

Choice Based Credit System (CBCS)

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2017-18)



SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

Disclaimer: The CBCS syllabus is uploaded as given by the Faculty concerned to the Academic Council. The same has been approved as it is by the Academic Council on 01.7.2017. Any query may kindly be addressed to the concerned Faculty.

Undergraduate Programme Secretariat

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

- 1. Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- 2. Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
 - 2.3 Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
- 3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
 - 3.1 AE Compulsory Course (AECC):** Environmental Science, English Communication/MIL Communication.
 - 3.2 AE Elective Course (AEEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.A (Honors), B.Com (Honors) & B.Sc. (Honors)

Course	*Credits	
	Theory+ Practical	Theory + Tutorial
I. Core Course (14 Papers)		
	14X4= 56	14X5=70
Core Course Practical / Tutorial*		
(14 Papers)	14X2=28	14X1=14
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective		
	4X4=16	4X5=20
(4 Papers)		
A.2. Discipline Specific Elective		
Practical/ Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
B.1. Generic		
Elective/	4X4=16	4X5=20
(4 Papers)		
B.2. Generic Elective Practical/		
Tutorial*	4 X 2=8	4X1=4
(4 Papers)		
• Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester		

III. Ability Enhancement Courses

1. Ability Enhancement Compulsory

(2 Papers of one 4 credit and One 2 credit)	1 X 4=4	1 X4=4
	1 X 2=2	1 X 2=2

Environmental Science English/MIL
Communication

2. Ability Enhancement Elective (Skill Based)

(Minimum 2)

2 X 2=4	2 X 2=4
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(2 Papers of 2 credit each)

Total credit	142	142
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Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses on its own.

* Wherever there is a practical there will be no tutorial and vice-versa

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN
B. Sc. Honours (Computer Science)

SE ME ST ER	CORE COURSE (14)	Ability Enhancement Compulsory Course(AECC) (2)	Skill Enhancement Course (SEC) (2)	Elective: Discipline SpecificDSE (4)	Elective:Ge neric (GE) (4)
I	Discrete Structure Computer Fundamentals and Digital Logic	AECC-I			GE - 1
II	Operating System Programming in C	AECC-II			GE - 2
III	Computer Architecture & Organization Formal Language (Automata) Data Structure		SEC - 1		GE - 3
IV	Software Engineering Computer Networks Object Oriented Programming with JAVA		SEC - 2		GE - 4
V	Design and Analysis of Algorithm Computer Graphics			DSE - 1	
				DSE - 2	
VI	Compiler Design Database Management System			DSE - 3	
				DSE - 4	

SEMESTER	COURSE OPTED	COURSE NAME	Credits
I	Core-I	Discrete Structure	6
	Core-II	Computer Fundamentals and Digital Logic	4
	Core-II Practical	Digital Logic Laboratory	2
	GE-I	Generic Elective-I	6
	AECC-I	Environmental Studies	4
II	Core-III	Operating System	6
	Core-IV	Programming in C	4
	Core-IV Practical	Programming in C Laboratory	2
	GE-II	Generic Elective-II	6
	AECC-II	English / MIL Communications	2
III	Core-V	Computer Architecture & Organization	6
	Core-VI	Formal Language (Automata)	6
	Core-VII	Data Structure	4
	Core-VII Practical	Data Structure Laboratory	2
	GE-III	Generic Elective-III	6
	SEC-I	Skill Enhancement Courses - I	2
IV	Core-VIII	Software Engineering	6
	Core-IX	Computer Networks	6
	Core-X	Object Oriented Programming with JAVA	4
	Core-X Practical	Object Oriented Programming with JAVA Laboratory	2
	GE-IV	Generic Elective-IV	6
	SEC-II	Skill Enhancement Courses - II	2
V	Core-XI	Design and Analysis of Algorithm	6
	Core-XII	Computer Graphics	4
	Core-XII Practical	Computer Graphics Laboratory	2
	DSE-I	Discipline Specific Elective – I	6
	DSE-II	Discipline Specific Elective – II	6

VI	Core-XIII	Compiler Design	6
	Core-XIV	Database Management System	4
	Core-XIV Practical	DBMS Laboratory	2
	DSE-III	Discipline Specific Elective – III	6
	DSE-IV	Discipline Specific Elective – IV	6
Total Credits			142

Core Papers(C): (Credit: 06 each)(1 period / week for tutorials or 4 periods / week of practical)

1. **Discrete Structure**
2. **Computer Fundamentals and Digital Logic**
3. **Operating System**
4. **Programming in C**
5. **Computer Architecture & Organization**
6. **Formal Language (Automata)**
7. **Data Structure**
8. **Software Engineering**
9. Computer Networks
10. **Object Oriented Programming with JAVA**
11. **Design and Analysis of Algorithm**
12. Computer Graphics
13. **Compiler Design**
14. Database Management Systems

Discipline Specific Elective Papers: (Credit: 06 each) - DSE- 1,DSE- 2 ,DSE- 3 , DSE- 4.

DSE - 1 (any one)

- a) Numerical Methods
- b) Advanced Algorithms

DSE - 2 (any one)

- a) Artificial Intelligence
- b) Microprocessor

DSE - 3 (any one)

- a) Information Security and Cryptography
- b) Operational Research For Computer Science

DSE - 4 (any one)

- a) Digital Image Processing
- b) Project Work / Dissertation

Note: Universities may include more options or delete some from this list

Other Discipline (Four papers of any one discipline) - GE 1 to GE 4

1. Mathematics
2. Physics
3. Economics
4. Commerce
5. Chemistry

Any one discipline of importance

Skill Enhancement Courses (Credit: 02 each): SEC - 1, SEC - 2

SEC - 1

- a) Internet Technology
- b) Unix and Shell Programming

SEC – 2

- a) Visual Programming
- b) Web Technology

Note: Universities may include more options or delete some from this list **Important:**

1. Each University/Institute should provide a brief write-up about each paper outlining the salient features, utility, learning objectives and prerequisites.
2. University/Institute can add/delete some experiments of similar nature in the Laboratory papers.
3. The size of the practical group for practical papers is recommended to be 10-15 students.
4. The size of tutorial group for papers without practical is recommended to be 8-10 students.

University/Institute can add to the list of reference books given at the end of each paper.

Curriculum

Course Title (SEM-I)	Course type	(L-T-P)	Credit	Marks
Discrete Structure	Core-I	5 - 1 - 0	6	50
Computer Fundamentals and Digital Logic	Core-II	4-0-0	4	50
Digital Logic Laboratory	Core-II Practical	0 - 0 - 2	2	50
Generic Elective - I	GE-I	5 - 1 - 0	6	50
Environmental Studies	AECC-I	4 - 0 - 0	4	50
	SEMESTER	TOTAL:	22	250
Course Title (SEM-II)	Course type	(L-T-P)	Credit	Marks
Operating System	Core-III	5- 1- 0	6	50
Programming in C	Core-IV	4-0-0	4	50
Programming in C Laboratory	Core-IV Practical	0 - 0- 2	2	50
Generic Elective-II	GE-II	5 - 1 - 0	6	50
English / MIL Communications	AECC-II	2 - 0 - 0	2	50
	SEMESTER	TOTAL:	20	250
Course Title (SEM-III)	Course type	(L-T-P)	Credit	Marks
Computer Architecture & Organization	Core-V	5 - 1 - 0	6	50

Formal Language (Automata)	Core-VI	5-1-0	6	50
Data Structure	Core-VII	4 - 0 - 0	4	50
Data Structure Laboratory	Core-VII Practical	0 - 0 - 2	2	50
Generic Elective-III	GE-III	5 - 1 - 0	6	50
Skill Enhancement Courses –I a) Internet Technology b) Unix and Shell Programming	SEC-I	2 - 0 - 0	2	50
	SEMESTER	TOTAL:	26	300
Course Title (SEM-IV)	Course type	(L-T-P)	Credit	Marks
Software Engineering	Core-VIII	5-1-0	6	50
Computer Networks	Core-IX	5-1-0	6	50
Object Oriented Programming with JAVA	Core-X	4 - 0 - 0	4	50
Object Oriented Programming with JAVA Laboratory	Core-X Practical	0 - 0 - 2	2	50
Generic Elective-IV	GE-IV	5 - 1 - 0	6	50
Skill Enhancement Courses – II a) Visual Programming b) Web Technology	SEC-II	2 - 0 - 0	2	50
	SEMESTER	TOTAL:	26	300
Course Title (SEM-V)	Course type	(L-T-P)	Credit	Marks
Design and Analysis of Algorithm	Core-XI	5 - 1 - 0	6	50
Computer Graphics	Core-XII	4 - 0 - 0	4	50
Computer Graphics Laboratory	Core-XII Practical	0 - 0 - 2	2	50
Discipline Specific Elective – I a) Numerical Methods b) Advanced Algorithms	DSE-I	5 - 1 - 0	6	50

Discipline Specific Elective – II a) Artificial Intelligence b) Microprocessor	DSE-II	5 - 1 - 0	6	50
	SEMESTER	TOTAL:	24	250
Course Title (SEM-VI)	Course type	(L-T-P)	Credit	Marks
Compiler Design	Core-XIII	5-1-0	6	50
Database Management System	Core-XIV	4 - 0 - 0	4	50
DBMS Laboratory	Core-XIV Practical	0 - 0 - 2	2	50
Discipline Specific Elective – III a) Information Security and Cryptography b) Operational Research For Computer Science	DSE-III	5 - 1 - 0	6	50
Discipline Specific Elective – IV a) Digital Image Processing b) Project Work / Dissertation	DSE-IV	5 - 1 - 0	6	50
	SEMESTER	TOTAL:	24	250
	GRAND	TOTAL:	142	1600

CORE COURSES (HONOURS IN COMPUTER SCIENCE)

Total Marks: 50

Theory: 40

Internal Assessment: 10

COMPUTER SCIENCE (C-I): Discrete Structures

Theory: 30 Lectures

1. Introduction: (12 Lectures)

Sets - finite and Infinite sets, uncountable Infinite Sets; functions, Relation, Equivalence Relation Properties of Binary Relations, Closure, Partial Ordering Relations; counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion. Groups; Subgroups; groups within groups; normal subgroups; Rings; Sub rings; Fields; Vector spaces.

2. Graph Theory (12 Lectures)

Basic Terminology, Models and Types, multigraphs and weighted graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring, Trees, Basic Terminology and properties of Trees, Introduction to Spanning Trees Kruskal's Algorithm ; Prim's Algorithm ; DFS ; BFS. Cut Set : Fundamental Cut Set and Cut Vertices. Planar and Dual Graphs ; Matrix Representation of Graphs (Adjacency and Incidence Matrices) ; Network ; Flow Augmenting Path ; Ford-Fulkerson Algorithm for Maximum Flow ; Floyd Algorithm ;

3. Propositional Logic (6 Lectures)

Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory

Recommended Books:

1. C.L. Liu & Mahopatra, Elements of Discrete mathematics, 2nd Sub Edition 1985, Tata McGraw Hill
2. Rosen, Discrete Mathematics and Its Applications, Sixth Edition 2006
3. T.H. Cormen, C.E. Leiserson, R. L. Rivest, Introduction to algorithms, Prentice Hall on India (3rd edition 2009)
4. M. O. Albertson and J. P. Hutchinson, Discrete Mathematics with Algorithms 1988 Johnwiley Publication
5. J. L. Hein, Discrete Structures, Logic, and Computability, Jones and Bartlett Publishers, 3rd Edition, 2009
6. D.J. Hunter, Essentials of Discrete Mathematics, Jones and Bartlett Publishers, 2008
7. Ash & Ash – “Discrete Mathematics”, TMH

COMPUTER SCIENCE (C-II): Computer Fundamentals and Digital Logic

Total Marks: 100

Theory: 50

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Computers & Problem solving (7 Lectures)

Generation of Computers; Computer system : **Basic Block Diagram, Super Mainframe, Mini & Personal Computer, Nomenclature**, Software : **Systems and Application**; Hardware & Software; Algorithms : **Definition, essential features**; Complexity : **notation, time & space**; Computability & correctness concepts; Structured programming concepts; Process of problem solving, Flowcharts and Pseudo codes.

2. Number System & Arithmetic (7 Lectures)

Number System : Positional, binary, octal, decimal, hexadecimal and their representations, Methods of conversion from one base to another, signmagnitude, 1's complement; 2's complement; Binary Arithmetic; Fixed & floating point numbers: representation, biased exponent, range & precision, errors, overflow, underflow, BCD arithmetic

3. Boolean Algebra (6 Lectures)

Concepts of propositional logic; Boolean algebra: definitions, postulates, properties, simplification of logical expressions using properties and maps (up to 4 variables), Min-term, Max-term expressions; Logic gates : AND OR, NOT, XOR, Combinational circuits, Simple logic design using logic gates.

4. Digital Logic and System Design (10 Lectures)

Alphanumeric codes: **ASCII, EBCDIC**; Single error detection & correction; Hamming Codes and decoding techniques. Combinational Circuits: **encoder, decoder, code converter, comparator, adder/subtractor, multiplexer, demultiplexer, parity generator, PLA**. Basic Sequential circuits; Flip-Flops: RS, JK, D, T; Schmitt-trigger; Concepts of single and two-phase clocks; Multivibrators: **astable and monostable**; Registers and shift registers; Counters : **Synchronous & asynchronous**. Digital-Analog interfacing: **D/A & A/D converters, basic ladder, counter ramp, successive approximation, sample and hold**.

Text books:

1. Givone: digital Principles & design ,TMH
2. Malvino: Digital Principles & application TMH
3. Jain :Modern Digital Electronics 2/e TMH
4. Marcovitz: Intro to logic Design Tata Mcgraw-hill
5. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill
6. Digital Technology- Virendra Kumar, New Age
7. Digital Logic Design- Morris Mano, PHI
8. Yarbrough- Digital Logic, Vikas
9. Salivahan- Digital Circuits and Design, Vikas

COMPUTER SCIENCE LAB (C-II): Computer Fundamentals and Digital Logic Lab Practical: 08

List of Experiments:

1. Realization of NOT, OR, AND, XOR, XNOR gates using universal gates
2. A. Gray to Binary conversion & vice-versa.
B. Code conversion between BCD and EXCESS-3
3. A. ODD and even parity generation and checking.
B. 4-bit comparator circuit
4. Design of combinational circuit to drive seven-segment display
5. Design of combinational circuits using multiplexer
6. A. Adder/Subtractor circuits using Full-Adder using IC and/ or logic gates. B. BCD Adder circuit using IC and/ or logic gates
7. Realization of RS, JK, and D flip flops using Universal logic gates
8. Realization of Asynchronous up/down counter
9. Realization of Synchronous Mod-N counter
10. Digital to Analog conversion

COMPUTER SCIENCE (C-III): Operating Systems

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1.Introduction

(5 Lectures)

Basic OS functions, resource abstraction, types of operating systems-multiprogramming systems, batch systems , time sharing systems; operating systems for personal computers & workstations, process control & real time systems.

2.Operating System Organization

(4 Lectures)

Processor and user modes, kernels, system calls and systemprograms.

3. Process Management

(8 Lectures)

System view of the process and resources, process abstraction, processhierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes, critical section, semaphores, methods for inter-process communication; deadlocks.

4. Memory Management

(8 Lectures)

Physical and virtual address space; memory allocation strategies -fixedand variable partitions, paging, segmentation, virtual memory

5. File and I/O Management

(5 Lectures)

Directory structure, file operations, file allocation methods, devicemanagement.

Recommended Books:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles 2008 5th Edition, Prentice Hall of India.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill 1992

COMPUTER SCIENCE (C-IV): Computer Programming in C**Total Marks: 100****Theory: 40****Practical: 50****Internal Assessment: 10****Theory: 30 Lectures****1. Introduction to C (2 Lectures)**

History of C, Using main() function, Compiling and Executing Simple Programs in C++.

2. Data Types, Variables, Constants, Operators and Basic I/O (4 Lectures)

Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putchar), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.h).

3. Expressions, Conditional Statements and Iterative Statements (4 Lectures)

Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

4. Functions and Arrays (8 Lectures)

Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments.

Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Two-dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

5. Derived Data Types (Structures and Unions) (4 Lectures)

Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as

members, Union with structures as members.

6. Pointers and References in C

(4 Lectures)

Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values

7. Memory Allocation in C

(2 Lectures)

Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators, storage of variables in static and dynamic memory allocation

8. File I/O, Preprocessor Directives

(2 Lectures)

Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

Reference Books

1. Tennenace W.Pratt, “Programming languages design and implementation”, Prentice Hall of India.
2. Allen B. Tucker, “Programming Languages”, Tata McGraw Hill.
3. Gottfried BS – Programming with C, TMH pub.
4. Balagurusamy:ANSI C TMH
5. Kanetkar, Yashvant – Understanding Pointers in C- 2nd Edn. BPB
6. Kanetkar, Yashvant - Let us C. - 3rd revised Edn. BPB
7. Roosta- Foundation of Programming Languages,Vikas
8. Jeyapoovan- A First Course in Prog with C, Vikas

COMPUTER SCIENCE LAB (C-IV):): Computer Programming in C Lab

Practical: 8 Lectures

1. WAP to print the sum and product of digits of an integer.
2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series
 $S = 1 + 1/2 + 1/3 + 1/4 + \dots$
4. WAP to compute the sum of the first n terms of the following series
 $S = 1 - 2 + 3 - 4 + 5 - \dots$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```
      *
     ***
    *****
   *********
```
10. WAP to perform following actions on an array entered by the user:
 - i) Print the even-valued elements

- ii) Print the odd-valued elements
- iii) Calculate and print the sum and average of the elements of array
- iv) Print the maximum and minimum element of array
- v) Remove the duplicates from the array
- vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.
16. Write a menu driven program to perform following operations on strings:
 - a) Show address of each character in string
 - b) Concatenate two strings without using strcat function.
 - c) Concatenate two strings using strcat function.
 - d) Compare two strings
 - e) Calculate length of the string (use pointers)
 - f) Convert all lowercase characters to uppercase
 - g) Convert all uppercase characters to lowercase
 - h) Calculate number of vowels
 - i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration
19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration
20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.
 - a) Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation):
 - b) a) Sum b) Difference c) Product d) Transpose
21. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
22. Write a program to retrieve the student information from file created in previous question and print it in following format:

Roll No. Name Marks
23. Copy the contents of one text file to another file, after removing all whitespaces.
24. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.
25. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

COMPUTER SCIENCE (C-V): Computer Architecture & Organization

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction (6 lectures)

Review of Pipelining, Examples of some pipeline in modern processors, pipeline hazards, data hazards, control hazards. Techniques to handle hazards, performance improvement with pipelines and effect of hazards on the performance. Vector processors- Use and effectiveness, memory to memory vector architectures, vector register architecture, vector length and stride issues, compiler effectiveness in vector processors. SISD, MISD, MIMD, Single instruction multiple data stream (SIMD) architectures. Array processors, comparison with vector processors, example of array processors such as MMX Technology.

2. Data Representation and Basic Computer Arithmetic (6 lectures)

Number systems, complements, fixed and floating point representation, character representation, addition, subtraction, magnitude comparison, multiplication and division algorithms for integers

3. Basic Computer Organization and Design (5 lectures)

Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt, Interconnection Structures, Bus Interconnection design of basic computer.

4. Central Processing Unit (5 lectures)

Register organization, arithmetic and logical micro-operations, stack organization, micro programmed control. Instruction formats, addressing modes, instruction codes, machine language, assembly language, input output programming, RISC, CISC architectures, pipelining and parallel architecture.

5. Memory Organization (4 lectures)

Cache memory, Associative memory, mapping.

6. Input-Output Organization (4 lectures)

Input / Output: External Devices, I/O Modules, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access, I/O Channels.

Recommended Books:

1. M. Mano, Computer System Architecture, Pearson Education 1992
2. A. J. Dos Reis, Assembly Language and Computer Architecture using C++ and JAVA, Course Technology, 2004
3. W. Stallings, Computer Organization and Architecture Designing for Performance, 8th Edition, Prentice Hall of India, 2009
4. Digital Design, M.M. Mano, Pearson Education Asia

COMPUTER SCIENCE (C-VI): Formal Language (Automata)

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

Finite State Machines : Definition, concept of sequential circuits, state table & state assignments, concept of synchronous, asynchronous and linear sequential machines. Finite State Models : Basic definition, mathematical representation, Moore versus Mealy m/c, capability & limitations of FSM, state equivalence & minimization, machine equivalence, incompletely specified machines, merger graph & compatibility graph, merger table, Finite memory, definite, information loss less & inverse machines : testing table & testing graph. Structure of Sequential Machines : Concept of partitions, closed partitions, lattice of closed partitions, decomposition : serial & parallel. Finite Automata : Preliminaries (strings, alphabets & languages, graphs & trees, set & relations), definition, recognition of a language by an automata - idea of grammar, DFA, NFA, equivalence of DFA and NFA, NFA with moves, regular sets & regular expressions : equivalence with finite automata, NFA from regular expressions, regular expressions from DFA, two way finite automata equivalence with one way, equivalence of Moore & Mealy machines, applications of finite automata. Closure Properties of Regular Sets : Pumping lemma & its application, closure properties minimization of finite automata : minimization by distinguishable pair, Myhill-Nerode theorem. Context Free Grammars : Introduction, definition, derivation trees, simplification, CNF & GNF. Pushdown Automata : Definition, moves, Instantaneous Descriptions, language recognised by PDA, deterministic PDA, acceptance by final state & empty stack, equivalence of PDA and CFL. Closure Properties of CFLs : Pumping lemma & its applications, Ogden's lemma, closure properties, decision algorithms. Introduction to Z. Regular language properties and their grammars. Context sensitive languages.

Text books :

1. Hopcroft JE. and Ullman JD., "Introduction to Automata Theory, Languages & Computation", Narosa.
2. K.L.P Mishra & N. Chandrasekharan – "Theory of Computer Science", PHI
3. Martin—Introduction
4. Lewis H. R. and Papadimitrou C. H., "Elements of the theory of Computation", P.H.I.
5. Kain, "Theory of Automata & Formal Language", McGraw Hill.

References :

1. Kohavi ZVI, "Switching & Finite Automata", 2nd Edn., Tata McGraw Hill.
2. Linz Peter, "An Introduction to Formal Languages and Automata", Narosa
3. "Introduction to Formal Languages", Tata McGraw Hill, 1983.

COMPUTER SCIENCE (C-VII): Data Structures

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

- 1. Arrays (2 Lectures)**
Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation)
- 2. Stacks (3 Lectures)**
Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack
- 3. Linked Lists (4 Lectures)**
Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists
- 4. Queues (3 Lectures)**
Array and Linked representation of Queue, De-queue, Priority Queues
- 5. Recursion (3 lectures)**
Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Understanding what goes behind Recursion (Internal Stack Implementation)
- 6. Trees (5 Lectures)**
Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).
- 7. Searching and Sorting (5 Lectures)**
Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques
- 8. Hashing (5 Lectures)**
Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table Reordering, Resolving collision by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function

Reference Books:

1. Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning, 2012.
2. SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
3. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++", Second edition, PHI, 2009.
4. Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
5. D.S Malik, Data Structure using C++,Second edition, Cengage Learning, 2010.
6. Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rd

edition, 2011

7. Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using Java, 2003.
8. Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan Computer Pub,2003
9. John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2 edition, 2009
10. Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition, Wiley
11. Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata McGraw Hill, 2014.
12. D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003.

COMPUTER SCIENCE LAB (C-VII): Data Structures Lab

Practical: 8Lectures

1. Write a program to search an element from a list. Give user the option to perform Linear or Binary search. Use Template functions.
2. WAP using templates to sort a list of elements. Give user the option to perform sorting using Insertion sort, Bubble sort or Selection sort.
3. Implement Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list and concatenate two linked lists (include a function and also overload operator +).
4. Implement Doubly Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
5. Implement Circular Linked List using templates. Include functions for insertion, deletion and search of a number, reverse the list.
6. Perform Stack operations using Linked List implementation.
7. Perform Stack operations using Array implementation. Use Templates.
8. Perform Queues operations using Circular Array implementation. Use Templates.
9. Create and perform different operations on Double-ended Queues using Linked List implementation.
10. WAP to scan a polynomial using linked list and add two polynomial.
11. WAP to calculate factorial and to compute the factors of a given no. (i)using recursion, (ii) using iteration
12. (ii) WAP to display fibonacci series (i)using recursion, (ii) using iteration
13. WAP to calculate GCD of 2 number (i) with recursion (ii) without recursion
14. WAP to create a Binary Search Tree and include following operations in tree:
 - (a) Insertion (Recursive and Iterative Implementation)
 - (b) Deletion by copying
 - (c) Deletion by Merging
 - (d) Search a no. in BST
 - (e) Display its preorder, postorder and inorder traversals Recursively
 - (f) Display its preorder, postorder and inorder traversals Iteratively
 - (g) Display its level-by-level traversals
 - (h) Count the non-leaf nodes and leaf nodes
 - (i) Display height of tree
 - (j) Create a mirror image of tree
 - (k) Check whether two BSTs are equal or not
15. WAP to convert the Sparse Matrix into non-zero form and vice-versa.
16. WAP to reverse the order of the elements in the stack using additional stack.

17. WAP to reverse the order of the elements in the stack using additional Queue.
18. WAP to implement Diagonal Matrix using one-dimensional array.
19. WAP to implement Lower Triangular Matrix using one-dimensional array.
20. WAP to implement Upper Triangular Matrix using one-dimensional array.
21. WAP to implement Symmetric Matrix using one-dimensional array.
22. WAP to create a Threaded Binary Tree as per inorder traversal, and implement operations like finding the successor / predecessor of an element, insert an element, inorder traversal.
23. WAP to implement various operations on AVL Tree.

COMPUTER SCIENCE (C-VIII): Software Engineering

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction (4 Lectures)

The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

2. Requirement Analysis (5 Lectures)

Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

3. Software Project Management (4 Lectures)

Estimation in Project Planning Process, Project Scheduling.

4. Risk Management (4 Lectures)

Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.

5. Quality Management (4 Lectures)

Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

6. Design Engineering (5 Lectures)

Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.

7. Testing Strategies & Tactics (4 Lectures)

Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System Testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

Recommended Books:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw-Hill, 2009.
2. P Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing

House, 2003.

3. K.K. Aggarwal and Y. Singh, Software Engineering (revised 2nd Edition), New Age International Publishers, 2008.
4. I. Sommerville, Software Engineering (8th edition), Addison Wesley, 2006.
5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005.
6. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India, 2004.

COMPUTER SCIENCE (C-IX): Computer Networks

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Computer Networks (3 Lectures)

Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

2. Data Communication Fundamentals and Techniques (5 Lectures)

Analog and digital signal; data-rate limits; digital to digital line encoding schemes; pulse code modulation; parallel and serial transmission; digital to analog modulation; multiplexing techniques- FDM, TDM; transmission media.

3. Networks Switching Techniques and Access mechanisms (5 Lectures)

Circuit switching; packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.

4. Data Link Layer Functions and Protocol (5 Lectures)

Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet.

5. Multiple Access Protocol and Networks (3 Lectures)

CSMA/CD protocols; Ethernet LANs; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways;

6. Networks Layer Functions and Protocols (3 Lectures)

Routing; routing algorithms; network layer protocol of Internet- IP protocol, Internet control protocols.

7. Transport Layer Functions and Protocols (3 Lectures)

Transport services- error and flow control, Connection establishment and release- three way

handshake;

8. Overview of Application layer protocol

(3 Lectures)

Overview of DNS protocol; overview of WWW &HTTP protocol.

Reference Books

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM Publishing Company Ltd 2007.
2. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI Pvt. Ltd 2002

COMPUTER SCIENCE (C-X): Object Oriented Programming in JAVA

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Java

(3 Lectures)

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

2. Arrays, Strings and I/O

(4 Lectures)

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

3. Object-Oriented Programming Overview

(4 Lectures)

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

3. Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata (7 lectures)

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

4. Exception Handling, Threading, Networking and Database Connectivity (7 Lectures)

Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

5. Applets and Event Handling

(5 Lectures)

Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts.

Reference Books

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

COMPUTER SCIENCE LAB (C-X): Object Oriented Programming in JAVA Lab 08 Lectures

1. To find the sum of any number of integers entered as command line arguments
2. To find the factorial of a given number
3. To learn use of single dimensional array by defining the array dynamically.
4. To learn use of in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
8. Write a program that show working of different functions of String and StringBuffer class like setCharAt(), setLength(), append(), insert(), concat() and equals().
9. Write a program to create a "distance" class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer
10. Modify the "distance" class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
11. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions (from lower to higher data type)
12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword
13. Write a program to show the use of static functions and to pass variable length arguments in a function.

14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program “DivideByZero” that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write a program to create URL object, create a URL Connection using the openConnection() method and then use it examine the different components of the URL content.
24. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.
25. Write a program that creates a Banner and then creates a thread to scrolls the message in the banner from left to right across the applet’s window.
26. Write a program to get the URL/location of code (i.e. java code) and document(i.e. html file).
27. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
28. Write a program to demonstrate different keyboard handling events.
29. Write a program to generate a window without an applet window using main() function.
30. Write a program to demonstrate the use of push buttons.

COMPUTER SCIENCE (C-XI): Design and Analysis of Algorithms

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction

(2 Lectures)

Basic Design and Analysis techniques of Algorithms, Correctness of Algorithm.

2. Algorithm Design Techniques

(4 Lectures)

Iterative techniques, Divide and Conquer, DynamicProgramming, Greedy Algorithms.

3. Sorting and Searching Techniques

(8 Lectures)

Elementary sorting techniques-Bubble Sort, InsertionSort, Merge Sort, Advanced Sorting techniques - Heap Sort, Quick Sort, Sorting in Linear Time - Bucket Sort, Radix Sort and Count Sort, Searching Techniques, Medians & Order Statistics, complexity analysis;

4. Lower Bounding Techniques

(4 Lectures)

Decision Trees

5. Balanced Trees (4 Lectures)
Red-Black Trees

6. Advanced Analysis Technique (4 Lectures)
Amortized analysis

7. Graphs (4 Lectures)
Graph Algorithms-Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees.

Recommended Books:

1. T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein Introduction to Algorithms, PHI, 3rd Edition 2009
2. Sarabasse& A.V. Gelder Computer Algorithm - Introduction to Design and Analysis, Publisher - Pearson 3rd Edition 1999

COMPUTER SCIENCE LAB (C-XII): Computer Graphics

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1.Introduction (3 Lectures)

Basic elements of Computer graphics, Applications of Computer Graphics.

2. Graphics Hardware (5 Lectures)

Architecture of Raster and Random scan display devices, input/output devices.

3. Fundamental Techniques in Graphics (10 Lectures)

Raster scan line, circle and ellipse drawing, thick primitives, Polygon filling, line and polygon clipping algorithms, 2D and 3D Geometric Transformations, 2D and 3D Viewing Transformations (Projections- Parallel and Perspective), Vanishing points.

4. Geometric Modeling (5 Lectures)

Representing curves & Surfaces.

5. Visible Surface determination (4 Lectures)

Hidden surface elimination.

6.Surface rendering (3 Lectures)

Illumination and shading models. Basic color models and Computer Animation.

Books Recommended:

1. J.D.Foley, A.Van Dan, Feiner, Hughes Computer Graphics Principles & Practice 2nd edition Publication Addison Wesley 1990.
2. D.Hearn, Baker: Computer Graphics, Prentice Hall of India 2008.
3. D.F.Rogers Procedural Elements for Computer Graphics, McGraw Hill 1997.
4. D.F.Rogers, Adams Mathematical Elements for Computer Graphics, McGraw Hill 2nd edition 1989.

COMPUTER SCIENCE LAB (C-XII): Computer Graphics Lab

Practical: 08 Lectures

1. Write a program to implement Bresenham's line drawing algorithm.
2. Write a program to implement mid-point circle drawing algorithm.
3. Write a program to clip a line using Cohen and Sutherland line clipping algorithm.
4. Write a program to clip a polygon using Sutherland Hodgeman algorithm.
5. Write a program to fill a polygon using Scan line fill algorithm.
6. Write a program to apply various 2D transformations on a 2D object (use homogenous coordinates).
7. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.
8. Write a program to draw Hermite /Bezier curve.

COMPUTER SCIENCE (C-XIII): Compiler Design

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Module I Introduction

Introduction to Compiling (2 Lectures)

Compilers, Analysis-synthesis model , The phases of the compiler, Cousins of the compiler.

Lexical Analysis (5 Lectures)

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

2. Module II Syntax Analysis (7 Lectures)

The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques. Syntax directed translation (4 Lectures)

Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

3. Module III Type checking (4 Lectures)

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions Run time environments

Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

4. Module IV. (8 Lectures)

Intermediate code generation

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations

Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.

2. Holub - "Compiler Design in C" – PHI

3. Tremblay and Sorenson Compiler Writing-McgrawHill International .

4. Chattopadhyay , S- Compiler Design (PHI)

COMPUTER SCIENCE (C-XIV): Database Management Systems

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1.Introduction (4 Lectures)

Characteristics of database approach, data models, database system architecture and data independence.

2. Entity Relationship(ER) Modeling (4 Lectures)

Entity types, relationships, constraints.

3. Relation data model (10 Lectures)

Relational model concepts, relational constraints, relational algebra, SQL queries

4. Database design (15 Lectures)

Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF).

5. Transaction Processing

(3 Lectures)

ACID properties, concurrency control

6. File Structure and Indexing

(8 Lectures)

Operations on files, File of Unordered and ordered records, overview of File organizations, Indexing structures for files(Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.

Books Recommended:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishnan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.

COMPUTER SCIENCE LAB (C-X): Database Management Systems Lab

Practical: 08 Lectures

Create and use the following database schema to answer the given queries.

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

EMPLOYEE Schema

DEPARTMENT Schema

Field	Type	NULL	KEY	DEFAULT
Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the

- Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
 3. Query to display the Employee Name concatenated by a Job separated by a comma.
 4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
 5. Query to display the Employee Name and Salary of all the employees earning more than \$2850.
 6. Query to display Employee Name and Department Number for the Employee No= 7900.
 7. Query to display Employee Name and Salary for all employees whose salary is not in the range of \$1500 and \$2850.
 8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
 9. Query to display Name and Hire Date of every Employee who was hired in 1981.
 10. Query to display Name and Job of all employees who don't have a current Manager.
 11. Query to display the Name, Salary and Commission for all the employees who earn commission.
 12. Sort the data in descending order of Salary and Commission.
 13. Query to display Name of all the employees where the third letter of their name is 'A'.
 14. Query to display Name of all employees either have two 'R's or have two ' A's in their name and are either in Dept No = 30 or their Manger's Employee No = 7788.
 15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
 16. Query to display the Current Date.
 17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
 18. Query to display Name and calculate the number of months between today and the date each employee was hired.
 19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
 20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
 21. Query to display Name, Hire Date and Day of the week on which the employee started.

22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an 'A' in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies \$100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.
35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department.

Discipline Specific Elective Papers COMPUTER SCIENCE: (Credit: 06 each) - DSE-1 ,DSE-2,DSE-3,DSE- 4.

DSE - 1 (any one)

1(A) Numerical Methods

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 lectures

Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors. (5L)

Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. (5L)

Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. (4L)

Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method. (6L)

Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method. (4L)

Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method. (6L)

Text Books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).

REFERNCE BOOKS:

1. Balagurusamy: Numerical Methods, Scitech.
2. Baburam: Numerical Methods, Pearson Education.
3. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
4. Soumen Guha & Rajesh Srivastava: Numerical Methods, OUP.
5. Srimanta Pal: Numerical Methods, OUP.
6. Laurence V. Fausett, Applied Numerical Analysis, Using MATLAB, Pearson, 2/e (2012)
7. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publisher, 6/e (2012)
8. Steven C Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists,

Tata McGraw Hill, 2/e (2010)

1(B) Advanced Algorithms

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory : 30

Advanced Data Structures

5hrs

Fibonacci heaps, Priority Queues. Dynamic Data Structures.

Divide and Conquer 4 hrs

Closest pair of points, Integer Multiplication, Convolutions and Fast Fourier Transforms

Greedy 3 hrs

Interval Scheduling, Proving optimality using Stays Ahead and Exchange Arguments.

Dynamic Programming 4 hrs

Principles of Dynamic Programming, Weighted Interval Scheduling, Segmented Least Squares, Subset Sums and Knapsacks

Network Flows 5 hrs

Max-flow problem, Ford Fulkerson Algorithm, Maximum flows and Minimum Cuts in a network, Bipartite Matching.

NP Completeness 9 hrs

Polynomial time reductions, Reduction via gadgets (satisfiability problem), Efficient Certification and Definition of NP, NP Complete problems, Sequencing problems, Partitioning problems, co-NP and asymmetry of NP.

Books Recommended:

1. Jon Kleinberg and Eva Tardos, Algorithm Design, Pearson Education, 2006
2. Cormen, Leiserson, Rivest and Stein, Introduction to Algorithms, Prentice Hall of India, Third Edition
3. Vijay V. Vazirani, Approximation algorithms, Springer

DSE - 2 (any one)

2(A) Artificial Intelligence

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory : 30

1.Introduction (03 Lectures)

Introduction to Artificial Intelligence, Background and Applications, Turing Test and Rational Agent approaches to AI, Introduction to Intelligent Agents, their structure, behavior and environment.

2.Problem Solving and Searching Techniques (10 Lectures)

Problem Characteristics, Production Systems, Control Strategies, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristics Search Techniques: Best First Search, A* algorithm, Constraint Satisfaction Problem, Means-End Analysis, Introduction to Game Playing, Min-Max and Alpha-Beta pruning algorithms.

3.Knowledge Representation (10 Lectures)

Introduction to First Order Predicate Logic, Resolution Principle, Unification, Semantic Nets, Conceptual Dependencies, Frames, and Scripts, Production Rules, Conceptual Graphs.

Programming in Logic (PROLOG)

4.Dealing with Uncertainty and Inconsistencies (04 Lectures)

Truth Maintenance System, Default Reasoning, Probabilistic Reasoning, Bayesian Probabilistic Inference, Possible World Representations.

5.Understanding Natural Languages (03 Lectures)

Parsing Techniques, Context-Free and Transformational Grammars, Recursive and Augmented Transition Nets.

BOOKS RECOMMENDED:

1. DAN.W. Patterson, Introduction to A.I and Expert Systems – PHI, 2007.
2. Russell &Norvig, Artificial Intelligence-A Modern Approach, LPE, Pearson Prentice Hall, 2nd edition, 2005.
3. Rich & Knight, Artificial Intelligence – Tata McGraw Hill, 2nd edition, 1991.
4. W.F. Clocksin and Mellish, Programming in PROLOG, Narosa Publishing House, 3rd edition, 2001.
5. Ivan Bratko, Prolog Programming for Artificial Intelligence, Addison-Wesley, Pearson Education, 3rd edition, 2000.

2(B) Microprocessor

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory : 30

Microprocessor architecture: [10 L]

Internal architecture, system bus architecture, memory and I/O interfaces.

Microprocessor programming: [10 L]

Register Organization, instruction formats, assembly language programming.

Interfacing: [10 L]

Memory address decoding, cache memory and cache controllers, I/O interface, keyboard, display, timer, interrupt controller, DMA controller, video controllers, communication interfaces.

Recommended Books:

1. Barry B. Brey : The Intel Microprocessors : Architecture, Programming and Interfacing.Pearson Education, Sixth Edition.2009
2. Walter A Triebel, Avtar Singh; The 8088 and 8086 Microprocessors Programming, Interfacing, Software, Hardware, and Applications. PHI, Fourth Edition 2005.

DSE - 3 (any one)

3(A) Information Security and Cryptography

Total Marks: 50

Theory: 40

Internal Assessment: 10

1. Introduction

[3L]

Security, Attacks, Computer Criminals, Security Services, Security Mechanisms.

2. Cryptography

[8L]

Substitution ciphers, Transpositions Cipher, Confusion, diffusion, Symmetric, Asymmetric Encryption. DES Modes of DES, Uses of Encryption, Hash function, key exchange, Digital Signatures, Digital Certificates.

3. Program Security

[4L]

Secure programs, Non malicious Program errors, Malicious codes virus, Trap doors, Salami attacks, Covert channels, Control against program

4. Threats.

[4L]

Protection in OS: Memory and Address Protection, Access control, File Protection, User Authentication.

5. Database Security

[3L]

Requirements, Reliability, Integrity, Sensitive data, Inference, Multilevel Security.

6. Security in Networks

[4L]

Threats in Networks, Security Controls, firewalls, Intrusion detection systems, Secure e-mails

7. Administrating Security

[4L]

Security Planning, Risk Analysis, Organisational Security Policy, Physical Security. Ethical issues in Security: Protecting Programs and data. Information and law.

Recommended Books:

1. C. P. Pfleeger, S. L. Pfleeger; Security in Computing, Prentice Hall of India, 2006

2. W. Stallings; Network Security Essentials: Applications and Standards, 4/E, 2010

3(B) Operation Research for Computer Science

Total Marks: 50

Theory: 40

Internal Assessment: 10

Module I

Linear Programming Problems (LPP):

[4L]

Basic LPP and Applications; Various Components of LP Problem Formulation.

Solution of Linear Programming Problems:

[8L]

Solution of LPP: Using Simultaneous Equations and Graphical Method;

Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution,

Convex set and explanation with examples.

Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.

Module II

Network Analysis:

[4L]

Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded).

Inventory Control:

[2L]

Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.

Module III

Game Theory:

[6L]

Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance.

Module IV

Queuing Theory:

[6L]

Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue

Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.

5L

Text Books:

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

References:

1. Kanti Swaroop — "Operations Research", Sultan Chand & Sons
2. Rathindra P. Sen—"Operations Research: Algorithms and Applications", PHI
3. R. Panneerselvam - "Operations Research", PHI
4. A.M. Natarajan, P. Balasubramani and A. Tamilarasi - "Operations Research", Pearson
5. M. V. Durga Prasad – "Operations Research", CENGAGE Learning
6. J. K. Sharma - "Operations Research", Macmillan Publishing Company

DSE - 4 (any one)

4(A) Digital Image Processing

Total Marks: 50

Theory: 40

Internal Assessment: 10

1. Introduction

(3 Lectures)

Light, Brightness adaption and discrimination, Pixels, coordinate conventions, Imaging Geometry, Perspective Projection, Spatial Domain Filtering, sampling and quantization.

2. Spatial Domain Filtering

(3 Lectures)

Intensity transformations, contrast stretching, histogram equalization, Correlation and convolution, Smoothing filters, sharpening filters, gradient and Laplacian.

3. Filtering in the Frequency domain

(5 Lectures)

Hotelling Transform, Fourier Transforms and properties, FFT (Decimation in Frequency and Decimation in Time Techniques), Convolution, Correlation, 2-D sampling, Discrete Cosine Transform, Frequency domain filtering.

4. Image Restoration

(4 Lectures)

Basic Framework, Interactive Restoration, Image deformation and geometric transformations, image morphing, Restoration techniques, Noise characterization, Noise restoration filters, Adaptive filters, Linear, Position invariant degradations, Estimation of Degradation functions, Restoration from projections.

5. Image Compression

(5 Lectures)

Encoder-Decoder model, Types of redundancies, Lossy and Lossless compression, Entropy of an information source, Shannon's 1st Theorem, Huffman Coding, Arithmetic Coding, Golomb Coding, LZW coding, Transform Coding, Sub-image size selection, blocking artifacts, DCT implementation

using FFT, Run length coding, FAX compression (CCITT Group-3 and Group-4), Symbol-based coding, JBIG-2, Bit-plane encoding, Bit-allocation, Zonal Coding, Threshold Coding, JPEG, Lossless predictive coding, Lossy predictive coding, Motion Compensation

6. Wavelet based Image Compression

(3 Lectures)

Expansion of functions, Multi-resolution analysis, Scaling functions, MRA refinement equation, Wavelet series expansion, Discrete Wavelet Transform (DWT), Continuous Wavelet Transform, Fast Wavelet Transform, 2-D wavelet Transform, JPEG-2000 encoding, Digital Image Watermarking.

7. Morphological Image Processing

(3 Lectures)

Basics, SE, Erosion, Dilation, Opening, Closing, Hit-or-Miss Transform, Boundary Detection, Hole filling, Connected components, convex hull, thinning, thickening, skeletons, pruning, Geodesic Dilation, Erosion, Reconstruction by dilation and erosion.

8. Image Segmentation

(4 Lectures)

Boundary detection based techniques, Point, line detection, Edge detection, Edge linking, local processing, regional processing, Hough transform, Thresholding, Iterative thresholding, Otsu's method, Moving averages, Multivariable thresholding, Region-based segmentation, Watershed algorithm, Use of motion in segmentation

Reference Books

1. R C Gonzalez , R E Woods, Digital Image Processing, 3rd Edition, Pearson Education.
2. A K Jain, Fundamentals of Digital image Processing, Prentice Hall of India.
3. K R Castleman, Digital Image Processing, Pearson Education.
4. Schalkoff, Digital Image Processing and Computer Vision, John Wiley and Sons.
5. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.

4(B) Project work / Dissertation

Total Marks: 50

Project:50

30 Lectures

This option is to be offered only in 6th Semester.

The students will be allowed to work on any project based on the concepts studied in core / elective or skill based elective courses.

The group size should be maximum of three (03) students.

Each group will be assigned a teacher as a supervisor who will handle both their theory as well lab classes.

A maximum of Four (04) projects would be assigned to one teacher.

Skill Enhancement Courses (Credit: 02 each) - SEC1 , SEC2

SEC - 1

Total Marks: 50

Theory: 40

Internal Assessment: 10

30 Lectures

1(A) Internet Technologies

Java (5 lectures)

Use of Objects, Array and ArrayList class

JavaScript (10 lectures)

Data types, operators, functions, control structures, events and event handling.

JDBC (5 lectures)

JDBC Fundamentals, Establishing Connectivity and working with connection interface, Working with statements, Creating and Executing SQL Statements, Working with Result Set Objects.

JSP (10 lectures)

Introduction to JavaServer Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values, Using an expression to Set an Attribute, Declaring Variables and Methods, Error Handling and Debugging, Sharing Data Between JSP Pages, Requests, and Users, Database Access.

Java Beans (10 lectures)

Java Beans Fundamentals, JAR files, Introspection, Developing a simple Bean, Connecting to DB

Recommended Books:

1. Web Enabled Commercial Application Development Using Html, Dhtml, javascript, Perl Cgi By Ivan Bayross, BPB Publications, 2009.
2. BIG Java Cay Horstmann, Wiley Publication , 3rd Edition., 2009
3. Java 7, The Complete Reference, Herbert Schildt, 8th Edition, 2009.
4. The Complete Reference J2EE, TMH, Jim Keogh, 2002.
5. Java Server Pages, Hans Bergsten, Third Edition, O'Reilly Media December 2003.

1. (B) UNIX AND SHELL PROGRAMMING

INTRODUCTION

10L

- What is linux/unix Operating systems
- Difference between linux/unix and other operating systems
- Features and Architecture
- Various Distributions available in the market
- Installation, Booting and shutdown process

System processes (an overview)

- External and internal commands
- Creation of partitions in OS
- Processes and its creation phases – Fork, Exec, wait

User Management and the File System

10L

Types of Users, Creating users, Granting rights

- User management commands
- File quota and various file systems available
- File System Management and Layout, File permissions
- Login process, Managing Disk Quotas
- Links (hard links, symbolic links)

Shell introduction and Shell Scripting

(10L)

- What is shell and various type of shell, Various editors present in linux
- Different modes of operation in vi editor
- What is shell script, Writing and executing the shell script
- Shell variable (user defined and system variables)
- System calls, Using system calls
- Pipes and Filters
- Decision making in Shell Scripts (If else, switch), Loops in shell
- Functions
- Utility programs (cut, paste, join, tr , uniq utilities)
- Pattern matching utility (grep)

Reference Books:

1. Sumitabha, Das, Unix Concepts And Applications, Tata McGraw-Hill Education, 2006
2. Michael Jang RHCSA/ RHCE Red Hat Linux Certification: Exams (Ex200 & Ex300) (Certification Press), 2011
3. Nemeth Synder & Hein, Linux Administration Handbook, Pearson Education, 2nd Edition ,2010
4. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Unix Network Programming, The sockets Networking API, Vol. 1, 3rd Edition,2014

SEC - 2

Total Marks: 50

Theory: 40

Internal Assessment: 10

30 Lectures

2(A) Visual Programming

INTRODUCTION

Windows concepts and terminology, key elements [12]

Creating the look, communication via messages, windows resources and functions, adding multimedia and sound resources

Writing windows applications, taking control of windows, adding menus, dialog boxes,

Special controls. Concepts of X-Windows System & programming. [15]

Introduction to Visual Basic & difference with BASIC. Concept about form Project, Application, Tools, Toolbox, Controls & Properties. Idea about Labels, Buttons, Text Boxes.

Data basics, Different type variables & their use in VB, sub-functions & Procedure details, Input box () & MsgBox ().

Making decisions, looping

List boxes & Data lists, List Box control, Combo Boxes, data Arrays.

Frames, buttons, check boxes, timer control, Programming with data, built in functions, ODBC data base connectivity.

Data form Wizard, query, and menus in VB Applications, Graphics.

Books:

1. Visual Basic 6 from the Ground Up, Cornell, TMH
2. Visual Basic 6, CDG, TMH
3. Visual Basic 6, Dietel, Pearson
4. Visual basic 6.0 in 30 days, Krishnan, Scitech
5. Beginning VB 6, Wright, SPD/WROX
6. Visual Basic Complete, Prasenjit Sinha, S. Chand
7. Win32 API Programming With VB, Roman, SPD/O'REILLY

2(B) Web Technology

Introduction

The Basics

Dynamic Web Pages [2L]

The need of dynamic web pages; an overview of DHTML, cascading style sheet (css), comparative studies of different technologies of dynamic page creation

Active Web Pages [2L]

Need of active web pages; java applet life cycle.

Java Script [3L]

Data types, variables, operators, conditional statements, array object, date object, string object.

Java Servlet [4L]

Servlet environment and role, HTML support, Servlet API, The servlet life cycle, Cookies and Sessions.

JSP [15L]

JSP architecture, JSP servers, JSP tags, understanding the layout in JSP, Declaring variables, methods in JSP, inserting java expression in JSP, processing request from user and generating dynamic response for the user, inserting applets and java beans into JSP, using include and forward action, comparing JSP and CGI program, comparing JSP and ASP program; Creating ODBC data source name, introduction to JDBC, prepared statement and callable statement.

J2EE [4L]

An overview of J2EE web services, basics of Enterprise Java Beans, EJB vs. Java Beans, basics of RMI, JNI.

Books:

1. Web Technologies - Godbole A. S. & Kahate A., TMH.
2. Web Technology & Design - Xavier C., New Age Publication.
3. Java Server Programming, J2EE edition. (VOL I and VOL II); WROX publishers
4. X-Window System, R.W.Scheifler & J. Gettys, PHI.

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2017-18)



SYLLABUS OF COURSES TO BE OFFERED

(General Elective for students other than B.Sc. (Hons.) Computer Science)

Disclaimer: The CBCS syllabus is uploaded as given by the Faculty concerned to the Academic Council. The same has been approved as it is by the Academic Council on 13.7.2015 and Executive Council on 14.7.2015. Any query may kindly be addressed to the concerned Faculty.

Undergraduate Programme Secretariat

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

- 1. Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
- 2. Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
 - 2.3 Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
- 3. Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
 - 3.1 AE Compulsory Course (AECC):** Environmental Science, English Communication/MIL Communication.
 - 3.2 AE Elective Course (AEEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of courses under B.A (Honors), B.Com (Honors) & B.Sc. (Honors) Course

	*Credits	
	Theory+ Practical	Theory + Tutorial
I. Core Course (14 Papers)		
	14X4= 56	14X5=70
Core Course Practical / Tutorial* (14 Papers)		
	14X2=28	14X1=14
II. Elective Course (8 Papers)		
A.1. Discipline Specific Elective (4 Papers)	4X4=16	4X5=20
A.2. Discipline Specific Elective Practical/ Tutorial* (4 Papers)	4 X 2=8	4X1=4
B.1. Generic Elective/ Interdisciplinary (4 Papers)	4X4=16	4X5=20
B.2. Generic Elective Practical/ Tutorial* (4 Papers)	4 X 2=8	4X1=4
• Optional Dissertation or project work in place of one Discipline Specific Elective paper (6 credits) in 6th Semester		

III. Ability Enhancement Courses

1. Ability Enhancement Compulsory

(2 Papers of 2 credit each) 2 X 2=4 2 X 2=4

Environmental Science English/MIL

Communication

2. Ability Enhancement Elective (Skill

Based) 4 X 1=4 4X 1=4

(Minimum 2) 2 X 1=2 2 X 1=2

(2 Papers of One 4 credit and one 2 credit)

Total credit 142 142

Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS/related courses on its own.

*** wherever there is a practical there will be no tutorial and vice-versa**

General Elective Papers (GE) (Minor - Computer Science) for other Departments/Disciplines: (Credit: 06 each)

GE – 1

Computer Fundamentals

Theory: 30

lectures Introduction: Introduction to computer system, uses, types. [3L]

Data Representation: Number systems and character representation, binary [3L]

Human Computer Interface: Types of software, Operating system as user interface, utility programs [4L]

Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter [6L]

Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks [4L]

Computer Organisation and Architecture: C.P.U., registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.

[5L]

Overview of Emerging Technologies: Bluetooth, cloud computing, big data, data mining, mobile computing and embedded systems. [5L]

Reference Books:

1. A. Goel, Computer Fundamentals, Pearson Education, 2010.
2. P. Aksoy, L. DeNardis, Introduction to Information Technology, Cengage Learning, 2006
3. P. K.Sinha, P. Sinha, Fundamentals of Computers, BPB Publishers, 2007

GE- 2

Introduction to Programming

Theory: 60 lectures

Introduction to C and C++ (3Lectures)

History of C and C++, Overview of Procedural Programming and Object-Orientation Programming, Using main() function, Compiling and Executing Simple Programs in C++.

Data Types, Variables, Constants, Operators and Basic I/O (4Lectures)

Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putchar), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.hetc).

Expressions, Conditional Statements and Iterative Statements (4Lectures)

Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch-case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

Functions and Arrays (4Lectures)

Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions

parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments.

Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Twodimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

Derived Data Types (Structures and Unions) (4Lectures)

Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members.

File I/O, Preprocessor Directives (4Lectures)

Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

Using Classes in C++ (4Lectures)

Principles of Object-Oriented Programming, Defining & Using Classes, Class Constructors, Constructor Overloading, Function overloading in classes, Class Variables & Functions, Objects as parameters, Specifying the Protected and Private Access, Copy Constructors, Overview of Template classes and their use.

Inheritance and Polymorphism (3Lectures)

Introduction to Inheritance and Polymorphism

Reference Books:

1. Herbtz Schildt, "C++: The Complete Reference", Fourth Edition, McGraw Hill.
2. E Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw-Hill Education, 2008.
3. Paul Deitel, Harvey Deitel, "C++ How to Program", 8th Edition, Prentice Hall, 2011.
4. John R. Hubbard, "Programming with C++", Schaum's Series, 2nd Edition, 2000.
5. Harry, H. Chaudhary, "Head First C++ Programming: The Definitive Beginner's Guide", First Create space Inc, O-D Publishing, LLC USA.

Introduction to Programming Lab

Practical: 15 lectures

1. Write a program to find greatest of three numbers.
2. Write a program to find gross salary of a person
3. Write a program to find grade of a student given his marks.
4. Write a program to find divisor or factorial of a given number.
5. Write a program to print first ten natural numbers.
6. Write a program to print first ten even and odd numbers.
7. Write a program to find grade of a list of students given their marks.
8. Create Matrix class. Write a menu-driven program to perform following Matrix operations (2-D array implementation): a) Sum b) Difference c) Product d) Transpose

GE- 3

Computer Networks and Internet Technologies

Theory: 30 lectures

Computer Networks: Introduction to computer network, data communication,

3L components of data communication, data transmission mode, data communication measurement, LAN, MAN, WAN, wireless LAN, internet, intranet, extranet. 3L

Network Models: Client/ server network and Peer-to-peer network, OSI, TCP/IP, layers and functionalities.

3L

Transmission Media: Introduction, Guided Media: Twisted pair, Coaxial cable, Optical fiber. Unguided media: Microwave, Radio frequency propagation, Satellite.

3L

LAN Topologies: Ring, bus, star, mesh and tree topologies.

2L

Network Devices: NIC, repeaters, hub, bridge, switch, gateway and router.

2L

Internet Terms: Web page, Home page, website, internet browsers, URL, Hypertext, ISP, Web server, download and upload, online and offline.

3L

Internet Applications: www, telnet, ftp, e-mail, social networks, search engines, Video Conferencing, e-Commerce, m-Commerce, VOIP, blogs.

3L

Introduction to Web Design: Introduction to hypertext markup language (html)

Document type definition, creating web pages, lists, hyperlinks, tables, web forms, inserting images, frames, hosting options and domain name registration. Customized Features: Cascading style sheet (css) for text formatting and other manipulations.

8L

Reference Books:

1. Computer networks - Tannenbaum
2. Data Communication and Networking - Forouzan - Tata McGraw Hill.
3. D.R. Brooks, An Introduction to HTML and Javascript for Scientists and Engineers, Springer W. Willard, 4.HTML A Beginner's Guide, Tata McGraw-Hill Education, 2009.
4. J. A. Ramalho, Learn Advanced HTML 4.0 with DHTML, BPB Publications, 2007

GE- 4

Information Security and Cyber Laws

Theory: 30 lectures

Course Introduction:

[4L]

Computer network as a threat, hardware vulnerability, software vulnerability, importance of data security.

Digital Crime:

[4L]

Overview of digital crime, criminology of computer crime.

Information Gathering Techniques: [4L]

Tools of the attacker, information and cyber warfare, scanning and spoofing, password cracking, malicious software, session hijacking

Risk Analysis and Threat: [4L]

Risk analysis, process, key principles of conventional computer security, security policies, authentication, data protection, access control, internal vs external threat, security assurance, passwords, authentication, and access control, computer forensics and incident response

Introduction to Cryptography and Applications : [4L]

Important terms, Threat, Flaw, Vulnerability, Exploit, Attack, Ciphers, Codes, Caesar Cipher, Rail-Fence Cipher, Public key cryptography (Definitions only), Private key cryptography (Definition and Example)

Safety Tools and Issues : [5L]

Firewalls, logging and intrusion detection systems, Windows and windows XP / NT security, Unix/Linux security, ethics of hacking and cracking

Cyber laws to be covered as per IT 2008: [5L]

Definitions, Digital Signature And Electronic Signature

- [Section 43] Penalty and Compensation for damage to computer, computer system, etc.
- [Section 65] Tampering with Computer Source Documents
- [Section 66 A] Punishment for sending offensive messages through communication service, etc.
- [Section 66 B] Punishments for dishonestly receiving stolen computer resource or communication device
- [Section 66C] Punishment for identity theft
- [Section 66D] Punishment for cheating by personation by using computer resource
- [Section 66E] Punishment for violation of privacy
- [Section 66F] Punishment for cyber terrorism
- [Section 67] Punishment for publishing or transmitting obscene material in electronic form
- [Section 67A] Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form
- [Section 67B] Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form
- [Section 72] Breach of confidentiality and privacy

Reference Books:

1. M. Merkow, J. Breithaupt, Information Security Principles and Practices, Pearson Education.2005
2. G.R.F. Snyder, T. Pardoe, Network Security, Cengage Learning, 2010
3. A. Basta, W.Halton, Computer Security: Concepts, Issues and Implementation, Cengage Learning India, 2008

Choice Based Credit System (CBCS)

COOCH BEHAR PANCHANAN BARMA UNIVERSITY

DEPARTMENT OF COMPUTER SCIENCE

UNDERGRADUATE PROGRAMME
(Courses effective from Academic Year 2017-18)



SYLLABUS OF COURSES TO BE OFFERED

Core Courses, Elective Courses & Ability Enhancement Courses

Disclaimer: The CBCS syllabus is uploaded as given by the Faculty concerned to the Academic Council. The same has been approved as it is by the Academic Council on 01.7.2017. Any query may kindly be addressed to the concerned Faculty.

Undergraduate Programme Secretariat

Preamble

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

The UGC has formulated various regulations and guidelines from time to time to improve the higher education system and maintain minimum standards and quality across the Higher Educational Institutions (HEIs) in India. The academic reforms recommended by the UGC in the recent past have led to overall improvement in the higher education system. However, due to lot of diversity in the system of higher education, there are multiple approaches followed by universities towards examination, evaluation and grading system. While the HEIs must have the flexibility and freedom in designing the examination and evaluation methods that best fits the curriculum, syllabi and teaching-learning methods, there is a need to devise a sensible system for awarding the grades based on the performance of students. Presently the performance of the students is reported using the conventional system of marks secured in the examinations or grades or both. The conversion from marks to letter grades and the letter grades used vary widely across the HEIs in the country. This creates difficulty for the academia and the employers to understand and infer the performance of the students graduating from different universities and colleges based on grades.

The grading system is considered to be better than the conventional marks system and hence it has been followed in the top institutions in India and abroad. So it is desirable to introduce uniform grading system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students. To bring in the desired uniformity, in grading system and method for computing the cumulative grade point average (CGPA) based on the performance of students in the examinations, the UGC has formulated these guidelines.

CHOICE BASED CREDIT SYSTEM (CBCS):

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC has formulated the guidelines to be followed.

Outline of Choice Based Credit System:

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2. **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
 - 2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).
 - 2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.
 - 2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.
P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
3. **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are the courses based upon the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.
 - 3.1 AE Compulsory Course (AECC): Environmental Science, English Communication/MIL Communication.
 - 3.2 AE Elective Course (AEEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.

Project work/Dissertation is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

Details of Courses Under Undergraduate Programme (B.Sc.)

Course	*Credits	
	Theory+ Practical	Theory+Tutorials
<u>I. Core Course</u>	12X4= 48	12X5=60
(12 Papers)		
04 Courses from each of the 3 disciplines of choice		
Core Course Practical / Tutorial*	12X2=24	12X1=12
(12 Practical/ Tutorials*)		
4 Courses from each of the 03 Disciplines of choice		
<u>II. Elective Course</u>	6x4=24	6X5=30
(6 Papers)		
Two papers from each discipline of choice including paper of interdisciplinary nature.		
Elective Course Practical / Tutorials*	6 X 2=12	6X1=6
(6 Practical / Tutorials*)		
Two Papers from each discipline of choice including paper of interdisciplinary nature		
• Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 6th Semester		
<u>III. Ability Enhancement Courses</u>		
1 . Ability Enhancement Compulsory	1 X 2=2	1X2=2
(2 Papers of 2 credits each)	1 X 4=4	1 X 4=4
Environmental Science		
English/MIL Communication		
2. Ability Enhancement Elective	4 X 2=8	4 X 2=8
(Skill Based)		
(4 Papers of 2 credits each)		
	<hr/> Total credit= 122	<hr/> Total credit= 122

Institute should evolve a system/policy about ECA/ General Interest/Hobby/Sports/NCC/NSS / related courses on its own.

*wherever there is practical there will be no tutorials and vice -versa

PROPOSED SCHEME FOR CHOICE BASED CREDIT SYSTEM IN

B. Sc. Program (Computer Science)

SEMESTER	CORE COURSE (12)	Ability Enhancement Compulsory Course (AECC) (2)	Skill Enhancement Course (SEC) (4)	Elective: Discipline Specific DSE (6)
I	Computer Fundamentals and Digital Logic (5 + 1)	(English/MIL Communication)/Environmental Science		
	DSC - 2A			
	DSC - 3A			
II	Programming in c (4 + 4)	Environmental Science/ (English/MIL Communication)		
	DSC - 2B			
	DSC - 3B			
III	Operating Systems (5 + 1)		SEC - 1	
	DSC - 2C			
	DSC - 3C			
IV	Database Management Systems (4 + 4)		SEC - 2	
	DSC - 2D			
	DSC - 3D			
V			SEC - 3	DSE - 1A
				DSE - 2A
				DSE - 3A
VI			SEC - 4	DSE - 1B
				DSE - 2B
				DSE - 3B

SEMESTER	COURSE OPTED	COURSE NAME	Credits
I	Ability Enhancement Compulsory Course-I	English/MIL communications	2
	Core course-I	Computer Fundamentals and Digital Logic	6
	Core course-II	DSC 2A	6
	Core Course-III	DSC 3A	6
II	Ability Enhancement Compulsory Course-II	Environmental Science	4
	Core course-IV	Programming in c	4
	Course- IV Practical/Tutorial	Programming in c Lab	2
	Core course-V	DSC 2B	6
	Core Course-VI	DSC 3B	6
III	Core course-VII	Operating Systems	6
	Core course-VIII	DSC 2C	6
	Core Course-IX	DSC 3C	6
	Skill Enhancement Course -1	SEC-1	2
IV	Core course-X	Database Management Systems	4
	Course-X Practical/Tutorial	Database Management Systems Lab	2
	Core course-XI	DSC 2D	6
	Course-XII	DSC 3D	6
	Skill Enhancement Course -2	SEC -2	2
V	Skill Enhancement Course -3	SEC -3	2
	Discipline Specific Elective -1	DSE-1A	6
	Discipline Specific Elective -2	DSE-2A	6
	Discipline Specific Elective -3	DSE-3A	6
VI	Skill Enhancement Course -4	SEC -4	2
	Discipline Specific Elective -4	DSE-1B	6
	Discipline Specific Elective -5	DSE-2B	6
	Discipline Specific Elective -6	DSE-3B	6
Total Credits			122

Core Papers: Computer Science (Credit: 06 each) (1 period / week for tutorials or 4 periods / week of practical)

1. Computer Fundamentals and Digital Logic
2. Programming in c
3. Operating System
4. Database Management Systems

Discipline Specific Elective Papers: (Credit: 06 each) (DSE-1, DSE -2)

Choose 2: One from each group.

Options for DSE-1:

1. Programming in JAVA
2. Software Engineering

Options for DSE-2:

1. Computer Networks
2. Project Work / Dissertation

Note: Universities may include more options or delete some from this list

Skill Enhancement Courses (any four) (Credit: 02 each) - SEC1, SEC2, SEC3, SEC4

Choose one from each group.

Options for SEC1:

1. Office Automation Tools

Options for SEC2:

1. Analysis of Algorithms and Data Structures

Options for SEC3:

1. Programming in Visual Basic / GAMBAS

Options for SEC4:

1. **Web Technology** and HTML Programming

Note: Universities may include more options or delete some from this list **Important:**

1. Each University/Institute should provide a brief write-up about each paper outlining the salient features, utility, learning objectives and prerequisites.
2. University/Institute can add/delete some experiments of similar nature in the Laboratory papers.
3. The size of the practical group for practical papers is recommended to be 10-15 students.
4. University/Institute can add to the list of reference books given at the end of each paper.

CORE COURSES (UNDER UNDERGRADUATE PROGRAMME COURSES IN COMPUTER SCIENCE)

COMPUTER SCIENCE (C-I):Computer Fundamentals and Digital Logic

Total Marks:50

Theory 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Computers & Problem solving (5 Lectures)

Generation of Computers; Computer system : **Basic Block Diagram, Super Mainframe, Mini & Personal Computer, Nomenclature**, Software : **Systems and Application**; Hardware & Software; Algorithms : **Definition, essential features**; Complexity : **notation, time & space**; Computability & correctness concepts; Structured programming concepts; Process of problem solving, Flowcharts and Pseudo codes.

2. Number System & Arithmetic (5 Lectures)

Number System : Positional, binary, octal, decimal, hexadecimal and their representations, Methods of conversion from one base to another, signmagnitude, 1's complement; 2's complement; Binary Arithmetic; Fixed & floating point numbers: representation, biased exponent, range & precision, errors, overflow, underflow, BCD arithmetic

3. Boolean Algebra (5 Lectures)

Concepts of propositional logic; Boolean algebra: definitions, postulates, properties, simplification of logical expressions using properties and maps (up to 4 variables), Min-term, Max-term expressions; Logic gates : AND OR, NOT, XOR, Combinational circuits, Simple logic design using logic gates.

4. Digital Logic and System Design (10 Lectures)

Alphanumeric codes: **ASCII, EBCDIC**; Single error detection & correction; Hamming Codes and decoding techniques. Combinational Circuits: **encoder, decoder, code converter, comparator,**

adder/subtractor, multiplexer, demultiplexer, parity generator, PLA. Basic Sequential circuits; Flip-Flops: RS, JK, D, T; Schmitt-trigger; Concepts of single and two-phase clocks; Multivibrators: **astable and monostable**; Registers and shift registers; Counters : **Synchronous & asynchronous.** Digital-Analog interfacing: **D/A & A/D converters, basic ladder, counter ramp, successive approximation, sample and hold.**

Text books:

1. Givone: digital Principles & design ,TMH
2. Malvino:Digital Principles &application TMH
3. Jain :Modern Digital Electronics 2/e TMH
4. Marcovitz:Intro to logic Design Tata Mcgraw-hill
5. Digital Integrated Electronics- H.Taub & D.Shilling, Mc Graw Hill
6. Digital Technology- Virendra Kumar, New Age
7. Digital Logic Design- Morries Mano, PHI
8. Yarbrough- Digital Logic,Vikas
9. Salivahan- Digital Circuits and Design, Vikas

COMPUTER SCIENCE (C-IV):Computer Programming in C

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to C (2 Lectures)

History of C,Using main() function, Compiling and Executing Simple Programs in C++.

2. Data Types, Variables, Constants, Operators and Basic I/O (4 Lectures)

Declaring, Defining and Initializing Variables, Scope of Variables, Using Named Constants, Keywords, Data Types, Casting of Data Types, Operators (Arithmetic, Logical and Bitwise), Using Comments in programs, Character I/O (getc, getchar, putc, putcharetc), Formatted and Console I/O (printf(), scanf(), cin, cout), Using Basic Header Files (stdio.h, iostream.h, conio.hetc).

3. Expressions, Conditional Statements and Iterative Statements (4 Lectures)

Simple Expressions in C++ (including Unary Operator Expressions, Binary Operator Expressions), Understanding Operators Precedence in Expressions, Conditional Statements (if construct, switch- case construct), Understanding syntax and utility of Iterative Statements (while, do-while, and for loops), Use of break and continue in Loops, Using Nested Statements (Conditional as well as Iterative)

4. Functions and Arrays (8 Lectures)

Utility of functions, Call by Value, Call by Reference, Functions returning value, Void functions, Inline Functions, Return data type of functions, Functions parameters, Differentiating between Declaration and Definition of Functions, Command Line Arguments/Parameters in Functions, Functions with variable number of Arguments.

Creating and Using One Dimensional Arrays (Declaring and Defining an Array, Initializing an Array, Accessing individual elements in an Array, Manipulating array elements using loops), Use Various types of arrays (integer, float and character arrays / Strings) Two-dimensional Arrays (Declaring, Defining and Initializing Two Dimensional Array, Working with Rows and Columns), Introduction to Multi-dimensional arrays

5. Derived Data Types (Structures and Unions) (4 Lectures)

Understanding utility of structures and unions, Declaring, initializing and using simple structures and unions, Manipulating individual members of structures and unions, Array of Structures, Individual data members as structures, Passing and returning structures from functions, Structure with union as members, Union with structures as members.

6. Pointers and References in C (4 Lectures)

Understanding a Pointer Variable, Simple use of Pointers (Declaring and Dereferencing Pointers to simple variables), Pointers to Pointers, Pointers to structures, Problems with Pointers, Passing pointers as function arguments, Returning a pointer from a function, using arrays as pointers, Passing arrays to functions. Pointers vs. References, Declaring and initializing references, Using references as function arguments and function return values

7. Memory Allocation in C (2 Lectures)

Differentiating between static and dynamic memory allocation, use of malloc, calloc and free functions, use of new and delete operators, storage of variables in static and dynamic memory allocation

8. File I/O, Preprocessor Directives (2 Lectures)

Opening and closing a file (use of fstream header file, ifstream, ofstream and fstream classes), Reading and writing Text Files, Using put(), get(), read() and write() functions, Random access in files, Understanding the Preprocessor Directives (#include, #define, #error, #if, #else, #elif, #endif, #ifdef, #ifndef and #undef), Macros

Reference Books

- 1. Tennence W.Pratt, “Programming languages design and implementation”, Prentice Hall of India.**
- 2. Allen B. Tucker, “Programming Languages”, Tata McGraw Hill.**
- 3. Gottfried BS – Programming with C, TMH pub.**
- 4. Balagurusamy:ANSI C TMH**
- 5. Kanetkar, Yashvant – Understanding Pointers in C- 2nd Edn. BPB**
- 6. Kanetkar, Yashvant - Let us C. - 3rd revised Edn. BPB**
- 7. Roosta- Foundation of Programming Languages,Vikas**
- 8. Jeyapoovan- A First Course in Prog with C, Vikas**

COMPUTER SCIENCE LAB (C-IV): Programming in C Lab

Practical: 8 Lectures

1. WAP to print the sum and product of digits of an integer.

2. WAP to reverse a number.
3. WAP to compute the sum of the first n terms of the following series
 $S = 1 + 1/2 + 1/3 + 1/4 + \dots$
4. WAP to compute the sum of the first n terms of the following series
 $S = 1 - 2 + 3 - 4 + 5 - \dots$
5. Write a function that checks whether a given string is Palindrome or not. Use this function to find whether the string entered by user is Palindrome or not.
6. Write a function to find whether a given no. is prime or not. Use the same to generate the prime numbers less than 100.
7. WAP to compute the factors of a given number.
8. Write a macro that swaps two numbers. WAP to use it.
9. WAP to print a triangle of stars as follows (take number of lines from user):

```

*
* * *
* * * * *
* * * * * *

```

10. WAP to perform following actions on an array entered by the user:
 - i) Print the even-valued elements
 - ii) Print the odd-valued elements
 - iii) Calculate and print the sum and average of the elements of array
 - iv) Print the maximum and minimum element of array
 - v) Remove the duplicates from the array
 - vi) Print the array in reverse order

The program should present a menu to the user and ask for one of the options. The menu should also include options to re-enter array and to quit the program.

11. WAP that prints a table indicating the number of occurrences of each alphabet in the text entered as command line arguments.
12. Write a program that swaps two numbers using pointers.
13. Write a program in which a function is passed address of two variables and then alter its contents.
14. Write a program which takes the radius of a circle as input from the user, passes it to another function that computes the area and the circumference of the circle and displays the value of area and circumference from the main() function.
15. Write a program to find sum of n elements entered by the user. To write this program, allocate memory dynamically using malloc() / calloc() functions or new operator.
16. Write a menu driven program to perform following operations on strings:
 - a) Show address of each character in string
 - b) Concatenate two strings without using strcat function.
 - c) Concatenate two strings using strcat function.
 - d) Compare two strings
 - e) Calculate length of the string (use pointers)
 - f) Convert all lowercase characters to uppercase
 - g) Convert all uppercase characters to lowercase
 - h) Calculate number of vowels

- i) Reverse the string
17. Given two ordered arrays of integers, write a program to merge the two-arrays to get an ordered array.
 18. WAP to display Fibonacci series (i)using recursion, (ii) using iteration
 19. WAP to calculate Factorial of a number (i)using recursion, (ii) using iteration
 20. WAP to calculate GCD of two numbers (i) with recursion (ii) without recursion.
 - a) Create Matrix class using templates. Write a menu-driven program to perform following Matrix operations (2-D array implementation):
 - b) a) Sum b) Difference c) Product d) Transpose
 21. Create a structure Student containing fields for Roll No., Name, Class, Year and Total Marks. Create 10 students and store them in a file.
 22. Write a program to retrieve the student information from file created in previous question and print it in following format:

Roll No. Name Marks
 23. Copy the contents of one text file to another file, after removing all whitespaces.
 24. Write a function that reverses the elements of an array in place. The function must accept only one pointer value and return void.
 25. Write a program that will read 10 integers from user and store them in an array. Implement array using pointers. The program will print the array elements in ascending and descending order.

COMPUTER SCIENCE (C-VII): Operating Systems

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1.Introduction

(5 Lectures)

Basic OS functions, resource abstraction, types of operating systems-multiprogramming systems, batch systems , time sharing systems; operating systems for personal computers & workstations, process control & real time systems.

2.Operating System Organization

(4 Lectures)

Processor and user modes, kernels, system calls and systemprograms.

3. Process Management

(8 Lectures)

System view of the process and resources, process abstraction, processhierarchy, threads, threading issues, thread libraries; Process Scheduling, non-pre-emptive and pre-emptive scheduling algorithms; concurrent and processes, critical section, semaphores, methods for inter-process communication; deadlocks.

4. Memory Management (8 Lectures)

Physical and virtual address space; memory allocation strategies -fixed and variable partitions, paging, segmentation, virtual memory

5. File and I/O Management (5 Lectures)

Directory structure, file operations, file allocation methods, device management.

Recommended Books:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications 2008.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2007.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education 1997.
4. W. Stallings, Operating Systems, Internals & Design Principles 2008 5th Edition, Prentice Hall of India.
5. M. Milenkovic, Operating Systems- Concepts and design, Tata McGraw Hill 1992

COMPUTER SCIENCE (C-X): Database Management Systems

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction (4 Lectures)

Characteristics of database approach, data models, database system architecture and data independence.

2. Entity Relationship(ER) Modeling (4 Lectures)

Entity types, relationships, constraints.

3. Relation data model (10 Lectures)

Relational model concepts, relational constraints, relational algebra, SQL queries

4. Database design (15 Lectures)

Mapping ER/EER model to relational database, functional dependencies, Lossless decomposition, Normal forms (upto BCNF).

5. Transaction Processing (3 Lectures)

ACID properties, concurrency control

6. File Structure and Indexing

(8 Lectures)

Operations on files, File of Unordered and ordered records, overview of File organizations, Indexing structures for files(Primary index, secondary index, clustering index), Multilevel indexing using B and B+ trees.

Books Recommended:

1. R. Elmasri, S.B. Navathe, Fundamentals of Database Systems 6th Edition, Pearson Education, 2010.
2. R. Ramakrishanan, J. Gehrke, Database Management Systems 3rd Edition, McGraw-Hill, 2002.
3. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6th Edition, Pearson Education, 2013.

COMPUTER SCIENCE LAB (C- X): Database Management Systems Lab

Practical: 08 Lectures

Create and use the following database schema to answer the given queries.

Field	Type	NULL	KEY	DEFAULT
Eno	Char(3)	NO	PRI	NIL
Ename	Varchar(50)	NO		NIL
Job_type	Varchar(50)	NO		NIL
Manager	Char(3)	Yes	FK	NIL
Hire_date	Date	NO		NIL
Dno	Integer	YES	FK	NIL
Commission	Decimal(10,2)	YES		NIL
Salary	Decimal(7,2)	NO		NIL

EMPLOYEE Schema

DEPARTMENT Schema

Field	Type	NULL	KEY	DEFAULT
Dno	Integer	No	PRI	NULL
Dname	Varchar(50)	Yes		NULL
Location	Varchar(50)	Yes		New Delhi

Query List

1. Query to display Employee Name, Job, Hire Date, Employee Number; for each employee with the Employee Number appearing first.
2. Query to display unique Jobs from the Employee Table.
3. Query to display the Employee Name concatenated by a Job separated by a comma.
4. Query to display all the data from the Employee Table. Separate each Column by a comma and name the said column as THE_OUTPUT.
5. Query to display the Employee Name and Salary of all the employees earning more than \$2850.
6. Query to display Employee Name and Department Number for the Employee No= 7900.
7. Query to display Employee Name and Salary for all employees whose salary is not in the range of \$1500 and \$2850.
8. Query to display Employee Name and Department No. of all the employees in Dept 10 and Dept 30 in the alphabetical order by name.
9. Query to display Name and Hire Date of every Employee who was hired in 1981.
10. Query to display Name and Job of all employees who don't have a current Manager.
11. Query to display the Name, Salary and Commission for all the employees who earn commission.
12. Sort the data in descending order of Salary and Commission.
13. Query to display Name of all the employees where the third letter of their name is 'A'.
14. Query to display Name of all employees either have two 'R's or have two 'A's in their name and are either in Dept No = 30 or their Manger's Employee No = 7788.
15. Query to display Name, Salary and Commission for all employees whose Commission Amount is 14 greater than their Salary increased by 5%.
16. Query to display the Current Date.
17. Query to display Name, Hire Date and Salary Review Date which is the 1st Monday after six months of employment.
18. Query to display Name and calculate the number of months between today and the date each employee was hired.

19. Query to display the following for each employee <E-Name> earns < Salary> monthly but wants < 3 * Current Salary >. Label the Column as Dream Salary.
20. Query to display Name with the 1st letter capitalized and all other letter lower case and length of their name of all the employees whose name starts with 'J', 'A' and 'M'.
21. Query to display Name, Hire Date and Day of the week on which the employee started.
22. Query to display Name, Department Name and Department No for all the employees.
23. Query to display Unique Listing of all Jobs that are in Department # 30.
24. Query to display Name, Dept Name of all employees who have an 'A' in their name.
25. Query to display Name, Job, Department No. And Department Name for all the employees working at the Dallas location.
26. Query to display Name and Employee no. Along with their Manger's Name and the Manager's employee no; along with the Employees' Name who do not have a Manager.
27. Query to display Name, Dept No. And Salary of any employee whose department No. and salary matches both the department no. And the salary of any employee who earns a commission.
28. Query to display Name and Salaries represented by asterisks, where each asterisk (*) signifies \$100.
29. Query to display the Highest, Lowest, Sum and Average Salaries of all the employees
30. Query to display the number of employees performing the same Job type functions.
31. Query to display the no. of managers without listing their names.
32. Query to display the Department Name, Location Name, No. of Employees and the average salary for all employees in that department.
33. Query to display Name and Hire Date for all employees in the same dept. as Blake.
34. Query to display the Employee No. And Name for all employees who earn more than the average salary.
35. Query to display Employee Number and Name for all employees who work in a department with any employee whose name contains a 'T'.
36. Query to display the names and salaries of all employees who report to King.
37. Query to display the department no, name and job for all employees in the Sales department.

Discipline Specific Elective Papers: (Credit: 06 each) (DSE-1, DSE -2):

Choose one from each group:

Options for DSE - 1 (any one)

- A. Programming in JAVA**
- B. Software Engineering**

Options for DSE-2: (any one)

- A. Computer Networks**
- B. Project Work / Dissertation**

Note: Universities may include more options or delete some from this list

DSE - 1 (any one)

1(A) Programming in Java

Total Marks: 100

Theory: 40

Practical: 50

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Java

(3 L)

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

2. Arrays, Strings and I/O

(4 L)

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

3. Object-Oriented Programming Overview (4 L)

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

1. Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Metadata (7 L)

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

2. Exception Handling, Threading, Networking and Database Connectivity (7 L)

Exception types, uncaught exceptions, throw, built-in exceptions, Creating your own exceptions; Multi-threading: The Thread class and Runnable interface, creating single and multiple threads, Thread prioritization, synchronization and communication, suspending/resuming threads. Using java.net package, Overview of TCP/IP and Datagram programming. Accessing and manipulating databases using JDBC.

3. Applets and Event Handling (5 L)

Java Applets: Introduction to Applets, Writing Java Applets, Working with Graphics, Incorporating Images & Sounds. Event Handling Mechanisms, Listener The design and Implementation of GUIs using the AWT controls, Swing components of Java Foundation Classes such as labels, buttons, textfields, layout managers, menus, events and listeners; Graphic objects for drawing figures such as lines, rectangles, ovals, using different fonts.

Reference Books

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

1(A) Programming in Java Lab

08 Lectures

1. To find the sum of any number of integers entered as command line arguments
2. To find the factorial of a given number
3. To learn use of single dimensional array by defining the array dynamically.
4. To learn use of in case of a two dimensional array
5. To convert a decimal to binary number
6. To check if a number is prime or not, by taking the number as input from the keyboard
7. To find the sum of any number of integers interactively, i.e., entering every number from the keyboard, whereas the total number of integers is given as a command line argument
8. Write a program that show working of different functions of String and StringBufferclass like setCharAt(), setLength(), append(), insert(), concat()and equals().
9. Write a program to create a “distance” class with methods where distance is computed in terms of feet and inches, how to create objects of a class and to see the use of this pointer
10. Modify the “distance” class by creating constructor for assigning values (feet and inches) to the distance object. Create another object and assign second object as reference variable to another object reference variable. Further create a third object which is a clone of the first object.
11. Write a program to show that during function overloading, if no matching argument is found, then java will apply automatic type conversions(from lower to higher data type)
12. Write a program to show the difference between public and private access specifiers. The program should also show that primitive data types are passed by value and objects are passed by reference and to learn use of final keyword
13. Write a program to show the use of static functions and to pass variable length arguments in a function.
14. Write a program to demonstrate the concept of boxing and unboxing.
15. Create a multi-file program where in one file a string message is taken as input from the user and the function to display the message on the screen is given in another file (make use of Scanner package in this program).
16. Write a program to create a multilevel package and also creates a reusable class to generate Fibonacci series, where the function to generate Fibonacci series is given in a different file belonging to the same package.
17. Write a program that creates illustrates different levels of protection in classes/subclasses belonging to same package or different packages
18. Write a program “DivideByZero” that takes two numbers a and b as input, computes a/b, and invokes Arithmetic Exception to generate a message when the denominator is zero.
19. Write a program to show the use of nested try statements that emphasizes the sequence of checking for catch handler statements.
20. Write a program to create your own exception types to handle situation specific to your application (Hint: Define a subclass of Exception which itself is a subclass of Throwable).
21. Write a program to demonstrate priorities among multiple threads.
22. Write a program to demonstrate multithread communication by implementing synchronization among threads (Hint: you can implement a simple producer and consumer problem).
23. Write a program to create URL object, create a URL Connection using the

- openConnection() method and then use it to examine the different components of the URL and content.
24. Write a program to implement a simple datagram client and server in which a message that is typed into the server window is sent to the client side where it is displayed.
 25. Write a program that creates a Banner and then creates a thread to scroll the message in the banner from left to right across the applet's window.
 26. Write a program to get the URL/location of code (i.e. java code) and document (i.e. html file).
 27. Write a program to demonstrate different mouse handling events like mouseClicked(), mouseEntered(), mouseExited(), mousePressed, mouseReleased() and mouseDragged().
 28. Write a program to demonstrate different keyboard handling events.
 29. Write a program to generate a window without an applet window using main() function.
 30. Write a program to demonstrate the use of push buttons.

1(B) Software Engineering

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction (4 Lectures)

The Evolving Role of Software, Software Characteristics, Changing Nature of Software, Software Engineering as a Layered Technology, Software Process Framework, Framework and Umbrella Activities, Process Models, Capability Maturity Model Integration (CMMI).

2. Requirement Analysis (5 Lectures)

Software Requirement Analysis, Initiating Requirement Engineering Process, Requirement Analysis and Modeling Techniques, Flow Oriented Modeling, Need for SRS, Characteristics and Components of SRS.

3. Software Project Management (4 Lectures)

Estimation in Project Planning Process, Project Scheduling.

4. Risk Management (4 Lectures)

Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.

5. Quality Management (4 Lectures)

Quality Concepts, Software Quality Assurance, Software Reviews, Metrics for Process and Projects.

6. Design Engineering (5 Lectures)

Design Concepts, Architectural Design Elements, Software Architecture, Data Design at the Architectural Level and Component Level, Mapping of Data Flow into Software Architecture, Modeling Component Level Design.

7. Testing Strategies & Tactics (4 Lectures)

Software Testing Fundamentals, Strategic Approach to Software Testing, Test Strategies for Conventional Software, Validation Testing, System Testing, Black-Box Testing, White-Box Testing and their type, Basis Path Testing.

Recommended Books:

1. R.S. Pressman, Software Engineering: A Practitioner's Approach (7th Edition), McGraw- Hill, 2009.
2. P Jalote, An Integrated Approach to Software Engineering (2nd Edition), Narosa Publishing House, 2003.
3. K.K. Aggarwal and Y. Singh, Software Engineering (revised 2nd Edition), New Age International Publishers, 2008.
4. I. Sommerville, Software Engineering (8th edition), Addison Wesle, 2006.
5. D. Bell, Software Engineering for Students (4th Edition), Addison-Wesley, 2005.
6. R. Mall, Fundamentals of Software Engineering (2nd Edition), Prentice-Hall of India, 2004.

DSE - 2 (any one)

2(A) Computer Networks

Total Marks: 50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

1. Introduction to Computer Networks (3 Lectures)

Network definition; network topologies; network classifications; network protocol; layered network architecture; overview of OSI reference model; overview of TCP/IP protocol suite.

2. Data Communication Fundamentals and Techniques (5 Lectures)

Analog and digital signal; data-ratelimits; digital to digital line encoding schemes; pulse code

modulation; parallel and serial transmission; digital to analog modulation-; multiplexing techniques- FDM, TDM; transmission media.

3. Networks Switching Techniques and Access mechanisms (5 Lectures)

Circuit switching; packet switching- connectionless datagram switching, connection-oriented virtual circuit switching; dial-up modems; digital subscriber line; cable TV for data transfer.

4. Data Link Layer Functions and Protocol (5 Lectures)

Error detection and error correction techniques; data-link control- framing and flow control; error recovery protocols- stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet.

5. Multiple Access Protocol and Networks (3 Lectures)

CSMA/CD protocols; Ethernet LANs; connecting LAN and back-bone networks- repeaters, hubs, switches, bridges, router and gateways;

6. Networks Layer Functions and Protocols (3 Lectures)

Routing; routing algorithms; network layer protocol of Internet- IP protocol, Internet control protocols.

7. Transport Layer Functions and Protocols (3 Lectures)

Transport services- error and flow control, Connection establishment and release- three way handshake;

8. Overview of Application layer protocol (3 Lectures)

Overview of DNS protocol; overview of WWW & HTTP protocol.

Reference Books

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM Publishing Company Ltd 2007.
2. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI Pvt. Ltd 2002

2(B) Project work / Dissertation

Total Marks: 50

Project:50

30 Lectures

This option is to be offered only in 6th Semester.

The students will be allowed to work on any project based on the concepts studied in core / elective

or skill based elective courses.

The group size should be maximum of three (03) students.

Each group will be assigned a teacher as a supervisor who will handle both their theory as well lab classes.

A maximum of Four (04) projects would be assigned to one teacher.

Skill Enhancement Courses (any four: one from each group)

Skill Enhancement Courses (Credit: 02 each) - SEC1,SEC2,SEC3, SEC4

Theory: 02 / Labs: 02

Options for SEC1:

1. Office Automation Tools

Options for SEC2:

1. Analysis of Algorithms and Data Structures

Options for SEC3:

1. Programming in Visual Basic / GAMBAS

Options for SEC4:

1. **Web Technology** and HTML Programming

Note: Universities may include more options or delete some from this list

Detailed Syllabus:

SEC-1:

1. Office Automation Tools

Total Marks:50

Practical: 40

Internal Assessment: 10

2 Lectures ,2 Practicals (each in group of 10 to 15)

Introduction to open office/MS office/Libre office (2L)

Word Processing: Formatting Text, Pages, Lists, Tables (5L)

Spreadsheets: Worksheets, Formatting data, creating charts and graphs, using formulas and functions, macros, Pivot Table (6L)

Presentation Tools: Adding and formatting text, pictures, graphic objects, including charts, objects, formatting slides, notes, hand-outs, slide shows, using transitions, animations (4L)

Books Recommended:

1. Introduction to **HTML** and **CSS** -- O'Reilly , 2010
2. Jon Duckett, **HTML** and **CSS**, John Wiley, 2012

Computer Lab Based on Office Automation:

Practical List for Text Editor:

1. Create a **telephone directory**.
 - The heading should be 16-point Arial Font in bold
 - The rest of the document should use 10-point font size
 - Other headings should use 10-point Courier New Font.
 - The footer should show the page number as well as the date last updated.
2. Design a time-table form for your college.
 - The first line should mention the name of the college in 16-point Arial Font and should be bold.
 - The second line should give the course name/teacher's name and the department in 14-point Arial.
 - Leave a gap of 12-points.
 - The rest of the document should use 10-point Times New Roman font.
 - The footer should contain your specifications as the designer and date of creation.
3. Create the following one page documents.

(a) Compose a note inviting friends to a get-together at your house, including a list of things to bring with them.

(b) Design a certificate in landscape orientation with a border around the document.

4. Create the following document: A newsletter with a headline and 2 columns in portrait orientation, including at least one image surrounded by text.

5. Convert following text to a table, using comma as delimiter

Type the following as shown (do not bold).

Color, Style, Item

Blue, A980, Van

Red, X023, Car

Green, YL724,

Truck

Name, Age,

Sex Bob, 23,

M Linda, 46,

F Tom, 29,

M

6. Prepare a grocery list having four columns (Serial number, the name of the product, quantity and price) for the month of April, 06.

- Font specifications for Title (Grocery List): 14-point Arial font in bold and italics.
- The headings of the columns should be in 12-point and bold.
- The rest of the document should be in 10-point Times New Roman.
- Leave a gap of 12-points after the title.

7. XYZ Publications plans to release a new book designed as per your syllabus. Design the first page of the book as per the given specifications.

(a) The title of the book should appear in bold using 20-point Arial font.

(b) The name of the author and his qualifications should be in the center of the page in 16-point Arial font.

(c) At the bottom of the document should be the name of the publisher and address in 16-point Times New Roman.

(d) The details of the offices of the publisher (only location) should appear in the footer.

8. Create the following one page documents.

a) Design a Garage Sale sign.

b) Make a sign outlining your rules for your bedroom at home, using a numbered list.

9. Enter the following data into a table given on the next page.

Salesperson	Dolls	Trucks	Puzzles
Amit	1327	1423	1193
Shivi	1421	3863	2934
Om	5214	3247	5467
Ananya	2190	1278	1928
Anupama	1201	2528	1203
Maharshi	4098	3079	2067

Add a column Region (values: S, N, N, S, S, S) between the Salesperson and Dolls columns to the given table Sort your table data by Region and within Region by Salesperson in ascending order:

Practical List for Spreadsheet

Q1. Create a student worksheet containing roll numbers, names and total marks. Open a document in Word and insert the excel worksheet using:-

- i) Copy/Paste
- ii) Embedding
- iii) Linking

Q2. The term wise marks for APS class of 20 students are stored in 3 separate sheets named term1, term2 and term3. Create 4th worksheet that contains student names and their total and average marks for the entire year. Give proper headings using headers. Make the column headings bold and italic. The 4th worksheet should contain college name as the first line. Make it bold, italic and center it.

Q3. Using a simple pendulum, plot 1-T and 1-T² graph.

I	t1	t2	t3	Mean(t)	T=t/20	T ₂
70						
80						
90						
100						

Q4. Consider the following employee worksheet:-

Full Name (First Last)	Grade 1/2/3	Basic Salary	HRA	PF	Gross	Net	(VA) Vehicle Allowance

HRA is calculated as follows:

Grade	HRA %(of Basic)
1	40%
2	35%
3	30%

Gross = Basic + HRA +
VA Net = Gross - PF PF is
8% for all Grades

VA is 15000, 10000 and 7000 for Grades 1, 2 and 3.

- Find max, min and average salary of employees in respective Grade
- Count no. of people where VA>HRA
- Find out most frequently occurring grade.
- Extract records where employee name starts with "A" has HRA>10000
- Print Grade wise report of all employees with subtotals of net salary and also grand totals. Use subtotal command.
- Extract records where Grade is 1 or 2 and salary is between 10000 and 20000 both inclusive.

Q5. In a meeting of a marketing department of an organization it has been decided that price of selling an item is fixed at Rs40. It was resolved to increase the sell of more of more items and getting the profit of Rs40,000/. Use Goal Seek to find out how many items you will have to sell to meet your profit figure.

Q6. To study the variation in volume with pressure for a sample of an air at constant temperature by plotting a graph for P - V and P-I/V. Sample observations are:-

Pressure(P)	Volume (V)	I/V	PV	P/V
75	20			
78.9	19			
83.3	18			
88.2	17			

Q7. Plot the chart for marks obtained by the students (out of 5) vs. frequency (total number of students in class is 50).

Q8. Create the following worksheet(s) containing an year wise sale figure of five salesmen in Rs.

Salesman	2002	2003	2004	2005
MOHAN	10000	12000	20000	50000
MITRA	15000	18000	50000	60000
SHIKHA	20000	22000	70000	70000
ROHIT	30000	30000	100000	80000
MANGLA	40000	45000	125000	90000

Apply the following Mathematical & Statistical functions:

- Calculate the commission for each salesman under the condition :-
 - If total sales is greater than Rs. 3, 00,000/-, then commission is 10% of total sale made by the salesman.
 - Otherwise, 4% of total sale.

- ii) Calculate the maximum sale made by each salesman.
- iii) Calculate the maximum sale made in each year.
- iv) Calculate the minimum sale made by each salesman.
- v) Calculate the minimum sale made in each year.
- vi) Count the no. of sales persons.
- vii) Calculate the cube of sales made by Mohan in the year 2002.
- viii) Find the difference in sales by salesman Mitra between the year 2002 and 2003.
Find the absolute value of difference.
- ix) Also calculate the Mode, Stddev, Variance, Median for the sale made by each salesman.
- ix) Calculate the year wise Correlation coefficient between the sales man Mohan and Mitra year wise

Q9. The following table gives an year wise sale figure of five salesmen in Rs.

Salesman	2000	2001	2002	2003
S1	10000	12000	20000	50000
S2	15000	18000	50000	60000
S3	20000	22000	70000	70000
S4	30000	30000	100000	80000
S5	40000	45000	125000	90000

- i) Calculate total sale year wise.
- ii) Calculate the net sales made by each salesman
- iii) Calculate the commission for each salesman under the condition :-
 - c) If total sales is greater than Rs. 4, 00,000/-, then commission is 5% of total sale made by the salesman.
 - d) Otherwise, 2% of total sale.
- iv) Calculate the maximum sale made by each salesman.
- v) Calculate the maximum sale made in each year.
- vi) Draw a bar graph representing the sale made by each salesman.
- vii) Draw a pie graph representing the sale made by salesmen in year 2001.

Q10. Consider the following worksheet for APS 1st year students:-

S.No.	Name	PH	CH	BY	MT	CS	Total Marks	%	Grade
1									
2									

Grade is calculated as follows:-

If % \geq 90 If % Grade A
 \geq 80 & $<$ 90 If % Grade B
 \geq 70 & $<$ 80 If % Grade C
 \geq 60 & $<$ 70 Grade D

Otherwise
 students will be declared fail.

- i) Calculate Grade using if function
- ii) Sort the data according to total marks
- iii) Apply filter to display the marks of the students having more than 65% marks.
- iv) Draw a pie chart showing % marks scored in each subject by the topper of the class.
- v) Draw the doughnut chart of the data as in (iv)
- vi) Enter the S.No. of a student and find out the Grade of the student using VLOOKUP.
- vii) Extract all records where name
 - a) Begins with "A"
 - b) Contains "A"
 - c) Ends with "A"

Practical List for presentation:

1. Create five Power point slides. Each slide should support different format. In these slides explain areas of applications of IT. Make slide transition time as 10 seconds.
2. Create five Power Point slides to give advantages/disadvantages of computer, application of computers and logical structure of computer.
3. Create five Power Point slides detailing the process of internal assessment. It should be a self running demo.

SEC 2:

1. Analysis of Algorithms and Data Structures

Total Marks:50

Theory: 40

Internal Assessment: 10

Theory: 30 Lectures

- | | |
|---|------------|
| 1. Arrays
Lectures) | (2) |
| Single and Multi-dimensional Arrays, Sparse Matrices (Array and Linked Representation) | |
| 2. Stacks
Lectures) | (3) |
| Implementing single / multiple stack/s in an Array; Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Applications of stack; Limitations of Array representation of stack | |
| 3. Linked Lists
Lectures) | (4) |
| Singly, Doubly and Circular Lists (Array and Linked representation); Normal and Circular representation of Stack in Lists; Self Organizing Lists; Skip Lists | |
| 4. Queues
Lectures) | (3) |
| Array and Linked representation of Queue, De-queue, Priority Queues | |

5. Recursion (3 lectures)

Developing Recursive Definition of Simple Problems and their implementation;
Advantages and Limitations of Recursion; Understanding what goes behind Recursion
(Internal Stack Implementation)

6. Trees (5 Lectures)

Introduction to Tree as a data structure; Binary Trees (Insertion, Deletion , Recursive and Iterative Traversals on Binary Search Trees); Threaded Binary Trees (Insertion, Deletion, Traversals); Height-Balanced Trees (Various operations on AVL Trees).

7. Searching and Sorting (5 Lectures)

Linear Search, Binary Search, Comparison of Linear and Binary Search, Selection Sort, Insertion Sort, Insertion Sort, Shell Sort, Comparison of Sorting Techniques

8. Hashing (5 Lectures)

Introduction to Hashing, Deleting from Hash Table, Efficiency of Rehash Methods, Hash Table
Reordering, Resolving collusion by Open Addressing, Coalesced Hashing, Separate Chaining, Dynamic and Extendible Hashing, Choosing a Hash Function, Perfect Hashing Function

Reference Books:

- > Adam Drozdek, "Data Structures and algorithm in C++", Third Edition, Cengage Learning, 2012.
- > SartajSahni, Data Structures, "Algorithms and applications in C++", Second Edition, Universities Press, 2011.
- > Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using C and C++", Second edition, PHI, 2009.
- > Robert L. Kruse, "Data Structures and Program Design in C++", Pearson.
- > D.S Malik, Data Structure using C++,Second edition, Cengage Learning, 2010.
- > Mark Allen Weiss, "Data Structures and Algorithms Analysis in Java", Pearson Education, 3rd edition, 2011
- > Aaron M. Tenenbaum, Moshe J. Augenstein, YedidyahLangsam, "Data Structures Using Java, 2003.
- > Robert Lafore, "Data Structures and Algorithms in Java, 2/E", Pearson/ Macmillan Computer Pub,2003
- > John Hubbard, "Data Structures with JAVA", McGraw Hill Education (India) Private Limited; 2 edition, 2009
- > Goodrich, M. and Tamassia, R. "Data Structures and Algorithms Analysis in Java", 4th Edition, Wiley
- > Herbert Schildt, "Java The Complete Reference (English) 9th Edition Paperback", Tata

McGraw Hill, 2014.

> D. S. Malik, P.S. Nair, "Data Structures Using Java", Course Technology, 2003.

SEC 3: Programming with VB/GAMBAS

Total Marks:50

Practical: 40

Internal Assessment: 10

2Lectures ,2 Practicals (each in group of 10 to 15)

GUI Environment: Introduction to graphical user interface (GUI), programming language (procedural, object oriented, event driven), the GUI environment, compiling, debugging, and running the programs.

(2L)

Controls : Introduction to controls textboxes, frames, check boxes, option buttons, images, setting borders and styles, the shape control, the line control, working with multiple controls and their properties, designing the user interface, keyboard access, tab controls, default & cancel property, coding for controls.

(4L)

Operations: Data types, constants, named & intrinsic, declaring variables, scope of variables, val function, arithmetic operations, formatting data.

(2L)

Decision Making : If statement, comparing strings, compound conditions (and, or, not), nested if statements, case structure, using if statements with option buttons & check boxes, displaying message in message box, testing whether input is valid or not.

(4L)

Forms Handling : Multiple forms creating, adding, removing forms in project, hide, show method, load, unload statement, me keyword, referring to objects on a different forms.

(2L)

Iteration Handling: Do/loops, for/next loops, using msgbox function, using string function.

(3L)

Book Recommended:

Programming in Visual Basic 6.0 by Julia Case Bradley, Anita C. Millispangh (Tata Mcgraw Hill Edition 2000 (Fourteenth Reprint 2004)

Software Lab Based on Visual Basic:

1. Practical exercises based on concepts listed in theory using VB.
2. Write a VB application to compute the sum of two variables.
3. Write a VB application to compute the factorial of a number n.
4. Write a VB application to compute the Fibonacci series of a number n.
5. Write a VB application to compute the series of prime numbers till number n.

6. Write a VB application to compute the maximum of three numbers.
7. Write a VB application to compute the sum of odd numbers and even numbers in an array of n integers.
8. Write a VB application to compare the strings.
9. Write a VB application to make a calculator.
10. Write a VB application to choose your hobbies from a list.
11. Write a VB application to illustrate the use of color radio button.
12. Write a VB application to illustrate the use of color scroll bar form.
13. Write a VB application to illustrate the use of color scroll bar label text.
14. Write a VB application to illustrate the use of color text box.
15. Write a VB application to show a timer.

SEC4:

Web Technology and HTML Programming

Total Marks:50

Practical: 40

Internal Assessment: 10

2Lectures ,2 Practicals (each in group of 10 to 15)

Unit-I: Introduction

Introduction to Web Design: Introduction to hypertext markup language (html) document type definition, creating web pages, graphical elements, lists, hyperlinks, tables, web forms, inserting images, frames. (3L)

Unit-II: The Basics

o The Head, the Body o Colors, Attributes o Lists, ordered and unordered (2)

Unit-III: Links

Introduction (3L)

Relative Links, Absolute Links o Link Attributes

Using the ID Attribute to Link Within a Document

Unit-IV: Images

Putting an Image on a Page o Using Images as Links o Putting an Image in the Background (2L)

Unit V: - Tables

Creating a Table (2L)

Table Headers o Captions

Spanning Multiple Columns o Styling Table •

Unit VI - Forms

Basic Input and Attributes o Other Kinds of Inputs o Styling forms with CSS (3L)

Customized Features: Cascading style sheets, (css) for text formatting and other manipulations

Unit VII : JDBC: JDBC Fundamentals, Establishing Connectivity and working with

connection interface, Working with statements, Creating and Executing SQL Statements,
Working with Result Set Objects. (5L)

Unit VIII: JSP: Introduction to JavaServer Pages, HTTP and Servlet Basics, The Problem with Servlets, The Anatomy of a JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, Implicit JSP Objects, Conditional Processing, Displaying Values (10L)

Book Recommended:

1. Introduction to **HTML** and CSS -- O'Reilly , 2010
2. Jon Duckett, HTML and CSS, John Wiley, 2012
3. Web Enabled Commercial Application Development Using Html, Dhtml, javascript, Perl Cgi By Ivan Bayross, BPB Publications, 2009.
4. Java 7 ,The Complete Reference, Herbert Schildt, 8th Edition, 2009.