , High Level Languages Programming Design Methodologies : Top Down and Bottom UP Program Development Cycle with case study, Program Execution and Translation Process ,Problem solving using Algorithms and Flowcharts, Performance Analysis and Measurements: Time and Space complexity

Module 2: Introduction to C Programming:
Features of C and its Basic Structure, Simple C programs, Constants, Integer Constants, Real Constants, Character Constants, String Constants, Backslash Character Constants, Concept of an Integer and Variable, Rules for naming Variables and assigning values to variables

Module 3: Operators and Expressions:
Arithmetic Operators, Unary Operators, Relational and Logical Operators, The Conditional Operator, Library Functions, Bitwise Operators, The Increment and Decrement Operators, The Size of Operator, Precedence of operators.

Module 4: Data Types and Input/Output Operators:
Floating-point Numbers, Converting Integers to Floating-point and vice-versa, Mixed-mode Expressions, The type cast Operator, The type char, Keywords, Character Input and Output, Formatted input and output, The gets() and puts() functions, Interactive Programming.

Module 5 : Control Statements and Decision Making:
The goto statement, The if statement, The if-else statement, Nesting of if statements, The conditional expression, The switch statement, The while loop, The do…while loop, The for loop, The nesting of for loops, The break statement and continue statement.

Module 6 : Arrays and Strings:
One Dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings

Module 7: Pointers – I:
Basics of Pointers, Pointers and One-dimensional Arrays, Pointer Arithmetic, Pointer Subtraction and Comparison, Similarities between Pointers and One-dimensional Arrays.

Module 8: Pointers – II:
Null pointers, Pointers and Strings, Pointers and two-dimensional arrays, Arrays of Pointers

Module 9: Structures and Unions:
Basics of Structures, Arrays of Structures, Pointers to Structures, Self-referential Structures, Unions

Module 10: Functions:

Function Philosophy, Function Basics, Function Prototypes, and Passing Parameters: Passing Parameter by value and Passing Parameter by reference, passing string to function, Passing array to function, Structures and Functions Recursion

Module 11: Storage Classes:
Storage Classes and Visibility, Automatic or local variables, Global variables, Static variables, External variables

Module 12: The Preprocessor:
File Inclusion, Macro Definition and Substitution, Macros with Arguments, Nesting of Macros, Conditional Compilation

Module 13: Dynamic Memory Allocation and Linked List:
Dynamic Memory Allocation, Allocating Memory with malloc, Allocating Memory with calloc, Freeing Memory, Reallocating Memory Blocks, Pointer Safety, The Concept of linked list, Inserting a node by using Recursive Programs, Sorting and Reversing a Linked List, Deleting the Specified Node in a Singly Linked List.

Module 14: File Management:
Defining and Opening a file, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Random Access to Files, Command Line Arguments.

Reference Books:
1. Programming with C, Gottfried, TMH
2. Let us C, Yashavant P. Kanetkar, BBP Publications, Delhi
3. Programming in ANSI C by E Balagurusamy, TMH
4. Problem Solving & Programming in C by R.S. Salaria, Khanna Publishing House

Paper Name: **Digital Electronics / Digital Electronics Lab**
Code: CS 102 / CS 192
Contact: 4L+2P
Credits: 4 + 2
Allotted Hrs: 60

Unit	Content	Hrs/Unit
	BINARY SYSTEMS: Digital Systems, Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes, Binary Storage and Registers, Binary logic.	5 hours
	BOOLEAN ALGEBRA AND LOGIC GATES : Basic Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and properties of Boolean algebra, Boolean functions canonical and standard forms, other logic operations, Digital logic gages, integrated circuits.	5
	GATE – LEVEL MINIMIZATION: The map method, Four-variable map, Five-Variable map, product of sums simplification Don't-care conditions, NAND and NOR implementation other Two-level implementnations, Exclusive – Or function, Hardward Description language (HDL).	5
	COMBINATIONAL LOGIC : Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.	10
	SYNCHRONOUS SEQUENTIAL LOGIC: Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, HDL for sequential circuits, State Reduction and Assignment, Design Procedure	
	Registers, shift Registers, Ripple counters synchronous counters, other counters, HDL for Registers and counters.	5
	Introduction, Random-Access Memory, Memory Decoding, Error Detection and correction Read-only memory, Programmable logic Array programmable Array logic, Sequential Programmable Devices.	5
	ASYNCHRONOUS SEQUENTIAL LOGIC : Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Reduction of state and Flow Tables, Race-Free state Assignment Hazards, Design Example.	5

Laboratory
 Combinational Circuits:
1. Implementation of different functions using Basic and Logic gates, SOP, POS
2. Study and prove De-Morgan's Theorem.
3. Universal function using NAND and NOR gates
4. Implementation of half and Full adder (3-bit) using basic logic gates and Universal logic gates (NAND & NOR).
5. Implementation of half and Full Subtractor (3-bit) using basic logic gates and Universal logic gates (NAND & NOR).
6. 1 Digit BCD adder using 7483 and other logic gates.
7. Design 4 to 1 multiplexer using logic/Universal gates and implement full adder/full subtractor.
8. Using 74153 and 74151 to implement full adder/ full subtractor and other functions.
9. Cascading of Multiplexers.
10. Design 2 to 4 decoder using basic / universal logic gates.
11. Study 74138 and 74139 and implement full adder / full subtractor and other functions.
12. Implementation of 1 bit Comparator using decoders.
13. Cascading of Decoders.
14. Design a parity generator and checker using basic gates.
15. Construct and study comparators using 7485.
16. Construct Comparator (2-bit) using logic gates
17. Design a seven segment display unit using Common anode/Common cathode and 7447 / 7448.
18. Study Priority Encoder Chip 74147/74148.

Text/Reference Books
1. DIGITAL DESIGN – Third Edition , M.Morris Mano, Pearson Education/P
2. Digital Circuits, Vol - I & II, D. Ray Chaudhuri, Platinum Publishers.
3. Digital Systems - Principle & Applications, Tocci & Widmer, EEE

Paper Name: **Soft skill (English Communication)**
Code: CS (HU 101)
Contact: 2L
Credits: 2
Allotted Hrs: 30

Objective:
1. To enable the learner to communicate effectively and appropriately in real life situation.
2. To use English effectively for study purpose across the curriculum.
3. To use R, W, L, S and integrate the use of four language skills, Reading, writing, listening and speaking.
4. To revise and reinforce structures already learnt.

Module 1: Grammar 5 hrs
Correction of sentence, Vocabulary/ word formation, Single word for a group of words, Fill in the blank, transformation of sentences, Structure of sentences – Active/ Passive Voice – Direct/ Indirect Narration

Module 2: Essay Writing 5 hrs
Descriptive – Comparative – Argumentative – Thesis statement - Structure of opening/ concluding paragraphs – Body of the essay

Module 3: Reading Comprehension 4 hrs
Global – Contextual – Inferential – Select passages from recommended text

Module 4: Business Correspondence 4 hrs
Letter Writing – Formal, Drafting, Biodata - Resume'- Curriculum Vitae

Module 5: Report Writing 4 hrs
Structure, Types of report – Practice Writing

Module 6: Communication skills 4 hrs
Public Speaking skills, Features of effective speech, verbal-nonverbal

Module 7: Group discussion 4 hrs
Group discussion – principle – practice

Text Books:
1. Mark MaCormack; Communication
2. John Metchell; How to write reports
3. S. R. Inthira & V. Saraswathi; Enrich your English – a) Communication skills b) Academic skills; CIEFL & OUP

Reference Books:
1. R. C. Sharma and K. Mohan; Business Correspondence and Report Writing; Tata McGraw Hill
2. L. Gartside; Model Business Letters; Pitman

Paper Name: Data Structures and Data Structures Lab
Code: CS 201 / CS 291
Contact: 4L+2P
Credits: 4 + 2
Allotted Hrs: 60

Course Objectives:
CO1. To understand and identify the different types of data.
CO2. To understand the pointers, structures and self-referential structure.
CO3. To learn the implementation of different types of memory allocation.
CO4. To learn File Management and the application.
CO5. To understand the implementation of Data Structure using Array.
CO6. To gain the proper knowledge of sorting, searching of data and their complexity analysis.
CO7. To understand the implementation of Linked list.
CO8. To understand the concept of tree and their different implementations.
CO9. To understand the graphs and their operations.
CO10.To learn the hash functions and their different functionalities.

Course Outcomes:
1 Ability to understand the basic structures of data
2 Ability to understand and use of the pointer, Self-referential structure
3 Ability to understand static and dynamic memory allocation in memory using malloc(),calloc(),realloc(), free().
4 Ability to understand File Management and the application using differentfunctions.
5 Ability to use and implement Data Structure using Array
6 Ability to do different types of Searching and Sorting
7. Ability to implement different types of Linked List
8. Ability to grasp the concept of different types of tree and theirimplementations.
9. Ability to understand of different types of graphs and their operations.
10. Ability to understand of Hashing and their different functionalities.

Module I: Concepts of Abstract data type(4L)
Concept of abstract data types, Structure, union, enum, pointer to structure, Self referential structure, Pointer to pointer 2.

Module II: Dynamic Memory Allocation (4L)
Difference between static and dynamic memory allocation, Using functions such as malloc(), calloc(), realloc(), free().

Module III: File Management (4L) Application of functions such as fopen(), fclose(), getc(), putc(), fprintf(), fscanf(), getw(), putw(), command line argument

Module IV: Data Structure using Array(4L)
Stack, queue, circular queue, priority queue, dequeue and their operations and applications.

Module V: Searching and Sorting(6L)
Searching: linear search, Binary search, their comparison, sorting: insertion sort, Selection sort. Quick sort, Bubble sort Heap sort, Comparison of sorting methods, Analysis of algorithm, complexity using big 'O' notation

Module VI: Linked List(4L)
Linear link lists, doubly linked lists, stack using linked list, queue using linked list, circular linked list and their operationsand applications.

Module VII: Trees (5L)
Binary trees, binary search trees, representations and operations, thread representations, sequential representations, B tree, B+ tree,

Module VIII: Graphs (5L)
Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal: Depth first search and Breadth first search. Spanning Trees, minimum spanning Tree, Shortest path algorithm

Module IX: Hashing (4L)

Definition, Hashing functions, Load factor and collision, open addressing (linear probing) and chaining method to avoid collision

Reference Books:
1. Mastering Algorithms with C,Loudon,SPD/O'REILLY
2. Data Structure Using C & C++, Tannenbaum, PHI
3. C and Data Structure, Radhaganesan, Scitech
4. Data Structures, R.S. Salaria, Khanna Publishing House
5. Data Structures in C, Ajay Agarwal, CyberTech
6. Data Structures Using C, Radhakrishnan&Shrinivasan, ISTE/EXCEL BOOKS
7. Expert Data Structures with C, R.B. Patel, Khanna Publishing House

Computer Organization
Code: CS 202
Contacts: 4L

Objective:
Course Objectives:
1. To understand the concept of Data Representation, Computer arithmetic,
2. To understand the concept of Register transfer and micro-operations
3. To understand the different types of Basic Computer organization and design, Micro programmed control
4. To understand the concept of Central processing unit
5. To understand the Pipeline and vector processing
6. To understand output organization, Memory organization

Unit	Content	Hrs/Unit
1	Data Representation:	4
	1. Number Systems – decimal, binary, octal, hexadecimal, alphanumeric representation, 2. Complements – 1's complement, 2' complement, 9's complement, 10' complement, (r-1)'s complement, r's complement, 3. Fixed point representation – Integer representation, arithmetic addition, arithmetic subtraction, overflow, decimal fixed-point representation, 4. Floating point representation, 5. IEEE 754 floating point representation	
2	Computer arithmetic:	5
	1. Addition algorithm of sign magnitude numbers, 2. Subtraction algorithm of sign magnitude numbers, 3. Addition algorithm of signed 2's complement data, 4. Subtraction algorithm of signed 2's complement data, 5. Multiplication algorithm, Booth's algorithm, 6. Division algorithm	
3	Register transfer and micro-operations:	5
	1. Register transfer language, 2. Register transfer, 3. Bus system for registers, 4. Memory transfers – memory read, memory write, 5. Micro operations – register transfer micro-operations, arithmetic micro-operations, logic micro operations, shift micro operations, 6. Binary adder, binary adder subtractor, binary incrementer, arithmetic circuit for arithmetic micro operations, 7. One stage logic circuit, 8. Selective set, Selective complement, Selective clear, Mask, Insert, Clear	
4	Basic Computer organization and design:	4
	1. Instruction codes, 2. Direct address, Indirect address & Effective address, 3. List of basic computer registers, 4. Computer instructions: memory reference, register reference & input – output instructions, 5. Block diagram & brief idea of control unit of basic computer, 6. Instruction cycle	

| 5 | Micro programmed control: | 2 |

1.Control memory, 2. Address sequencing, 3. Micro program examples

| 6. | Central processing unit: | 5 |

1. General register organization, 2. Stack organization, Register stack, Memory stack, Stack operations –push & pop, 3. Evaluation of arithmetic expression using stack, 4. Instruction format, 5. Types of CPU organization (single accumulator, general register & stack organization) & example of their instructions, 6. Three, two, one & zero address instruction, 7. Definition and example of data transfer, data manipulation & program control instructions

| 7. | Pipeline and vector processing: | 3 |

1.Parallel processing, 2. Flynn's classification, 3. Pipelining, Example of pipeline, space time diagram, speedup, 4. Basic idea of arithmetic pipeline, example of floating-point addition/ subtraction using pipeline

| 8. | Input – output organization: | 6 |

1. Peripheral devices, 2. Input – output interface, 3. Isolated I/O, Memory mapped I/O, 4. Asynchronous data transfer: strobe & handshaking, 5. Programmed I/O, 6. Interrupt initiated I/O, 7. Basic idea of DMA & DMAC 8. Input – output processor

| 9. | Memory organization: | 6 |

1. Memory hierarchy, 2. Main memory definition, types of main memory, types of RAM, ROM, difference between SRAM & DRAM, 3. Cache memory, Cache memory mapping – Direct, Associative, Set Associative, 4. CAM, hardware organization of CAM, 5. Virtual memory, mapping using pages, page fault, mapping using segments, TLB, 6. Auxiliary memory, diagrammatic representation of magnetic disk & hard disk drive, 7. Definitions of seek time, rotational delay, access time, transfer time, latency

Text book and Reference books:
Text Book:
1. Computer System Architecture, M. Morris Mano, PEARSON
2. Computer Organization & Architecture – Designing For Performance, William Stallings,PEARSON
Reference Book
1. Computer Architecture &Organisation, J.P. Hayes, TATA MCGRAW HILL
2. Computer Organization and Architecture, T. K. Ghosh, TATA MCGRAW-HILL
3. Computer Architecture, BehroozParhami, OXFORD UNIVERSITY PRESSReferences: Boris Beizer, Software Testing Techniques, Dreamtech, 2009

Course Outcomes:
On completion of the course students will be able to
1) Understand data representation systems and different algorithm of computer arithmetic.
2) Realize memory transfer process and different micro-operations.
3) Demonstrate basic computer organization and micro program control.
4) Discuss about the Central processing unit and pipeline processing.
5) Understand Peripheral devices interfacing and Memory organization.

Computer Organization Lab.
Code: CS 292
Contacts: 2P

Objective:
Course Objectives:
1. To understand the behavior of Logic Gates, Adders, Multiplier and Divider
2. To understand the behavior of Memory, ALU and Processor.
3. To understand the concept of pipelining and interfacing

List of Laboratory Experiments:
1. HDL introduction.
2. Basic digital logic base programming with HDL
3. 8-bit Addition, Multiplication, Division
4. 8-bit Register design
5. Memory unit design (24x8 (16 byte)) and perform memory operations.
6. 8-bit simple ALU design
7. 8-bit simple CPU design
8. Interfacing of CPU and Memory.
9. Any experiment specially designed by the college

Course Outcomes:
On completion of the course, students will be able to
1) Analyze the behaviour of logic gates.
2) Design combinational circuits for basic components of computer system and applications.
3) Design Arithmetic logic units and different types of memory blocks.
4) Analyze the operational behaviour of Control processing unit and interfacing

Text & Reference books:
1. Circuit Design and Simulation with VHDL, By Volnei A. Pedroni · 2010, MIT Press.
2. VHDL Programming by Example By Douglas L. Perry · 2002, McGraw-Hill Education

Paper Name: **Quantitative Aptitude and Logical Reasoning**
Code: CS (HU 201)
Contact: 2L
Credits: 2
Allotted Hrs: 30

Course Outcome

On successful completion of the course the students will be able to:
- Understand the basic concepts of quantitative ability
- Understand the basic concepts of logical reasoning Skills
- Acquire satisfactory competency in use of reasoning
- Solve campus placements aptitude papers covering Quantitative Ability, Logical Reasoning Ability

Module - I

1. Quantitative Ability (Basic Mathematics)   **6 Hrs**
1.1. Number Systems
1.2. LCM and HCF
1.3. Decimal Fractions
1.4. Simplification
1.5. Square Roots and Cube Roots
1.6. Average
1.7. Problems on Ages
1.8. Surds & Indices
1.9. Percentages
1.10 Problems on Numbers

Module – II

2.   Quantitative Ability (Applied & Engineering Mathematics)   **6 Hrs**
2.1. Logarithm
2.2. Permutation and Combinations
2.3   Probability
2.4   Profit and Loss
2.5   Simple and Compound Interest
2.6. Time, Speed and Distance
2.7. Time & Work
2.8. Ratio and Proportion
2.9. Area
2.10 Mixtures and Allegation

Module – III   **8 Hrs**

3. Data Interpretation
3.1. Data Interpretation
3.2. Tables
3.3. Column Graphs
3.4. Bar Graphs
3.5. Line Charts
3.6. Pie Chart
3.7. Venn Diagrams

Module – IV

4. Logical Reasoning (Deductive Reasoning)   **10 Hrs**

4.1. Analogy

4.2. Blood Relation

4.3 Directional Sense

4.4. Number and Letter Series

4.5. Coding – Decoding

4.6. Calendars

4.7. Clocks

4.8. Venn Diagrams

4.9. Seating Arrangement

4.10. Syllogism

4.11. Mathematical Operations

Reference books:

1. A Modern Approach to Verbal & Non Verbal Reasoning by R S Agarwal

2. Analytical and Logical reasoning by Sijwali B S

3. Quantitative aptitude for Competitive examination by R S Agarwal

4. Analytical and Logical reasoning for CAT and other management entrance test by Sijwali B S

5. Quantitative Aptitude by Competitive Examinations by Abhijit Guha

Paper Name: Object Oriented Programming Using JAVA/ OOP using JAVA Laboratory
Code: CS 301 / CS 391
Contact: 4L+2P
Credits: 4 + 2

Course Objectives:
CO1. To understand the concept of Class, Data, Polymorphism, Inheritance, Dynamic Binding
CO2. To understand the concept of Overview of JAVA
CO3. To understand the different types of natural Data type, Variable and Constants token in JAVA
CO4. To understand the concept of Control Statement of JAVA
CO5. To understand the Iteration Statement, Arrays and Vector, Classes and
Objects, Inheritance.
CO6. To understand Packages, Interfaces, Exception Handling, Multithreaded Programming, Applets, Abstract Window
Toolkit

Course Outcomes:
1 Students will able to understand **OOPs Concept**
2 Students will able to understand Java features,JVM,Comparison between Java and C++, Idea of any Java
3 Studentswill abletounderstand DataTypes,variablesandconstants Tokens in Java (Identifiers, Literals, Keywords, Operator)
4 Students will able to understand control statement -Simple if statement, if…else statement, Nesting of if-else statement, switch statement
5 Students will able to understand for loop, while loop, Do-While loop
6 Students will able to understand 1D and 2D array, vectorconcepts
7 Students will able to understand Creating main() in aseparate class, Methods with parameters, Methods witha return type, Method overloading, Passing
8 Students will able to understand Basic concepts, typesofinheritance, use of super keyword, overriding methods.
9 Students will able to understandUser defined package, importpackage, Class path, How to create
10 Students will able to understand User defined package,import package, Class path, How to create interface, use andextend interface
11 Students will able to understand Byte Streams, InputStream, Output Stream Character Streams (Reader,Writer), How Files and Streams Work, Working with Reader classes (InputStreamReader, BufferedReader)
12 Students will able to understand Overview, Thread Lifecycle, Advantages of multithreading over multi-taskingThread Creation and simple programs, Synchronizedthreads, Synchronized Methods
13 Students will able to understand Applet vs. Application,Applet class, Advantages of Applet, Applet LifecycleMy First Applet, Applet tag, How to run applet
14 Students will able to understand GUI Components,Interface and Classes of AWT Package, Labels, Buttons,Check Boxes, Radio button, Text Area, Text Field,Scrollbar, Panels, Layout managers, Simple event drivenprogramming with Text Field and Button

Module I: Oops Concept (4L)
Object, Class, Data abstraction, Data encapsulation, Inheritance, Polymorphism, Dynamic inding

Module II: An overview of Java (2L).
Java features, JVM, Comparison between Java and C++, Idea of any Java Development Kit (JDK), learn to runjava program through command line and with any JDK

Module III: Data Concept (2L)
Data Types, variables and constants Tokens in Java (Identifiers, Literals, Keywords, Operator)

Module IV: Control Statements (2L)
Simple if statement, if…else statement, Nesting of if-else statement, switch statement

Module V: Iteration Statement (2L)
For loop, While loop, Do-While loop

Module VI: Arrays and Vector (2L)
1D and 2D array, vector concepts

Module VII: Classes and Objects (3L)

Creating main() in a separate class, Methods with parameters, Methods with a return type, Method overloading, PassingObjects as Parameters, Passing Values to methods and Constructor, Abstract classes

Module VIII: Inheritance (2L)
Basic concepts, types of inheritance, use of super keyword, overriding methods.

Module X: Packages, Interfaces (3L)
User defined package, import package, Class path, How to create interface, use and extend interface

Module XI: Exception Handling (2L)
Overview, What is Exceptions and handling exception?, Compile time errors Run time errors, try…catch, Using Multiple catch Blocks, finally Block, Throwing an Exception, Using the throw and throws Statement.

Module XII: Stream (3L)
Byte Streams, Input Stream, Output Stream Character Streams (Reader, Writer), How Files and Streams Work, Working with Reader classes (InputStreamReader, BufferedReader)

Module XIII: Multithreaded Programming (3L)
Overview, Thread Life cycle, Advantages of multithreading over multi-tasking Thread Creation and simple programs, Synchronized threads, Synchronized Methods

Module XIV: Applets (4L)
Applet vs. Application, Applet class, Advantages of Applet, Applet Lifecycle My First Applet, Applet tag, How to run applet

Module XV: Abstract Window Toolkit (4L)
GUI Components, Interface and Classes of AWT Package, Labels, Buttons, Check Boxes, Radio button, Text Area, Text Field, Scrollbar, Panels, Layout managers, Simple event driven programming with Text Field and Button

Reference Books:
1. Let Us JAVA 2 Edition, YashavantKanetkar BPB Publications
2. Programming with JAVA 5th Edition, E Balagurusamy, TMH
3. Core JAVA, TanweerAlam, Khanna Publishing House

Paper Name: **Design and Analysis of Algorithm/ Design Analysis of Algorithm Lab**
Code: CS 302/ CS 392
Contact: 4L+ 2P
Credits: 4 + 2
Allotted Hrs: 60

Objective:

1 To introduce students to a powerful programming language
2 To understand the basic structure of a program
3 To gain knowledge of various programming errors.
4 To enable the students to make flowchart and design an algorithm for a given problem.
5 To enable the students to develop logics and programs

Module I: [8L]
Time and space complexity. Asymptotic notations. Recurrence for divide and conquer and its solution, the substitution method and recursion-tree method for solving recurrences. The master method: proof and solving recurrence problems, merge sort, heap sort, quick sort and their complexity analysis.

Module II: [8L]
Advanced data structure: adt and data structure, linear vs non-linear data structure. Tree: tree as an adt, definition and terminologies, threaded binary tree, bst. Avl tree, balance multi way search tree: 2-3 tree, red-black tree, b tree, b+ tree, tries, spatial data representation using k-d tree, quad tree [8L]

Module III: [12L]
Graph: definition, computer representation of graphs, graph traversals: bfs & dfs, spanning tree. Graph colouring-chromatic number, algorithm for transitive closure, topological sort, and critical paths, Dynamic programming : matrix-chain multiplication, all pair shortest paths, single source shortest path, travelling salesman problem, 0-1 knapsack problem, lcs problem. Greedy method: knapsack problem, job sequencing with deadlines, activity – selection, huffman codes, minimum spanning tree by prim's and kruskal's algorithms. Disjoint set manipulation: set manipulation algorithm like union-find, union by rank, path compression. Topological sorting Backtracking: use in solving problem, 4 queen and 8-queen problem, subset sum problem Branch and bound: basic method, applications: the 15-puzzle problem.

Module IV: [8L]
 Computational geometry: robust geometric primitives, convex hull, triangulation, voronoi diagrams, nearest neighbor search, range search, point location, intersection detection, bin packing, medial-axis transform, polygon partitioning, simplifying polygons, shape similarity, motion planning, maintaining line arrangements, min kowski sum. [8L]

Module V: [8L]
Set and string problems: set cover, set packing, string matching, approximate string matching, text compression, cryptography, finite state machine minimization, longest common substring/subsequence, shortest common superstring. Advanced areas: notion of np-completeness: p class, np-hard class, np-complete class, circuit satisfiability problem. approximation algorithms, randomized algorithms, multithreaded algorithms, parallel algorithms. amortized analysis and its applications, [8L]

Design and Analysis of Algorithm Lab

Practical: Based on Theory

List of Practical:
 As compatible with theory curriculum.

BOOKS FOR STUDY:

Reference Books:

1. A.Aho, J.Hopcroft and J.Ullman "The Design And Analysis Of Algorithms", Pe.

2. T Cormen, C Leiserson and R Rivest "Introduction To Algorithms", Phi.
3. Fundamentals Of Algorithms- G.Brassard,P.Bratlay, Phi.
4. Horowitz Ellis, Sahani Sartaz, R. Sanguthevar " Fundamentals Of Computer Algorithms".

Paper Name: **Database Management Systems/ DBMS Lab**
Code: CS 303 / CS 393
Contact: 4L+ 2P
Credits: 4 + 2
Allotted Hrs: 60

Course Objectives:
1. Concepts of file management and relational data management
2. Understanding data management
3. Understanding attributes of real world entities
4. Define real world entities into schema
5. Relational definition among various schemas of a system/ problem
6. Integrity management among data

Module 1: Introducing to Data and Data Management (4L)
Introduction, Data and Information, Database and Data Base Management System, Components of Database System, Basics of Database Management System, File-based System and Database Management System, Advantages of using Database over File based system, Data Dictionary and Metadata, ANSI-SPARC Architecture, Database Users, Role of Database Administrator (DBA) and Data Administrator(DA), Database Environment, Need for a Database, Characteristics, or Features, or Advantages of Database Systems, Limitations of Database

Module 2: Data Models and Architecture of DBMS (6L)
Schemas and Instances, DBMS Architecture, Three Level Architecture of Database(ANSI SPARC architecture), Evolution of Data Models, Hierarchical Data Model, Network Data Model, Relational Data Model Object-oriented Data Model, Object-relational Data Model, Data and Structural Independence, Database Languages DDL, DML, DCL, TCL, Database Access, Database Structure

Module 3: Data Modeling using ER Modeling (6L)
Basic Terminology related to ER Model, Relational Model – Introduction, Advantages and Disadvantages, Identifying Entities, and Relationships, Types of Relationships, Relationship Participation, Notations in ER Model, Strong and Weak entity sets Composite entity, Managing Many-to-many, Relationship, Example of E-R Model, Types of Integrity Constraints, Extended E-R Model, Translating the ER Model into Relational Model, Object Modeling, Subclass and Super class, Specialization, Generalization and Aggregation, Class Diagram

Module 4: Relational Model and Relational Database Management System (6L)
Introduction, RDBMS Terminology, Various Types of Keys, Relational Integrity Rules Entity integrity Rule, referential integrity rule, Functional Dependency, Armstrong Axioms, Relational Set Operators, Retrieval Operators, CODD's Twelve Rules of Relational Database, ACID properties, Views and their purpose, Database Life Cycle, Data Dictionary, Relational Algebra and relational calculus, exercise on Relational calculus and relational algebra, Comparisons of relational algebra and calculus Tuple Relational Calculus, Domain Relational Calculus, Introduction to SQL

Module 5: Normalization (6L)
Introduction, Need for Normalization, Types of Dependencies - Functional Partial functional and Transitive, Multi-valued Dependency, Join Dependency, Lossless and Lossy Decompositions, Normalizing Tables, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Examples on Normalization, Determining, Candidate Key and further decomposition, Closure of a set and FD's and MVD's, Armstrong's AXIOMS, Minimal or canonical cover of FD's, Lossless Decomposition

Module 6: Managing Data Using Structured Query Language (SQL) (6L)
Introduction, Features of SQL, Database Languages - data definition and Data manipulation languages, Data Definition Commands, Data Manipulation Commands, (SELECT Statement and different Clauses, SQL Functions - Aggregate, Date and Time Functions, String Functions, Conversion Functions, Mathematical Functions, Special Operators), Types of Constraints, Different types of Join and Set Operators, Group by and having clauses, Sub-query, Views, Advances SQL, Roll-up, Commit and Save point, Create user grant revoke, Introduction to PL/SQL – conditional statements, loop, variable binding, Embedded SQL

Module 7: Transaction and Query Processing (5L)
Transaction Processing States, ACID Properties of Transaction, read and write operations in transaction, concurrency problems and reasons for recovery, System log, Steps of Query Processing, Query Optimization

Module 8: Indexing and Hashing (1L)
Introduction, Overview, Primary Secondary Multi level, Dense and Space Index

Reference Books:

1. Korth, Silberschatz, Sudarshan – Database System Concepts; Tata Mc. Graw Hill
2. Ramez Elmasri, Shamkant B Navathe - Fundamentals of Database Systems; Pearson
3. C.J. Date - An Introduction to Database Systems, 8e, Pearson Education
4. Rajiv Chopra - Database Management Systems ; S CHAND
5. Atul Kahate - Introduction to Database Management Systems , Pearson
6. P.S. Deshpande - SQL and PL/SQL for Oracle 10g Black Book; Wiley Dreamtech
7. Database Management Systems, R.P. Mahapatra, Khanna

Paper Name: Web Design (HTML, CSS, Java Script)
Code: CS 304 A
Contacts: 2L

Web Design Principles
1.1 Basic principles involved in developing a web site 1.2 Planning process 1.3 Five Golden rules of web designing 1.4 Designing navigation bar 1.5 Page design 1.6 Home Page Layout 1.7 Design Concept.

Basics in Web Design
2.1 Brief History of Internet 2.2 What is World Wide Web 2.3 Why create a web site 2.4 Web Standards 2.5 Audience requirement.

Introduction to HTML
3.1 What is HTML 3.2 HTML Documents 3.3 Basic structure of an HTML document 3.4 Creating an HTML document 3.5 Mark up Tags 3.6 Heading-Paragraphs 3.7 Line Breaks 3.8 HTML Tags.

Elements of HTML
4.1 Introduction to elements of HTML 4.2 Working with Text 4.3 Working with Lists, Tables and Frames 4.4 Working with Hyperlinks, Images and Multimedia 4.5 Working with Forms and controls.

Introduction to Cascading Style Sheets
5.1 Concept of CSS 5.2 Creating Style Sheet 5.3 CSS Properties 5.4 CSS Styling(Background, Text Format, Controlling Fonts) 5.5 Working with block elements and objects 5.6 Working with Lists and Tables 5.7 CSS Id and Class 5.8 Box Model(Introduction, Border properties, Padding Properties, Margin properties) 5.9 CSS Advanced(Grouping, Dimension, Display, Positioning, Floating, Align,Pseudo class, Navigation Bar, Image Sprites, Attribute sector) 5.10 CSS Color 5.11 Creating page Layout and Site Designs.

Introduction to Web Publishing or Hosting

6.1 Creating the Web Site 6.2 Saving the site 6.3 Working on the web site 6.4 Creating web site structure 6.5 Creating Titles for web pages 6.6 Themes-Publishing web sites.

Books
1. HTML 5 in simple steps, Kogent Learning Solutions Inc., Dreamtech Press
2. Web Technologies: HTML, Javascript, Kogent Learning, Wiley India

Paper Name: **Python**
Code: CS 304B
Contact: 2L

Introduction
History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator
Conditional Statements
If, If- else, Nested if-else, Looping, For, While, Nested loops Control Statements Break, Continue, Pass String Manipulation Accessing Strings, Basic Operations, String slices, Function and Methods

Lists
Introduction, Accessing list, Operations, Working with lists, Function and Methods

Tuple

Introduction, Accessing tuples, Operations, Working, Functions and Methods

Dictionaries
Introduction, Accessing values in dictionaries, Working with dictionaries,

Function
Properties Functions Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

Modules
Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions

Exception Handling
Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

Books

1. Let Us Python - 3rd Edition: Python Is Future, Embrace It Fast by Aditya Kanetkar Yashavant Kanetkar
2. Python: The Complete Reference by Martin C. Brown
3. Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming by Eric Matthes
4. Automate the Boring Stuff with Python, 2nd Edition: Practical Programming for Total Beginners by Al Sweigart
5. Python Programming: Using Problem Solving Approach by Reema Thareja

Paper Name: Operating Systems/ Operating Systems Lab
Code: CS 401/ CS 491
Contacts: 4L + 2P

Objective:
1 To learn the mechanisms of OS to handle processes and threads and their communication
2 To learn the mechanisms involved in memory management in contemporary OS
3 To gain knowledge on distributed operating system concepts that includes architecture,
Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4 To know the components and management aspects of concurrency management

Unit	Content	Hrs/Unit
1	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3
2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching	10
	Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,	
	Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	
3	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	5
4	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	5
5	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).	8
6	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms	6
	File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.	
	Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
4. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
5. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
6. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:
On completion of the course students will be able to
1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.
4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Laboratory Experiments:

1 . Managing Unix/Linux Operating System [4P]:
Basic Unix/Linux command (creating file, display file, copying file, renaming fie, deleting file, moving file, creating directories, removing directories, change directories, file permission etc.), basic filter command, vi editor, advanced filter command

2. Shell Scripting [6p]
Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).

3. User Administration [2p]
Password file management, Shadow file, Groups and the group file, user-management commands, setting passwords, creating & removing users & user groups

4. Process [4P]
Starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process

5. Inter-process communication [4P]
Pipes (use functions pipe, popen, pclose), named pipes (FIFOs, accessing FIFO), message passing & shared memory (IPC version V)

6. POSIX Threads [4P]
Programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

Course Outcome:
After successful completion of this course, students will be able to:
1. Do the use of basic UNIX/ Linux Commands from the command line, and create Shell Scripts to customize their UNIX/ Linux Working Environment.
2. Organize and manage users within UNIX/ Linux.
3. Organize and manage their files within the UNIX/ Linux
4. Implement the Inter-process communication using FIFOs, Message Queues, Semaphores, and Shared Memory.

Syllabus of B. Sc. In Computer Science
(Effective for 2021-2022 Admission Session)
Choice Based Credit System
140 Credit (3-Year UG)

Paper Name: Data Communication and Computer Networks/ Data Communication and Computer Networks Lab
Code: CS 402/ CS 492
Contacts: 4L + 2P

Objective:
1. Build an understanding of the fundamental concepts of computer networking.
2. Familiarize the student with the basic taxonomy and terminology of the computer networking area.
3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
4. Allow the student to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Unit	Content	Hrs/Unit
1	**Introduction:**	6
	Data communications Components, data representation, direction of data flow (simplex, half duplex, full duplex).	
	Network Hardware: Physical structure (type of connection, topology), categories of network (LAN, MAN, WAN).	
	Internet: Brief history, Protocols and standards, **Reference models:** OSI reference model, properties of all the layers, TCP/IP reference model, their comparative study.	
2	**Physical Layer**	10
	Data & Signals: Analog & Digital Data and Signals, periodic and non-periodic signals, composite signals, bandwidth, bit rate, transmission of digital signals.	
	Transmission Impairments: Attenuation, Distortion and Noise.	
	Data Rate Limits: Noiseless Channel: Nyquist Data rate, Noisy Channel: Shannon's Capacity, calculation of data rate using both limits.	
	Digital Transmission	
	Digital to Digital Conversion: Line coding, schemes (RZ, NRZ, Manchester, Differential Manchester), block coding.	
	Analog to Digital Conversion: Sampling, Nyquist rate of sampling, Pulse code modulation (PCM), Delta Modulation (DM), Adaptive Delta Modulation (ADM), parallel and serial transmission.	
	Analog Transmission	
	Digital to Analog: Amplitude shift keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Amplitude Modulation (QAM).	
	Analog to Analog Conversion:	
	Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation.	
	Bandwidth Utilization Techniques	
	Multiplexing: FDM, Synchronous & Statistical TDM, WDM.	
	Transmission Medium	
	Guided media: Twisted pair, Coaxial, Fiber optics.	

Unguided: Radio waves, microwaves, Infrared, Antenna, Communication satellites

Switching and Telephone network

Circuit switched networks, Packet Switched networks, Virtual Circuit switch.

Major components of telephone network, Dial up modem, DSL and ADSL modems, Cable

TV for data transfer

3	**Data link Layer:**	8

Types of errors, framing (character and bit stuffing), error detection & correction methods, Linear and cyclic codes, checksum.

Protocols: Stop & wait ARQ, Go-Back- N ARQ, Selective repeat ARQ, HDLC.

Physical addressing: MAC address and its format.

Medium Access sub layer

Point to Point Protocol, Token Ring: Reservation, Polling. **Multiple access protocols:** Pure & Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

Channelization: FDMA, TDMA, CDMA.

Wired and Wireless LAN: Standards, fast Ethernet, Protocol 802.11, Bluetooth.

4	**Network layer**	6

Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway,

Addressing: IP addressing, Subnetting, **Routing techniques:** static vs. dynamic routing ,

Protocols: RARP, ARP, IP, ICMP

5	**Transport layer**	5

Process to Process delivery: UDP, TCP

6	**Application Layer**	5

Introduction to DNS, Remote logging, FTP, Electronic mail, WWW & HTTP

Text book and Reference books:
1. Data Communication and Networking, B.A. Forouzan, Tata McGraw Hill.
2. Computer Networks, A.S. Tanenbaum, Pearson Education .
3. Data and Computer Communication, W. Stallings, Pearson Education.
4. Data & Computer Communication,Black, PHI.
5. Internet & World Wide Web: How to program,Harvey M. Deitel& Paul J. Deitel.

Course Outcomes:
On completion of the course students will be able 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. Familiarity with the basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Laboratory Experiments:

1. **Computer Networks: Practical**

Familiarization with Networking cables (CAT5, CAT6, UTP), Connectors (RJ-45, Tconnector),
Hubs, Switches, LAN installation & configuration (peer-to-peer) process.

2. **Web Design: Practical**

Web page design by HTML

3. **Handling HTML form**

HTML
Capturing Form Data, GET and POST form methods, Dealing with multi value fields
Redirecting a form after submission.

4. **Socket Programming**

Course Outcome:
After successful completion of this course, students will be able to:
1. Understand fundamental underlying principles of computer networking.
2. Analyze performance of various communication protocols.
3. Practice packet /file transmission between nodes and Networks.

Paper Name: Software Engineering/ Software Project Management Lab
Code: CS 403/ CS 493
Contacts: 4L + 2P

Objective:
1) Be successful professionals in the field with solid fundamental knowledge of software engineering
2) Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
3) Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Unit	Content	Hrs/Unit
1	**Introduction**	6
	Defining system, open and closed system, modeling of system through computer hardware, communication systems, external agents and software systems; Importance of Engineering Methodology towards computerization of a system.	
2	**Software Life Cycle**	10
	Classical and Iterative Waterfall Model; Spiral Model; Prototype Model; Evolutionary model and its importance towards application for different system representations, Comparative Studies.	
3	**Software Requirement and Specification Analysis**	10
	Requirements Principles and its analysis principles; Specification Principles and its representations	
	Software Design Analysis – Different level of DFD Design, Physical and Logical DFD, Use and Conversions between them, Decision Tables and Trees, Structured analysis, Coupling and Cohesion of different modules	
	Software Cost Estimation Modeling –COCOMO.	

| 4 | **Software Testing** | 8 |

Software Verification and Validation; Testing objectives, Testing Principles, Testability; Error and Faults; Unit Testing, White Box and Blank Box Testing, Test Case Design: Test Vector, Test Stub.

| 5 | **Software Quality Assurances** | 6 |

Concepts of Quality, Quality Control, Quality Assurance, IEEE Standard for Statistical

Software Quality Assurances (SSQA) criterions.

Text book and Reference books:
1. Software Engineering: A Practitioner's Approach by R.S. Pressman, McGraw-Hill.
2. An Integrated Approach to Software Engineering by P. Jalote, Narosa Publishing House.
3. Software Engineering by K.K. Aggarwal and Y. Singh, New Age International
Publishers.
4. Software Engineering by I. Sommerville, Addison Wesle.
5. Software Engineering for Students by D. Bell, Addison-Wesley.
6. Fundamentals of Software Engineering by R. Mall, PHI.

Course Outcomes:
On completion of the course students will be able to
1) Apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2) To work in one or more significant application domains
3) Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4) Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
5) Demonstrate an ability to use the techniques and tools necessary for engineering practice

Laboratory Experiments:

1. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system.
2. To perform the function oriented diagram: Data Flow Diagram (DFD) and Structured chart.
3. To perform the user's view analysis for the suggested system: Use case diagram.
4. To draw the structural view diagram for the system: Class diagram, object diagram.
5. To draw the behavioral view diagram: State-chart diagram, Activity diagram
6. To perform the behavioral view diagram for the suggested system: Sequence diagram, Collaboration diagram
7. To perform the implementation view diagram: Component diagram for the system.
 8. To perform the environmental view diagram: Deployment diagram for the system.
9. To perform various testing using the testing tool unit testing, integration testing for a sample code of the suggested system.
10. Perform estimation of effort using COCOMO and FP Estimation for chosen system.
11. To prepare time line chart/Gantt Chart/PERT Chart for selected software project.

Course Outcome:
After successful completion of this course, students will be able to:
1) Build a fully functional, interactive, layered, distributed, database-backed software system from the ground-up as part of a small, agile, development team in a laboratory setting
2) Become acquainted with historical and modern software methodologies
3) Understand the phases of software projects and practice the activities of each phase
4) Practice clean coding
5) Take part in project management
6) Become adept at such skills as distributed version control, unit testing, integration testing, build management, and deployment

Paper Name: Android Development
Code: CS404 A
Contacts: 2L

Course Outcomes: Upon completion of the subject, students will be able to:
- Understanding of the fundamentals of Android operating systems
- Install and configure android application development tools.
- Design and develop user Interfaces for the Android platform.
- Ability to develop software for Android Mobile
- Ability to deploy and debug programs running on mobile devices

Unit	Content
	Introduction Brief History of mobile technologies, Different mobile technologies, Introduction to Android, Get to know the required tools, Creating your first Android application, Anatomy of android Application. Understanding Activities, linking Activities using intents, fragments, calling Built-in Applications using Intents, Displaying Notifications.
	User Interface and Designing with views Understanding the components of a screen, adapting to display orientation, managing changes to screen orientation, Utilizing the Action Bar, Creating the user Interface programmatically, Listening for UI Notifications. Using Basic Views, Using Picker views, Using List views to display lists, Understanding specialized fragments. Designing User interface Designing by declaration, creating the opening screen, using alternate resources, implementing an about box, applying a theme, adding a menu, adding settings, debugging with log messages, debugging with debugger.
	Displaying with views, Data persistence Using Image Views to display pictures, using menus with views, some additional views. Saving and loading user preferences , persisting Data Files
	Storing local Data & Putting SQL to work Reading/writing local data, Accessing the Internal File system, Accessing SD card. Introducing SQLite, In and Out of SQLite, Hello Database, Data Binding, using content provider, implementing content provider.
	Preparing and Publishing & Content Providers Preparing app for publishing, Deploying APK files, uploading in Market. Creating and using Databases. Sharing Data in Android, using content provider, creating your own content providers, using content providers.
	Messaging , Location based services and Networking SMS Messaging, Sending E-mail, Displaying Maps, Getting Location Data, Monitoring a Location.

Text Books and Reference Books:
[1] Grant Allen, Beginning Android 4, Apress, 2012.
[2] Ed Burnette, Hello, Android: Introducing Google's Mobile Development Platform, Pragmatic. Bookshelf (2009), ISBN-13: 978-1934356173.
[3] Jerome (J.F) DiMarzio, Android - A programmer's Guide, TataMcgraw Hill, 2010, ISBN: 9780071070591

Paper Name: Web Server Programming
Code: CS404B
Contacts: 2L

1. Develop and demonstrate a XHTML file that includes Javascript script for the following problems: a) Input: A number n obtained using prompt Output: The first n Fibonacci numbers b) Input: A number n obtained using prompt Output: A table of numbers from 1 to n and their squares using alert

2. a) Develop and demonstrate, using Javascript script, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert windows must be produced when errors are detected. b) Modify the above program to get the current semester also (restricted to be a number from 1 to 8)

3. a) Develop and demonstrate, using Javascript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. b) Modify the above document so that when a paragraph is moved from the top stacking position, it returns to its original position rather than to the bottom.

4. a) Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include 100 USN, Name, Name of the College, Brach, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document. b) Create an XSLT style sheet for one student element of the above document and use it to create a display of that element.

5. a) Write a Perl program to display various Server Information like Server Name, Server Software, Server protocol, CGI Revision etc. b) Write a Perl program to accept UNIX command from a HTML form and to display the output of the command executed.

6. a) Write a Perl program to accept the User Name and display a greeting message randomly chosen from a list of 4 greeting messages. b) Write a Perl program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

7. Write a Perl program to display a digital clock which displays the current time of the server.

8. Write a Perl program to insert name and age information entered by the user into a table created using MySQL and to display the current contents of this table.

9. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.

10. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.

11. Create a XHTML form with Name, Address Line 1, Address Line 2, and E-mail text fields. On submitting, store the values in MySQL table. Retrieve and display the data based on Name.

12. Build a Rails application to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.

Books

1)   Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.

Paper Code: Artificial Intelligence/ Artificial Intelligence Lab
Code: CS 501/ CS 591
Contacts: 4L + 2P

Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]
Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.

Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs

Search techniques [5]
Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [4]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Knowledge & reasoning [3]
Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [2]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [3]
Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Probabilistic reasoning [3]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.

Planning [2]
Overview, components of a planning system, Goal stack planning, Hierarchical planning, other planning techniques.

Learning [3]
Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.

Expert Systems [2]
Representing and using domain knowledge, expert system shells, knowledge acquisition.

Laboratory

1)   Basic knowledge of programming language like Prolog & Lisp.

2) Resolution using Python

Books:
1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Logic & Prolog Programming, Saroj Kaushik, New Age International
6. Expert Systems, Giarranto, VIKAS

Paper Code: Multimedia and its Applications/ Multimedia Laboratory
Code: CS 502/ CS 592
Contacts: 4L + 2P

Unit	Content	Hrs/Unit
	Multimedia:	4
	Introduction to multimedia, Components and its application, Uses of multimedia. Web and Internet multimedia applications, Transition from conventional media to digital media.	
	Making Multimedia:	6
	Impact of multimedia, Hardware - Macintosh and Windows production Platforms, other peripherals - Connections, Memory and storage devices, Multimedia software.	
	Text/Image/Sound	16
	Usage of various font and text in multimedia, Families and faces of fonts, outline fonts, bitmap fonts International character sets and hypertext, Digital fonts techniques.	
	Still Images – Colour Science , Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats : Bitmaps, GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Vector and 3D Drawing. Natural Light.	
	MIDI and Digital Audio, Audio File Formats.	
	Video:	10
	Video Basics, How Video Works, Analog & Digital video, video compression techniques, various recording file formats and standards (jpeg, mpeg), DVI technology. . Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21	
	Animation:	8
	Principle of Animations. Animation Techniques Animation File Formats, Morphing.	
	Multimedia System:	10

An overview of multimedia system and media streams, Source representation and compression techniques text, speech and audio, still image and video, Graphics and animation.

Multimedia Authoring and Multi-modal Communication: Video conferencing, Networking support, Trans-coding, Authoring Basics, Introduction of Authoring Tools.   6

Laboratory

Sample practical problems can be included related to theory as follows

Using various multimedia software
1. Create an application in HTML using forms that lets the users to fill-in their personal information/resume.
2. Create a simple animation by using Macromedia Flash
3. Drawing a Semi Circle by snap tool
4. Drawing a 24 spokes on a wheel
5. Placing a text along a curved path

Text/ Reference Books:
1. Multimedia: Making it work by Tay Vaughan, TMH.
2.Multimedia: Computing, Communications Applications by R Steinmetz and K Naharstedt, Pearson.
3. Multimedia Handbook by Keyes, TMH.
4. Multimedia System Design by K. Andleigh and K. Thakkar, PHI.

Paper Name: **Cloud Computing/ Cloud Computing Lab**
Code: DSE 503A / DSE 593A
Contact: 4 L + 2 P
Credits: 4 + 2

Course Objectives:
1. To gain knowledge of Cloud Computing and its Basics.
2. To gain knowledge on use of Platforms in Cloud Computing
3. To gain knowledge of cloud Infrastructure.
4. To understand the concepts of Services and Applications.

Course Outcomes:
1 Students will able to gain knowledge of Cloud Computing and its Basics
2 Students will able to gain knowledge on use of Platforms in Cloud Computing
3 Students will able to understand the cloud Infrastructure
4 Students will be able to gain knowledge of concepts of Services and Applications

Definition of Cloud Computing: Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as a Service with examples of services/ service providers, Cloud Reference model

Cloud Architecture: A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients

Services and Applications by Type IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)

Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization:

Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance

Concepts of Platform as a Service Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks

Use of Google Web Services Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service.

Use of Amazon Web Services Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, Amazon Elastic Block Store, Amazon SimpleDB and Relational Database Service

Use of Microsoft Cloud Services Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services

Concepts of Cloud Security Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)

Cloud Management An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle)

Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs

Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs

Cloud-based Storage: Cloud storage definition – Manned and Unmanned

Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services

Laboratory

1) Application development in Cloudsim
2) Amazon cloud service trials

Books/ References

1) Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2) Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3) Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4) Cloud Computing, Miller, Pearson
5) Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson
6) Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Paper Name: **Cryptography and Information Security/ Cryptography and Information Security Lab**
Code: DSE 503B / DSE 593B
Contact: 4L+ 2P
Credits: 4 + 2
Allotted Hrs: 60

Course Objectives:

1.   Explain the objectives of information security
2.   Explain the importance and application of each of confidentiality, integrity, authentication and availability
3.   Understand various cryptographic algorithms.
4.   Understand the basic categories of threats to computers and networks
5.   Describe public-key cryptosystem.
6.   Describe the enhancements made to IPv4 by IPSec
7.   Understand Intrusions and intrusion detection
8.   Discuss the fundamental ideas of public-key cryptography.
9.   Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message.
10.   Discuss Web security and Firewalls

Module 1

Attacks on Computers and Computer Security: Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security

Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

Module 2

Symmetric key Ciphers: Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Crypt analysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption Function, Key distribution

Asymmetric key Ciphers: Principles of public key crypto systems, Algorithms (RSA, Diffie-Hellman, ECC), Key Distribution.

Module 3

Message Authentication Algorithms and Hash Functions: Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm

Authentication Applications: Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication.

Module 4

E-Mail Security: Pretty Good Privacy, S/MIME

IP Security: IP security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining security associations, key management.

Module 5

Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction

Intruders, virus and Firewalls: Intruders, Intrusion detection, password management, virus and related threats, Countermeasures, Firewall design principles, types of firewalls

Case Studies on Cryptography and security: Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability, Virtual E lections

Cryptography and Information Security Lab

Implement following algorithms
1) Caesar Cipher
2) Playfair cipher
3) Vigenere cipher
4) Rail fence transformation
5) RSA algorithm
6) SHA 1

Reference Books:
1. Cryptography and Network Security: William Stallings, Pearson Education,4″' Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill Edition
3. Cryptography and Network Security: C K Shyamala, N Harin i, Dr T R Padmanabhan, Wiley India, 1"
4. Cryptography and Network Security: Forouzan Mukhopadhyay, MC Graw Hill, 2″" Edition
5. Information Security, Principles and Practice: Mark Stamp, Wiley India.
6. Principles of Computer Security: WM.Arthur Conklin, Greg White, TMH
7. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
8. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

Paper Name: Advanced Java Programming / Advanced Java Programming Lab
Code: CS503C/ CS 593 C
Contacts: 4L + 2P

OBJECTIVES
- To be familiarize with RMI and JSP
- To understand the Java Servlets and Database connectivity
- To know more about the Enterprise Java Bean (EJB) Programming

Unit	Content	Hrs/Unit
1	**SERVLETS** Background, The Life Cycle of a Servlet & The JSDK-A Simple Servlet – The Servlet API -RolePlay-Servlet Concept – The javax.servlet Package – Reading Servlet Parameters, The javax.servlet.http Package – Handling HTTP Request and Responses – Using Cookies – Session Tracking – Request Dispatcher – Servlet Config Methods and Example – Servlet Context Methods and Example – Filter, FilterConfig	10
2	**JSP& JAVABEANS** Life Cycle of JSP - JSP API - Scripting Tag, expression tag, declaration tag – Implicit Objects (out, request, response, config, application, session, pageContext, page, Exception) – Directive Elements (page, include, taglib) – Exception Handling - Action Elements (jsp:forward, jsp:include, Bean class, jsp:useBean, jsp:setProperty, jsp:getProperty) – JSTL – Custom Tags (API, Attributes, Iteration, Example)- What Is a Java Bean? – Advantages of Java Beans – Introspection, Bound and Constrained Properties – Persistence & Customizers	10
3	**Design Patterns** Gang of four – Different types: Creational, Structural and Behavioral – Singleton, DAO, DTO, MVC, Front Controller, Factory Method, Observer, Prototype, Façade etc. **JDBC** Presentation to JDBC Connection settings – The Concept of JDBC – JDBC Driver Types – JDBC Packages – A Brief Overview of the JDBC Process – Database Connection – Associating the JDBC/ODBC Bridge with the Database – Statement	10

Objects – Result Set.

4	**TESTING using JUNIT**	10

Junit: What & Why - Types of Testing – Annotation used in Junit – Assert class – Test Cases

Build Tools - MAVEN

Building an application – Build tools: Ant, Maven, Gradle etc. – Ant vs Maven– Maven Repository – Understanding pom.xml – Maven Example – Maven Web App Example

Bridge with the Database – Statement Objects – Result Set.

5	**SPRING**	10

Basics of Spring – Spring Modules – Dependency Injection – Different Types of Injection – Autowiring – Spring MVC – Spring JDBC (JdbcTemplate, PreparedStatement, CallableStatement, ResultSetExtractor, RowMapper, SimpleJdbcTemplate) – ApplicationContext

JAVA 8 Features

Optional class – Stream API – Lambda Expressions – Default methods – Method references – Functional Interfaces – Static methods in interface – Collector class

6	**SERVER**	10

Apache Tomcat – Installation , configuration

APPLET, AWT AND EVENT HANDLING

Applet Basics – Applet architecture – HTML APPLET tag – Passing parameter to AppletgetDocumentBase() and getCodeBase() – AWT classes and Graphics – AWT ControlsEvent Handling – Event Classes – Event Listener Interfaces – Layout Managers – Menus

INTRODUCING SWING

Exploring Swing – JLabel and ImageIcon, JTextField – The Swing Buttons – JTabbedPane -JScrollPane, JList&JcomboBox – Trees &JTables

Laboratory Problems

Sample practical problems can be included related to theory as follows

Assignments:
1. Library Management System using JSP, Servlet, JDBC, JavaBeans
2. Employee Management System using Spring MVC, Spring JDBC, Maven, Java 8
3. File explorer and display of selected file in display pane using Swing
4. Calculator using Applet, AWT and Event Handling

Books/ References

1. Black Book "Java server programming" J2EE, 1st ed.,
2. Dream Tech Publishers, 2008. 3. Kathy walrath" 2.
3. Complete Reference J2EE by James Keogh mcgraw publication
4. Core Java, Volume II: Advanced Features by Cay Horstmann and Gary Cornell Pearson Publication

5. Java Persistence with Hibernate by Christian Bauer, Gavin King
6. Spring in Action 3rd edition , Craig walls, Manning Publication
7. Hibernate 2nd edition, Jeff Linwood and Dave Minter, Beginning Après publication
8. Java Server Faces in Action, Kito D. Mann, Manning Publication
9. JDBC™ API Tutorial and Reference, Third Edition, Maydene Fisher, Jon Ellis, Jonathan Bruce, Addison Wesley
10. Beginning JSP, JSF and Tomcat, Giulio Zambon, Apress
11. JSF2.0 CookBook, Anghel Leonard, PACKT publication

Paper Code: Machine Learning/ Machine Learning Lab
Course Code: CS601/ CS691
Contact: 4L + 2P

Objective:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed.
- To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Unit	Content	Hrs/Unit
1	● Basic concepts of learning, Hypothesis Space, Basic statistics: Probability, Bayes Theorem, Naïve Bayes, Bayesian network ● Regression Analysis: Correlation, Bivariate and Multivariate regression, Types of regression – Linear, Logistic, Non-linear or Polynomial	6
2	● Supervised, Unsupervised, Semi-supervised learning, Instance-based learning, k-Nearest Neighbourhood, Ensemble methods – Bagging, Boosting and Stacking ● Support Vector Machine: Working principle, Linear Discriminant Analysis (LDA), Non-linearity and kernel methods	6
3	● Decision Trees: Introduction and building, Algorithms used – ID3, Information Gain, Gini Index, Chi-square, Reduction in variance, Overfitting and Under fitting, L1 and L2 regularisation, Random Forest ● Dimensionality reduction: Principle Component Analysis (PCA), Independent Component Analysis (ICA), Singular Valued Decomposition (SVD)	6
4	● Artificial Neural Network: Biological Neuron, MP Neuron, HEVNet, Perceptron, Multilayer Perceptron, Gradient descent, Back-propagation algorithm ● Convolution Neural Network(CNN), Recurrent Neural Network(RNN), Long Short Term Memory Network(LSTM)	6
5	● Clustering techniques: k-means, Mean-Shift Clustering, Density-Based Spatial Clustering of Applications with Noise (DBSCAN), Hierarchical clustering ● Reinforcement Learning: The Learning Task, Q Learning, Algorithm, Non-deterministic Rewards and Actions	6
6	● Advanced topics: Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning, Inference in Graphical Models ● Evaluating Machine Learning algorithms and Model Selection and real life applications	6

Machine Learning Lab

Practical: Based on Theory

Model Assignments

1 Write a program to demonstrate the working of decision trees algorithm.
Use an appropriate dataset for building the decision tree and apply this knowledge to classify a new sample.

2 Write a program to demonstrate the working of support vector machine algorithm. Use an appropriate dataset and apply this knowledge to classify a new sample.

3 Write a program to implement k-Nearest Neighbour algorithm to classify a real life dataset. Print both correct and wrong predictions. Python ML library classes may be used for this problem.

4 Write a program to implement random forest algorithm to classify real life dataset.

5 Write a program to implement Naïve Bayes algorithm in real life dataset classification.

6 Write a program to implement K-means algorithm on real life dataset.

7 Write a program to implement linear and logistic regression in real life dataset.

8 Write a program to implement deep learning in real life dataset.

9 Write a program to implement PCA in real life dataset.

BOOKS FOR STUDY:

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.
4. Tom M. Mitchell, Machine Learning, McGraw-Hill, 1997(freely available online)
5. Machine Learning in Action - Peter Harrington
6. Machine Learning: An Algorithmic Perspective - Stephen Marsland

Paper Code: Web Technology/ Web Technology Lab
Course Code: CS602/ CS692
Contact: 4L + 2P

1) About the course/go through syllabus. Review of HTML, CSS. What's a web application? Why are we using JavaScript? Introduction to tutorials

2) Review of HTML forms and form validation using JavaScript. What is client-side scripting? What is server-side scripting? Introduction to JavaScript and its constructs

3) Variables, constants, Conditional Statements, assignment statements, loops

4) Data types, Functions, Arrays, Random numbers, String methods

5) Introduction to JQuery, animation, scaling, menus, special effects.

6) More JavaScript and JQuery in web pages, labs and in class exercises contd. Quarter project is introduced

7) Host Objects : Browsers and the DOM-Introduction to the Document Object Model DOM History and Levels-Intrinsic Event Handling-Modifying Element Style-The Document Tree-DOM Event HandlingAccommodating Noncompliant Browsers Properties of window-Case Study. Server-Side Programming: Java Servlets- Architecture -Overview-A Servelet-Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies- URL Rewriting-Other Capabilities-Data Storage Servelets and Concurrency-Case Study- Related Technologies.

8) Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration -Namespaces JavaScript and XML: Ajax-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data:XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers-Case Study- Related Technologies. Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSPJavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller ParadigmCase Study-Related Technologies.

9) Web Services: JAX-RPC-Concepts-Writing a Java Web Service-Writing a Java Web Service ClientDescribing Web Services: WSDL- Representing Data Types: XML Schema-Communicating Object Data: SOAP Related Technologies-Software Installation-Storing Java Objects as Files-Databases and Java Servlets.

Web Technology Laboratory

1) Introduction to PHP, server side of scripting language Download a server Handling form input with PHP. User authentication

2) Catch up with topics, projects, quizzes Students work in-class on projects

3) PHP Basic Constructs o Variables and data types o Expressions and operators o Conditional statements

4) PHP Basic Constructs contd. O Iteration statements o while loops, for loops o switch statements

5) PHP Basic Constructs contd. O Functions o Arrays and Objects o PHP $_GET o PHP $_POST

6) PHP cookies PHP sessions

7) What's a database and what's an RDBMS? Introduction to SQL. Using MySQL. Relational Database concepts. Designing your web database

8) Primary keys in database tables. SQL statements: SELECT and INSERT. SQL statements: UPDATE and DELETE. Introduction to PHPMyAdmin. Creating a database in PHPMyAdmin. Accessing a database through PHP

9) Inserting data into the Database. Retrieving data from the Database. Using sub queries. Updating, adding and deleting records

10) Accessing MYSQL database from the web with PHP. Web database architecture. Querying the database from the web. Putting new information in the database.

Books/ References

1) Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education,
2) Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education
3) Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition
4) Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education, 2001.
5) Bates, "Developing Web Applications", Wiley, 2006.

Paper Code: E-Commerce/ E-Commerce Lab
Course Code: DSE 603A/ DSE 693A
Contact: 4L + 2P

E-commerce and its Technological Aspects Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture.

Consumer Oriented E Commerce E-Retailing: Traditional retailing and e retailing, Benefits of e retailing, Key success factors, Models of e retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, matchmaking services, Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce

Electronic Data Interchange: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.

Security in E Commerce Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

Issues in E Commerce Understanding Ethical, Social and Political issues in E-Commerce: A model for Organizing the issues, Basic Ethical Concepts, Analyzing Ethical Dilemmas, Candidate Ethical principles Privacy and Information Rights: Information collected at E-Commerce Websites, The Concept of Privacy, Legal protections Intellectual Property Rights: Types of Intellectual Property protection, Governance.

E-Commerce Lab

Design various E-Commerce Portals

Books/ References

1) Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
2) RaviKalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley
3) Efraim Turban, Jae Lee, David King, H.Michael Chung, "Electronic Commerce–A ManagerialPerspective", Addison-Wesley.
4) Elias M Award, "Electronic Commerce from Vision to Fulfilment", 3rd Edition, PHI, Judy Strauss, Adel El-Ansary, Raymond Frost, "E-Marketing", 3RDEdition, Pearson Education.

Paper Code: Sensor Networks and IoT/ Sensor Networks and IoT Lab
Course Code: DSE 603B/ DSE 693B
Contact: 4L + 2P

Module 1
Introduction and Applications: What is Sensor, types of sensors and use, Measurement System, smart transportation, smart cities, smart living, smart energy, smart health, and smart learning.

Module 2
Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security IoT Reference Architecture Introduction,

Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints, hardware, Data representation and visualization, Interaction and remote control.

Module 3
IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices. L1, L2

Module 4
IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases

Module 5
Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud-based data collection, storage and computing services using Nimbits. L1, L2

Module 6
Industrial Automation-Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction, Case study: phase one-commercial building automation today, Case study: phase two commercial building automation in the future. Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

Sensor Networks and IoT Lab
Course Code: DSE 693B

1. Familiarization with Arduino IDE and writing a program using Arduino IDE for
   a) LED blinking
   b) Temperature Sensor
   c) programming on Heartbeat sensor using Arduino
   d) Arduino Line Follower Robot
   e) Robotic ARM Arduino
2. Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework. Program simple web server in Python using Flask framework.
3. Setup Raspberry Pi and write a program to blink an LED using Python.
4. Interfacing digital sensors and relay boards with Raspberry Pi
5. Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.

Text Books:

- Mandler, B., Barja, J., MitreCampista, M.E., Cagáová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publication
- Internet of Things: A Hands-On Approach Paperback – 2015, by ArsheepBahga (Author), Vijay Madisetti (Author)
- IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things by Pearson Paperback – 16 Aug 2017 ,by Hanes David (Author), Salgueiro Gonzalo (Author), Grossetete Patrick (Author), Barton Rob (Author)
- Raj Kamal, ‖Internet of Things-Architecture and design principles‖, McGraw Hill Education.

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